PORTLAND HARBOR RI/FS

APPENDIX N

SENSITIVITY ANALYSIS

FEASIBILITY STUDY

June 2016

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TABLE OF CONTENTS

LIST OF TABLES .....N-ii

LIST OF FIGURES ..... N-iii

N1. INTRODUCTION N-1

N2. GENERAL METHODOLOGY AND RELEVANT COST GUIDANCE N-2

N3. SENSITIVITY ANALYSES PERFORMED FOR RETAINED FS ALTERNATIVES N-3

N4. CONCLUSIONS..... N-5

LIST OF TABLES

Table N-1 Comparison of Constant Dollar Costs and Present Value Cost For Alternatives B, D, E, F, G, and I Based on Two Periods of Analysis (30 and 100 Years)

Table N-2 Comparison of Constant Dollar Costs and Present Value Costs For Alternatives B, D, E, F, G, and I Based on Two Site-Wide Monitoring and Monitored Natural Recovery Frequency Scenarios (Current versus 5-Year)

Table N-3 Comparison of Constant Dollar Costs and Present Value Costs For Alternatives B, D, E, F, G, and I Based on Three Subtitle C/TSCA Disposal Volume Scenarios (Reduced, Current and Increased)

Table N-4 Comparison of Constant Dollar Costs and Present Value Costs For Alternatives B, D, E, F, G, and I Based on Three Construction Duration Scenarios (Reduced, Current and Increased)

Table N-5 Comparison of Constant Dollar Costs and Present Value Costs For Alternatives B, D, E, F, G, and I Based on Three Overdredge Scenarios (Reduced, Current and Increased)

LIST OF FIGURES

Figure N-1a Comparison of Constant Dollar Costs and Present Value Cost For Alternative B - 100 Year Period Analysis

Figure N-1b Comparison of Constant Dollar Costs and Present Value Cost For Alternative D - 100 Year Period Analysis

Figure N-1c Comparison of Constant Dollar Costs and Present Value Cost For Alternative E - 100 Year Period Analysis

Figure N-1d Comparison of Constant Dollar Costs and Present Value Cost For Alternative F - 100 Year Period Analysis

Figure N-1e Comparison of Constant Dollar Costs and Present Value Cost For Alternative G - 100 Year Period Analysis

Figure N-1f Comparison of Constant Dollar Costs and Present Value Cost For Alternative I - 100 Year Period Analysis

Figure N-2 Comparison of Constant Dollar Costs and Present Value Cost For Alternatives B and G Based on Two Site-Wide Monitoring and Monitored Natural Frequency Scenarios (Current versus 5-Year)

Figure N-3 Comparison of Constant Dollar Costs and Present Value Cost For Alternatives B and G Based on Three Subtitle C/TSCA Disposal Volume Scenarios (Reduced, Current and Increased)

Figure N-4a Comparison of Constant Dollar Costs and Present Value Cost For Alternatives B, D, and E Based on Three Construction Duration Scenarios (Reduced, Current and Increased)

Figure N-4b Comparison of Constant Dollar Costs and Present Value Cost For Alternatives F, G, and I Based on Three Construction Duration Scenarios (Reduced, Current and Increased)

Figure N-5 Comparison of Constant Dollar Costs and Present Value Cost For Alternatives B and G Based on Three Overdredge Scenarios (Reduced, Current and Increased)

ATTACHMENT N-1 Sensitivity Analysis - Cost Estimate Backup

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N1. INTRODUCTION

CDM Federal Programs Corporation (CDM Smith) has been tasked to complete detailed analysis cost estimates for the Portland Harbor Superfund Site Feasibility Study (FS), herein referred to as the FS cost estimates. Cost estimates were developed for Alternatives B, C, D, E, F, G, H, and I as presented in Section 3 and included in Appendix G

EPA has also requested sensitivity analyses be performed on alternatives retained for detailed analysis as presented in Section 4 to obtain a better understanding of the impacts of various cost drivers on the total costs (both constant dollar (non-discounted) costs and present value dollar (discounted) costs). The alternatives that underwent sensitivity analyses in this appendix are Alternatives B, D, E, F, G, and I.

N2. GENERAL METHODOLOGY AND RELEVANT COST GUIDANCE

Cost estimates are developed according to *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 540-R-00-002, July 2000). Section 5.8 of this guidance provides information specific to performing sensitivity analyses. According to this guidance, sensitivity analysis is a type of uncertainty analysis that measures the project impact of changing one or more input values. In the development of a remedial alternative cost estimate, a sensitivity analysis should be considered for those factors that have a relatively high degree of uncertainty and that, with only a small change in their value, could significantly affect the overall cost of the alternative.

Factors typically considered in a cost sensitivity analysis for a remedial alternative include:

- Nature and Extent of Contamination – Estimated volumes of contaminated media or material and degree of contamination (i.e., concentrations) are dependent on assumptions about site conditions.

- Remedy Failure / Effective Life of Technology - The potential failure of a remedy or components thereof would require substantial additional costs for replacement of the remedy or its components. Particularly relevant for technologies or processes that are unproven and lack sufficient performance history.

- Project Duration – The time required for a remedial action, or components thereof, to achieve remedial action objectives can be a major factor, particularly for those actions requiring many years of O&M.

- Discount Rate – Although a rate of 7 percent should normally be used to compare alternatives, a range of values both below and above 7 percent can be used to investigate uncertainty concerning future economic conditions.

A sensitivity analysis might vary the values for these factors (low, medium, high), while keeping the values for other factors the same, and noting the impact on the total estimated cost. The results of a sensitivity analysis should be reported in terms of total present value for each scenario. The baseline, or original estimate, should be included for comparison.

N3. SENSITIVITY ANALYSES PERFORMED FOR RETAINED FS ALTERNATIVES

Based on input from EPA, CDM Smith performed sensitivity analyses for the following cost estimate evaluations and comparisons:

1) Period of Analysis Assumptions (30 years versus 100 years)

   Comparison of constant dollar (non-discounted) costs and present value (discounted) costs for Alternatives B, D, E, F, G, and I for two periods of analysis (30 years and 100 years). Under this evaluation, capital costs, periodic costs, and annual O&M costs were kept constant for both periods of analyses. The difference between the two scenarios is that periodic costs and annual costs ceased at Year 30 for the 30 year period of analysis and continued until year 100 for the 100 year period of analysis. These costs are presented in **Table N-1**. The accompanying graphs illustrate the how the constant dollar (non-discounted) costs and present value (discounted) costs increase from year 0 to year 100 for each of the alternatives.

2) Monitoring Frequency Assumptions (currently assumed monitoring frequency vs. 5-year frequency)

   Comparison of constant dollar (non-discounted) costs and present value (discounted) costs for Alternatives B, D, E, F, G, and I for two separate O&M frequency scenarios. Frequency for site-wide monitoring and monitored natural recovery is currently assumed to occur every 2 years for the first 10 years, followed by every 4 years for the remaining years of the 30 year period of analysis. This current assumption was compared to a scenario where frequency for monitoring is assumed to occur every 5years for the entire 30 year period of analysis. All capital costs and other costs not related to monitoring were kept constant for both scenarios. These costs are presented in **Table N-2** and presented graphically for Alternatives B and G in **Figure N-2**.

3) Subtitle C/TSCA Disposal Volume Assumptions (current Subtitle C/TSCA disposal volume vs. Subtitle C/TSCA disposal volume ±15 percent)

   Comparison of constant dollar (non-discounted) costs and present value (discounted) costs for Alternatives B, D, E, F, G, and I for three separate Subtitle C/TSCA disposal scenarios. In this comparison, the current volume assumption for Subtitle C/TSCA disposal was reduced by 15 percent in one scenario and increased by 15 percent in the other scenario. Under each scenario, the overall disposal volume was held constant, while the Subtitle C/TSCA volume was adjusted (when Subtitle C/TSCA volume was reduced by 15 percent of its total volume, the volume assumed for Subtitle D was increased by that corresponding volume and thus overall volume remained constant). All capital costs not related to the offsite disposal as well as periodic costs and annual costs were kept constant for all three scenarios. These costs are presented in **Table N-3** and presented graphically for Alternatives B and G in **Figure N-3**.

4) Construction Duration Assumptions (currently assumed construction duration versus construction duration ±50 percent)

   Comparison of constant dollar (non-discounted) costs and present value (discounted) costs for Alternatives B, D, E, F, G, and I for three separate construction duration scenarios. In this comparison, the current construction duration assumptions were reduced by 50 percent in one scenario and increased by 50 percent in the other scenario. Under each scenario the total capital costs for construction was held constant, while the application of the costs within the present value analysis was adjusted (the total capital cost was divided by the duration, and annually applied per year in the present value analysis). Periodic costs were kept constant for all three scenarios. These costs are presented in **Table N-4** and presented graphically for Alternatives B, D, E, F, G, and I in **Figures N-4a** and **N-4b** .

5) Overdredge Assumptions (currently assumed (average) overdredge factor assumption [1.75] vs. low/high overdredge factor [1.50/2.0])

   Comparison of constant dollar (non-discounted) costs and present value (discounted) costs for Alternatives B, D, E, F, G, and I for three separate overdredge scenarios. Overdredge is currently accounted for by applying an overdredge factor of 1.75 to the calculated neat dredge volumes. In this comparison, overdredge factors of 1.50 [low] and 2.0 [high] are compared to the base assumption of 1.75. By increasing the overdredge factor, the overall dredging volumes as well as offsite disposal volumes (both Subtitle C/TSCA and Subtitle D) increase, while decreasing the overdredge factor will decrease those volumes. All capital costs not related to the overdredge factor as well as periodic costs and annual costs were kept constant for all three scenarios. These costs are presented in **Table N-5** and presented graphically for Alternatives B and G in **Figure N-5**.

N4. CONCLUSIONS

Based on the figures and tables, the following conclusions can be drawn for the scenarios evaluated as part of this sensitivity analysis:

1) Period of Analysis Assumptions (30 years versus 100 years)

   As illustrated in **Figures N-1a** through **N-1f**, the constant dollar costs for each alternative increase as the periods of analyses increase. However, the constant dollar expenditures after year 30 have minimal effects on the present value costs. Based on the analysis, the present value costs are generally not sensitive to changes to period of analysis beyond 30 years.

2) Monitoring Frequency Assumptions (currently assumed O&M Frequency vs. 5-year frequency)

   As illustrated in **Table N-2** and **Figure N-2**, reducing the frequency of O&M has a moderate impact on the total present value cost. Total present value cost of each alternative was reduced by between approximately 9 and 15 percent by reducing the O&M frequency to every five years. The largest reduction in present value cost was for Alternative B and smallest for Alternative G.

3) Subtitle C/TSCA Disposal Volume Assumptions (current Subtitle C/TSCA disposal volume vs. Subtitle C disposal volume ±15 percent)

   As illustrated in **Table N-3** and **Figure N-3**, reducing and increasing the volumes of Subtitle C by 15 percent has minimal effects on the total present value cost relative to the other sensitivity analysis scenarios. The total present value cost was increased by approximately 1.2 percent and 0.2 percent for Alternatives B and G, respectively, with a 15 percent increase in Subtitle C volume. Conversely, the total present value cost was reduced by approximately 1.2 percent and 0.2 percent for Alternatives B and G, respectively, with a 15 percent decrease in Subtitle C volume. Based on the analysis, there is minimal sensitivity in present value costs due to changes to these volumes. There is some additional minor sensitivity between alternatives (there is a greater magnitude in cost impacts for Alternative B than Alternative G) due to the increased volumes of overall dredging independent of the disposal assumptions.

4) Construction Duration Assumptions (currently assumed construction duration versus construction duration ± 50 percent)

   As illustrated in **Table N-4** and **Figures N-4a** through **N-4b**, reducing and increasing the construction duration assumptions has a relatively significant effect on the total present value cost compared to the other sensitivity analysis scenarios. There is an inverse relationship between construction duration and total present value cost (increasing construction duration results in a decreased total present value cost). This inverse relationship exists because escalation (inflation) is not applied in the constant

dollar analysis and not included during present value analysis per EPA 540-R-00-002. Thus the effect of progressively lengthening construction duration results in applying costs in later years where the impacts of discounting reduce present value cost at an increasing rate. Total present value cost was reduced by approximately 4 and 18 percent for Alternatives B and G, respectively, with a 50 percent increase in construction duration compared to the baseline estimate. The total present value cost was increased by approximately 4 and 21 percent for Alternatives B and G, respectively, with a 50 percent decrease in construction duration compared to the baseline. Shortening the construction durations has a slightly higher effect on sensitivity for all alternatives compared to lengthening the construction duration for the discounting reasons previously mentioned.

5) Overdredge Assumptions (current overdredge factor assumption [1.75] vs. low/high overdredge factor [1.50/2.0])

   As illustrated in **Table N-5** and **Figure N-5**, reducing and increasing the overdredge factor has a small to moderate impact on the total present value cost. Total present value costs were increased by approximately 6 percent and 9 percent for Alternatives B and G, respectively, by increasing the overdredge factor to 2.0. The total present value costs were reduced by approximately 6 percent and 10 percent for Alternatives B and G, respectively, by decreasing the overdredge factor to 1.5. There is some additional minor sensitivity between alternatives. Although changes to the overdredge assumption have a direct linear effect on dredge volume quantities, the sensitivity of the present value costs between alternatives are additionally affected by factors such as changes in dredge areas and types of dredging (open water versus confined).

Tables

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Table N-1
Comparison of Constant Dollar Costs and Present Value Costs
For Alternatives B, D, E, F, G, and I Based on Two Periods of Analysis (30 Years and 100 Years)
Portland Harbor Superfund Site
Portland, Oregon

Scenario	Alternative B Total Expenditures		Alternative D Total Expenditures		Alternative E Total Expenditures		Alternative F Total Expenditures		Alternative G Total Expenditures		Alternative I Total Expenditures	
	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost
30-Year Period of Analysis (Base Estimate Scenario)	$642,421,000	$451,460,000	$953,032,000	$653,700,000	$1,239,797,000	$869,530,000	$2,178,919,000	$1,371,170,000	$3,208,659,000	$1,777,320,000	$1,173,299,000	$811,290,000
100-Year Period of Analysis	$1,150,465,000	$463,890,000	$1,649,062,000	$670,720,000	$1,964,614,000	$887,240,000	$3,147,620,000	$1,394,830,000	$4,458,676,000	$1,807,840,000	$1,914,461,000	$829,410,000

Table N-2
Comparison of Constant Dollar Costs and Present Value Costs
For Alternatives B, D, E, F, G, and I Based on Two Site-Wide Monitoring and Monitored Natural Recovery Frequency Scenarios (Current versus 5-Year)
Portland Harbor Superfund Site
Portland, Oregon

Scenario	Alternative B Total Expenditures		Alternative D Total Expenditures		Alternative E Total Expenditures		Alternative F Total Expenditures		Alternative G Total Expenditures		Alternative I Total Expenditures	
	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost
Monitoring Frequency Reduced (Monitoring Every 5 Years)	$535,445,000	$385,990,000	$807,536,000	$564,650,000	$1,089,929,000	$777,800,000	$1,980,923,000	$1,249,990,000	$2,954,607,000	$1,621,830,000	$1,019,595,000	$717,220,000
Current Monitoring Frequency Assumptions (Base Estimate Scenario)	$642,421,000	$451,460,000	$953,032,000	$653,700,000	$1,239,797,000	$869,530,000	$2,178,919,000	$1,371,170,000	$3,208,659,000	$1,777,320,000	$1,173,299,000	$811,290,000

Table N-3
Comparison of Constant Dollar Costs and Present Value Costs
For Alternatives B, D, E, F, G, and I Based on Three Subtitle C/TSCA Disposal Volume Scenarios (Reduced, Current and Increased)
Portland Harbor Superfund Site
Portland, Oregon

Scenario	Alternative B Total Expenditures		Alternative D Total Expenditures		Alternative E Total Expenditures		Alternative F Total Expenditures		Alternative G Total Expenditures		Alternative I Total Expenditures	
	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost
Reduced Subtitle C Disposal Volume (-15%)	$636,423,000	$446,030,000	$947,034,000	$648,600,000	$1,233,798,000	$864,590,000	$2,172,921,000	$1,367,040,000	$3,202,661,000	$1,773,830,000	$1,167,693,000	$806,670,000
Current Subtitle C/TSCA Disposal Volume (Base Estimate Scenario)	$642,421,000	$451,460,000	$953,032,000	$653,700,000	$1,239,797,000	$869,530,000	$2,178,919,000	$1,371,170,000	$3,208,659,000	$1,777,320,000	$1,173,299,000	$811,290,000
Increased Subtitle C Disposal Volume (+15%)	$648,422,000	$456,900,000	$959,033,000	$658,800,000	$1,245,798,000	$874,470,000	$2,184,920,000	$1,375,300,000	$3,214,660,000	$1,780,810,000	$1,178,907,000	$815,910,000

Table N-4
Comparison of Constant Dollar Costs and Present Value Costs
For Alternatives B, D, E, F, G, and I Based on Three Construction Duration Scenarios (Reduced, Current and Increased)
Portland Harbor Superfund Site
Portland, Oregon

Scenario	Alternative B Total Expenditures		Alternative D Total Expenditures		Alternative E Total Expenditures		Alternative F Total Expenditures		Alternative G Total Expenditures		Alternative I Total Expenditures	
	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost
Reduced Construction Duration (50% Shorter Construction Duration)	$642,421,000	$472,350,000	$953,032,000	$700,600,000	$1,239,797,000	$961,260,000	$2,178,919,000	$1,633,960,000	$3,208,659,000	$2,257,320,000	$1,173,299,000	$894,460,000
Currently Assumed Construction Duration (Base Estimate Scenario)	$642,421,000	$451,460,000	$953,032,000	$653,700,000	$1,239,797,000	$869,530,000	$2,178,919,000	$1,371,170,000	$3,208,659,000	$1,777,320,000	$1,173,299,000	$811,290,000
Increased Construction Duration (50% Longer Construction Duration)	$642,421,000	$432,340,000	$953,032,000	$612,540,000	$1,239,797,000	$792,370,000	$2,178,919,000	$1,174,880,000	$3,208,659,000	$1,455,570,000	$1,173,299,000	$741,340,000

Table N-5
Comparison of Constant Dollar Costs and Present Value Costs
For Alternatives B, D, E, F, G, and I Based on Three Overdredge Scenarios (Reduced, Current and Increased)
Portland Harbor Superfund Site
Portland, Oregon

Scenario	Alternative B Total Expenditures		Alternative D Total Expenditures		Alternative E Total Expenditures		Alternative F Total Expenditures		Alternative G Total Expenditures		Alternative I Total Expenditures	
	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost
Reduced Overdredge Factor (Overdredge Factor of 1.5)	$614,700,000	$426,340,000	$904,931,000	$612,810,000	$1,160,229,000	$803,980,000	$2,002,138,000	$1,249,560,000	$2,924,679,000	$1,612,030,000	$1,108,912,000	$758,250,000
Current Overdredge Factor of 1.75 (Base Estimate Scenario)	$642,421,000	$451,460,000	$953,032,000	$653,700,000	$1,239,797,000	$869,530,000	$2,178,919,000	$1,371,170,000	$3,208,659,000	$1,777,320,000	$1,173,299,000	$811,290,000
Increased Overdredge Factor (Overdredge Factor of 2.0)	$670,143,000	$476,580,000	$1,001,130,000	$694,580,000	$1,319,363,000	$935,070,000	$2,355,700,000	$1,492,770,000	$3,492,638,000	$1,942,610,000	$1,237,685,000	$864,330,000

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Figures

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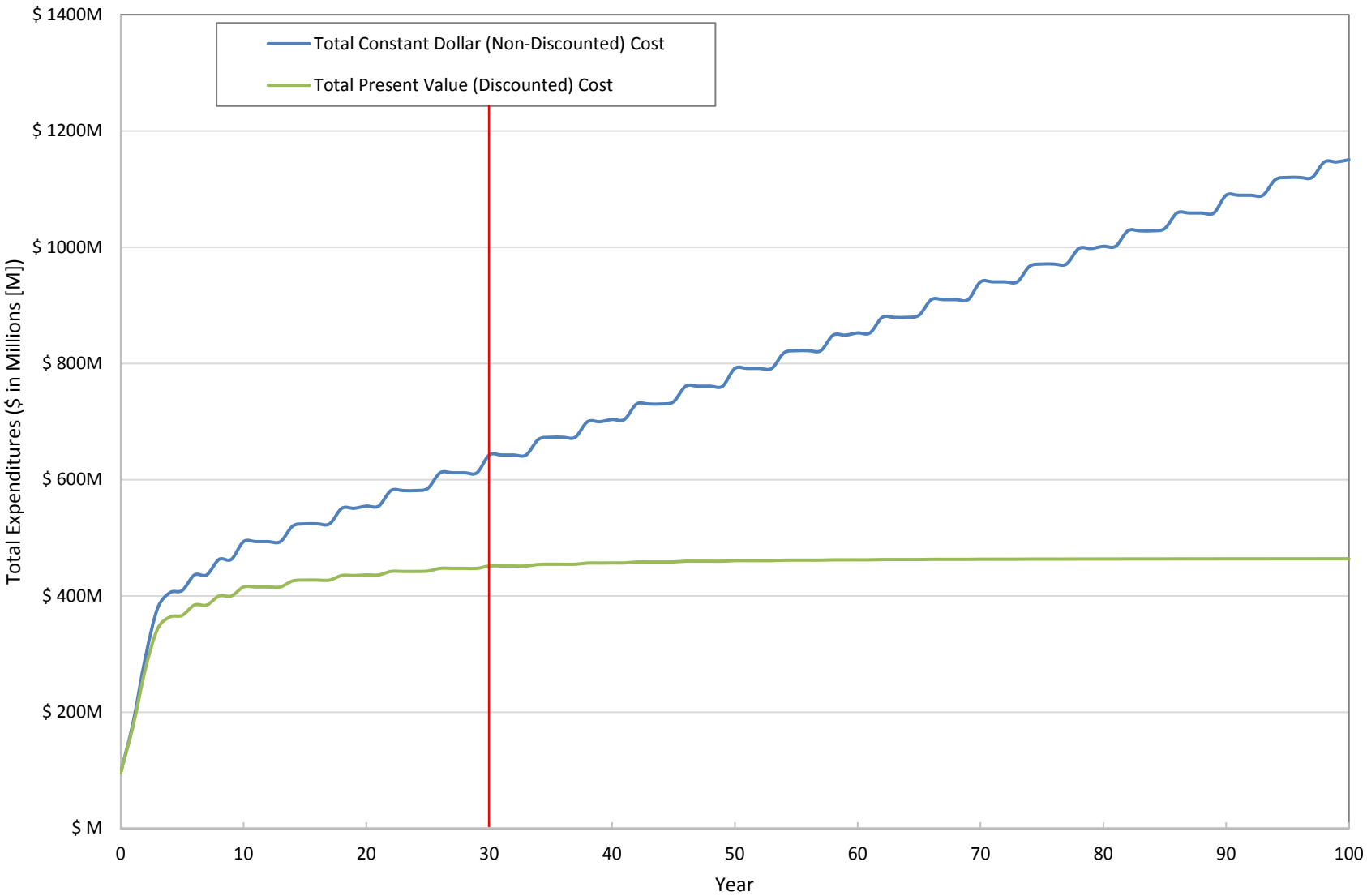

Figure N-1a. Comparison of Constant Dollar Costs and Present Value Cost for Alternative B - 100 Year Period Analysis

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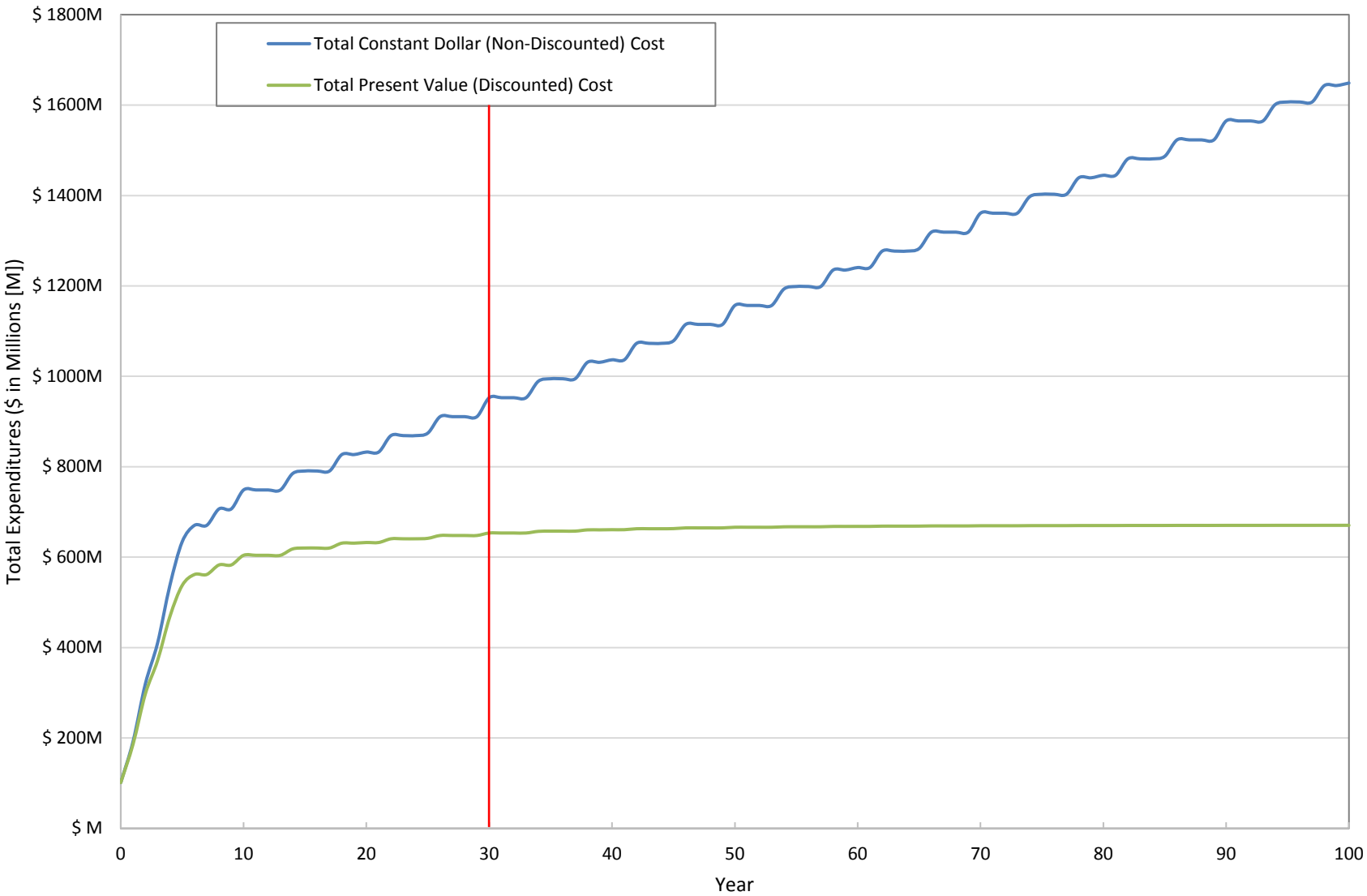

Figure N-1b. Comparison of Constant Dollar Costs and Present Value Costs For Alternative D - 100 Year Period of Analysis

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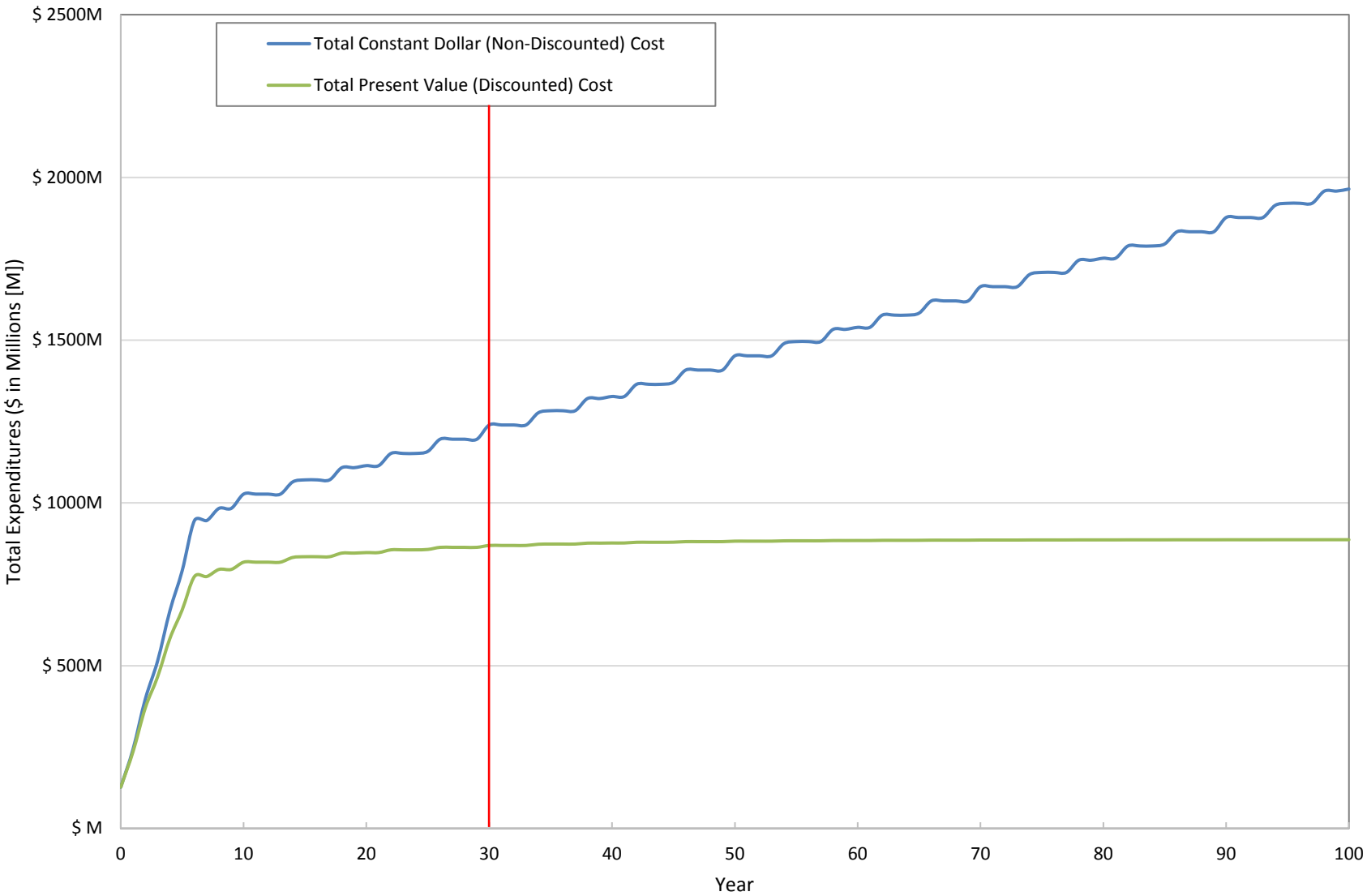

Figure N-1c. Comparison of Constant Dollar Costs and Present Value Costs For Alternative E - 100 Year Period of Analysis

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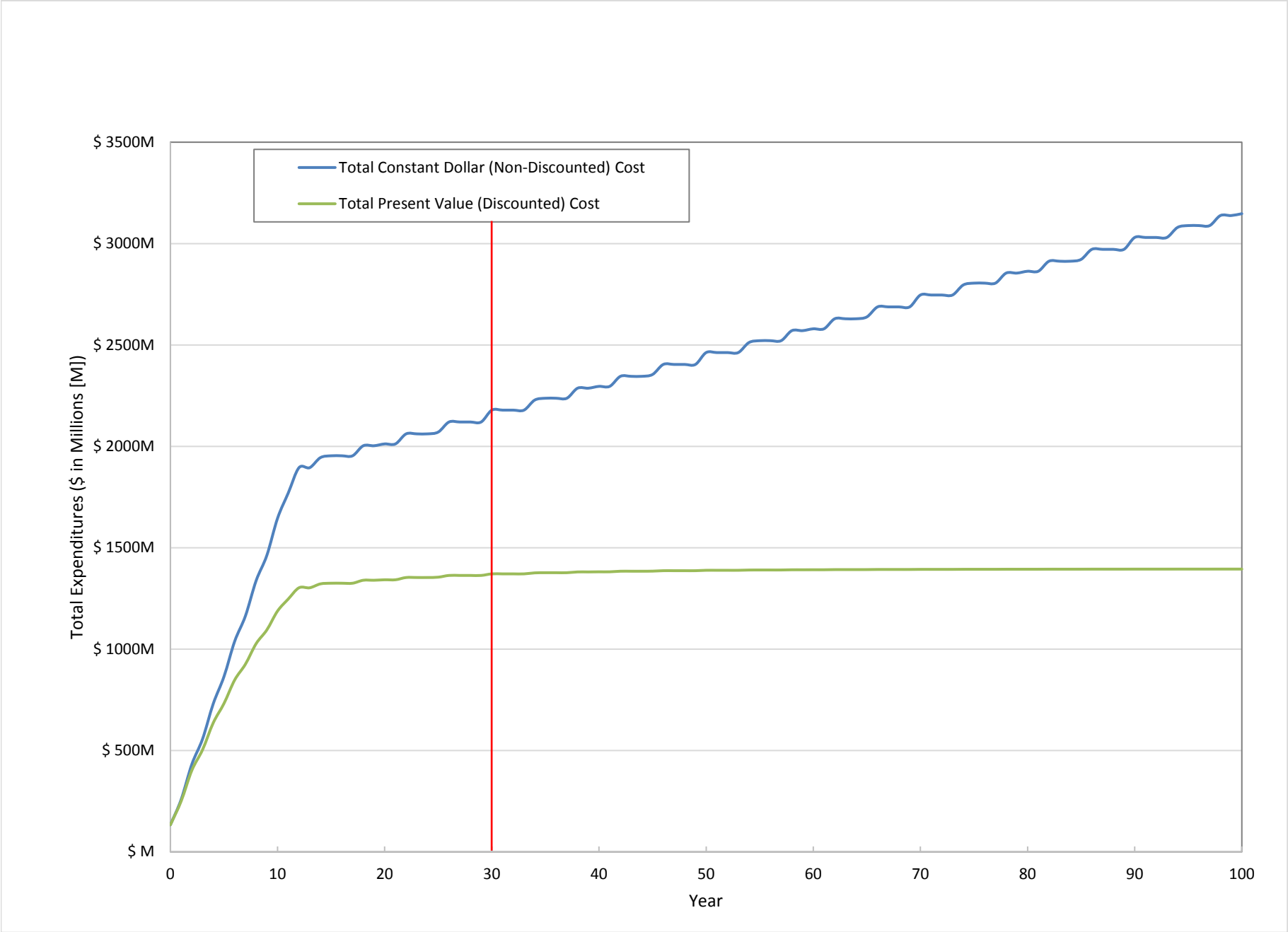

Figure N-1d. Comparison of Constant Dollar Costs and Present Value Costs For Alternative F - 100 Year Period of Analysis

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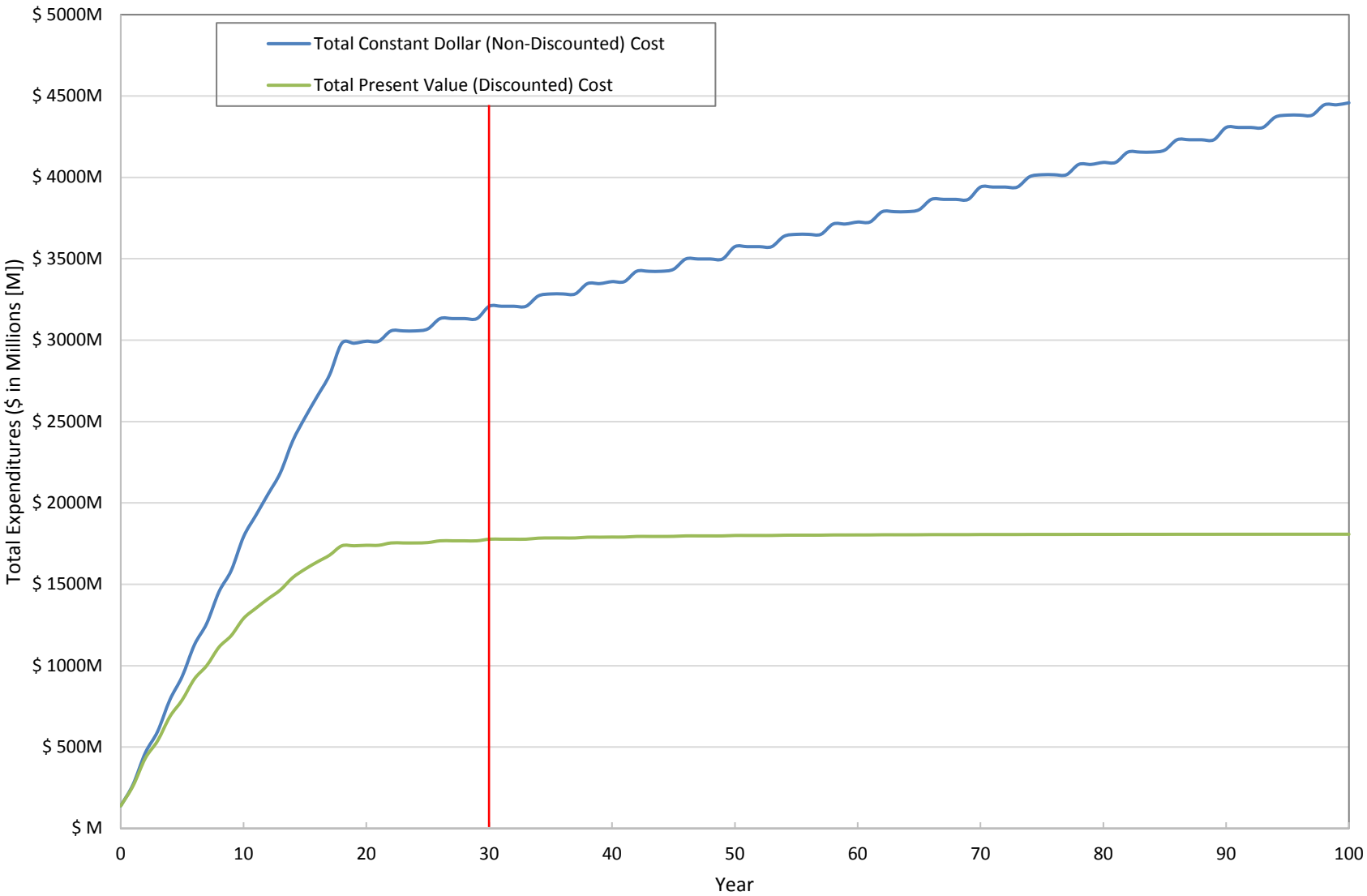

Figure N-1e. Comparison of Constant Dollar Costs and Present Value Costs For Alternative G - 100 Year Period of Analysis

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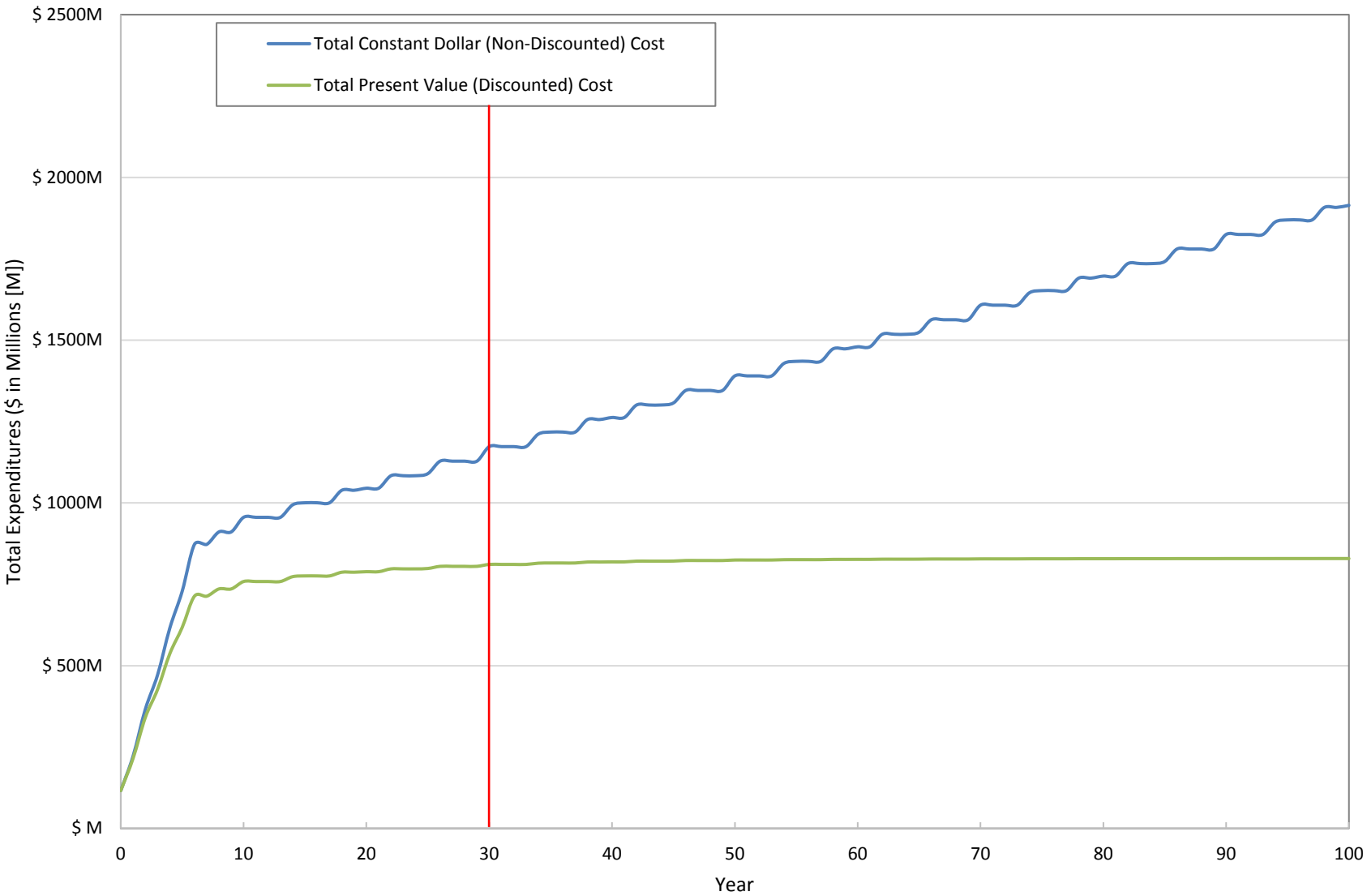

Figure N-1f. Comparison of Constant Dollar Costs and Present Value Costs For Alterntive I - 100 Year Period of Analysis

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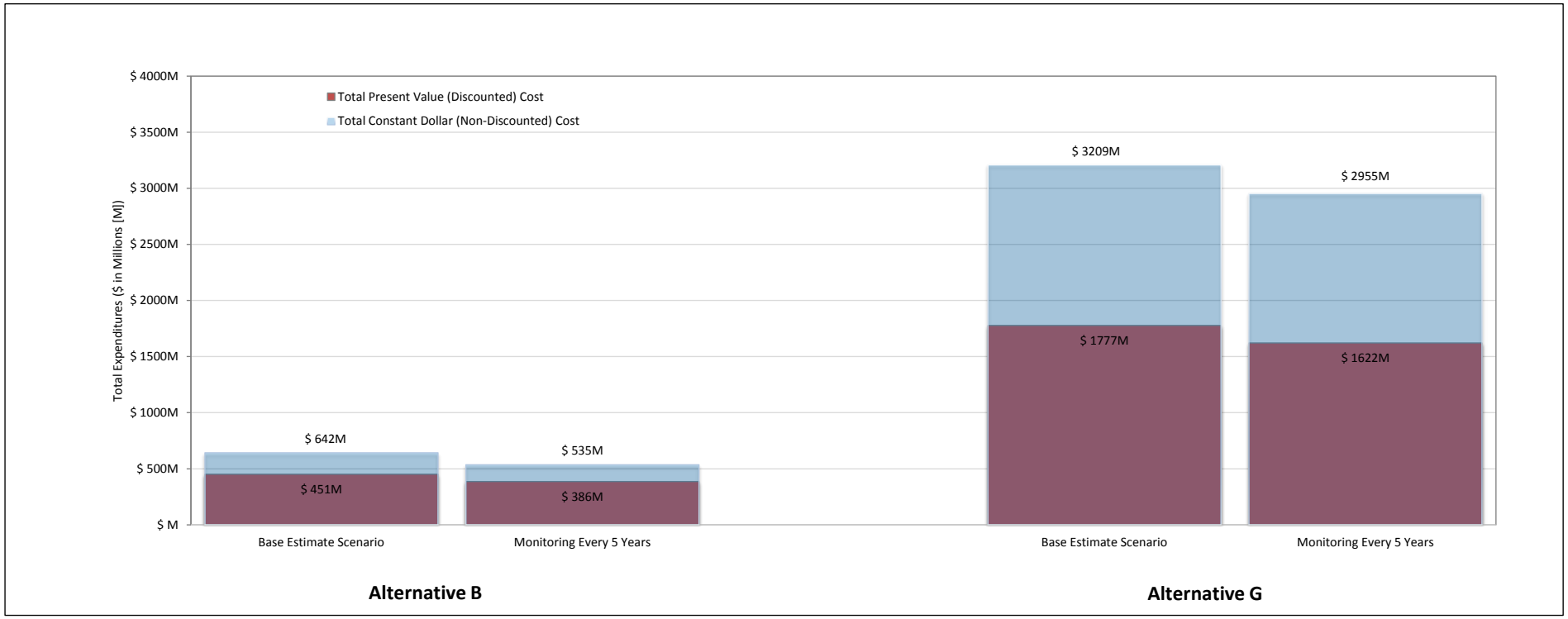

Figure N-2. Comparison of Constant Dollar Costs and Present Value Cost For Alternatives B and G Based on Two Site-Wide Monitoring and Monitored Natural Frequency Scenarios (Current versus 5-Year)

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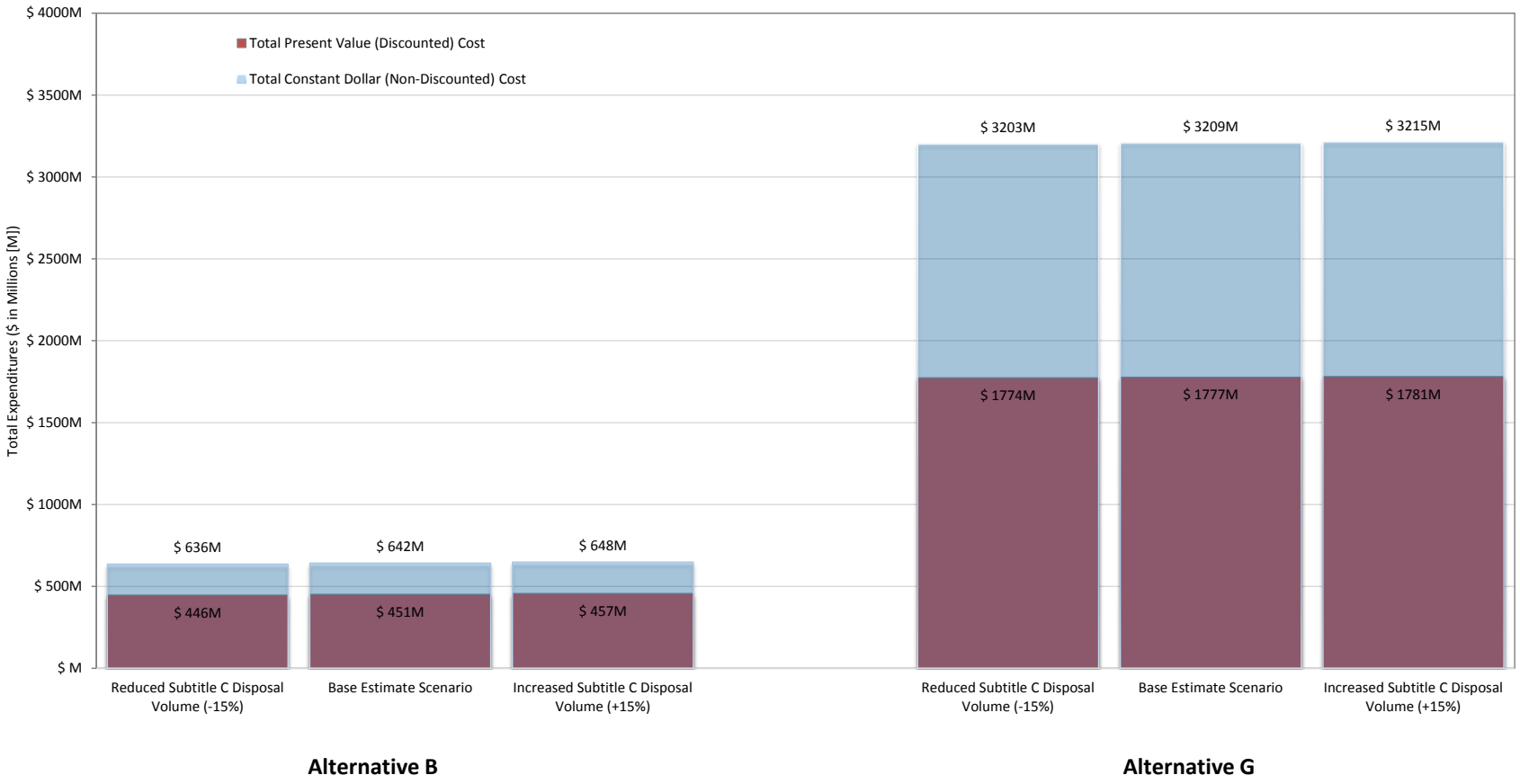

Figure N-3. Comparison of Constant Dollar Costs and Present Value Cost For Alternatives B and G Based on Three Subtitle C/TSCA Disposal Volume Scenarios (Reduced, Current and Increased)

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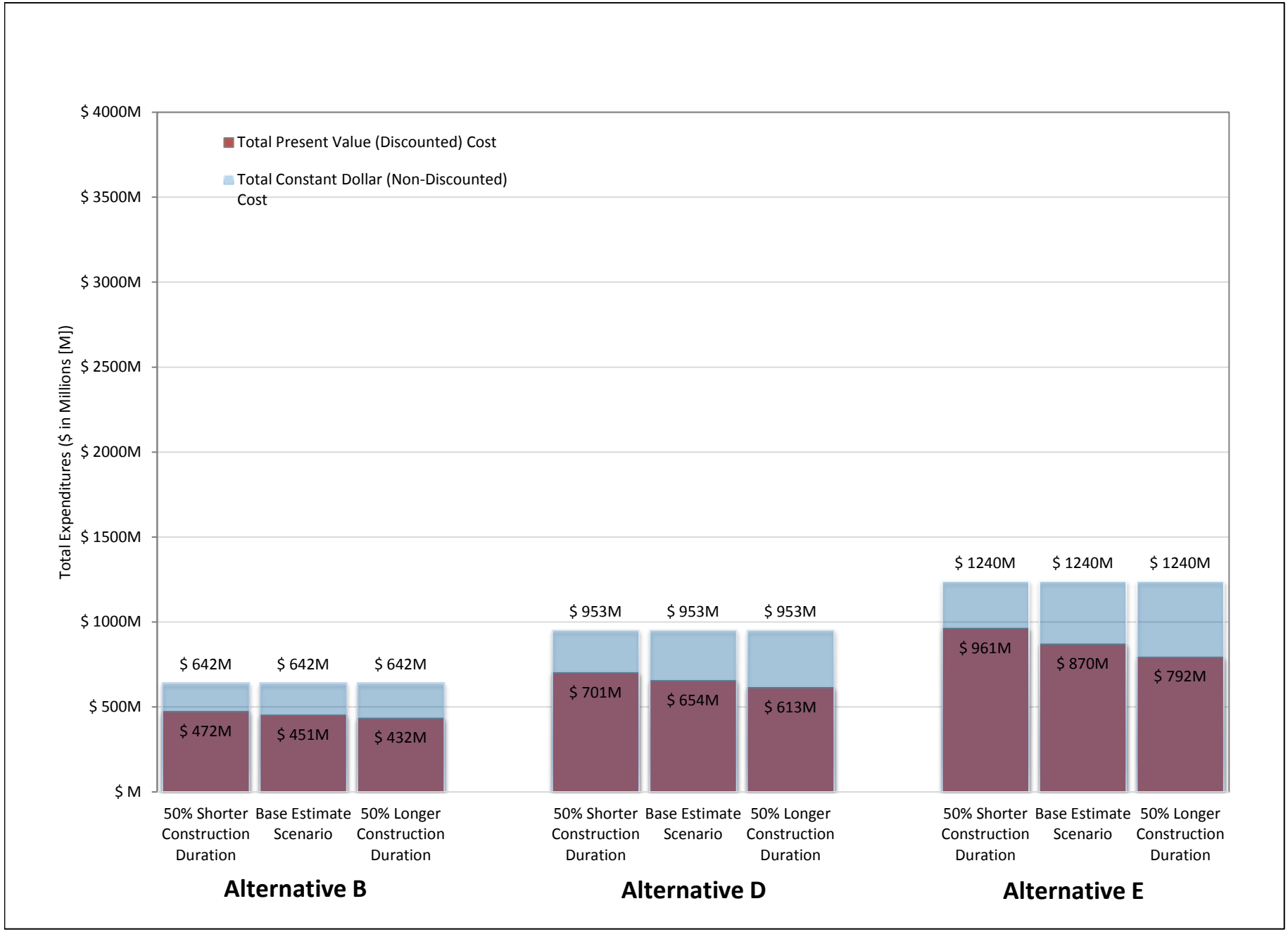

Figure N-4a. Comparison of Constant Dollar Costs and Present Value Cost For Alternatives B, D, and E Based on Three Construction Duration Scenarios (Reduced, Current and Increased)

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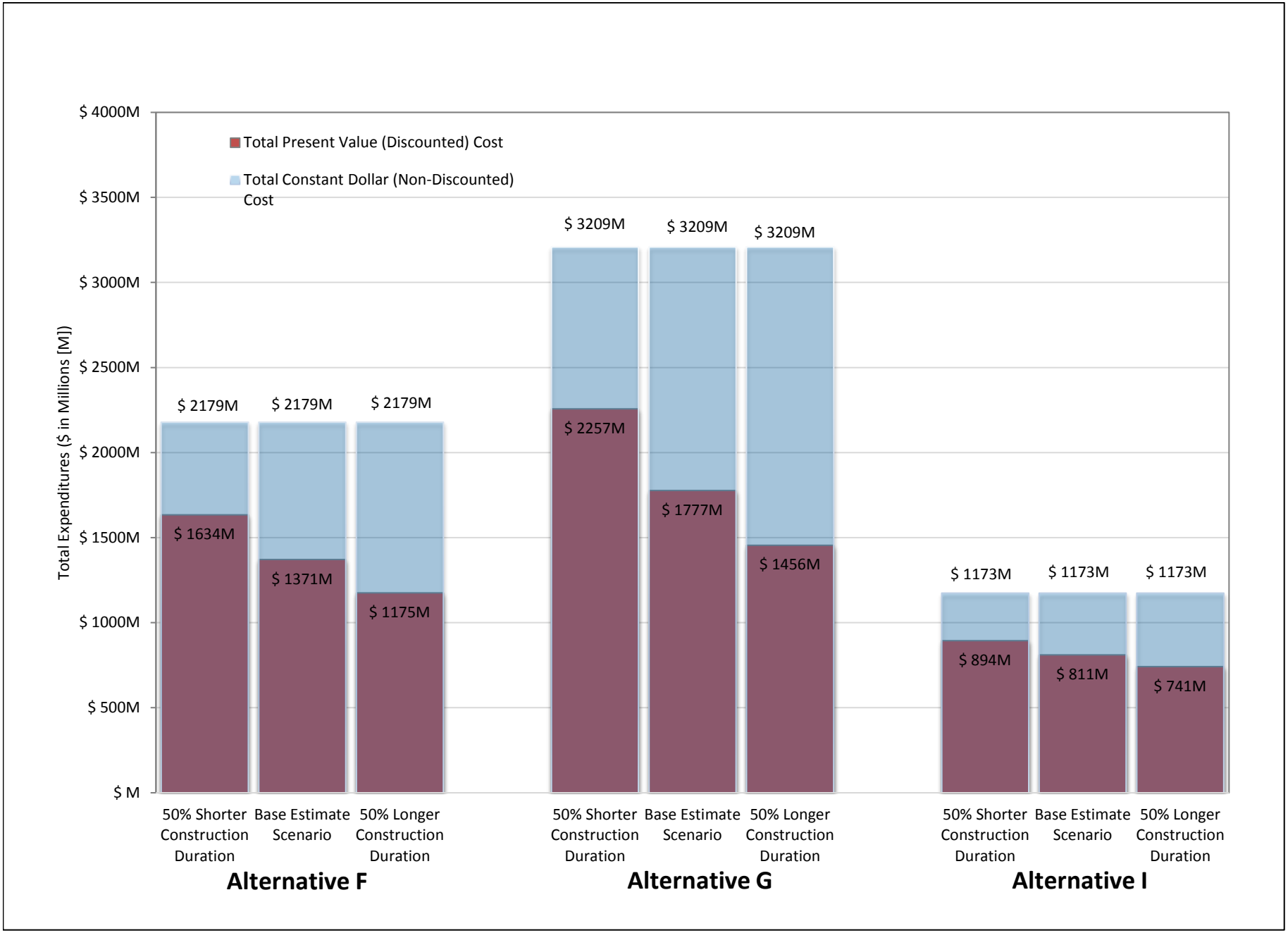

Figure N-4b. Comparison of Constant Dollar Costs and Present Value Cost For Alternatives F, G, and I Based on Three Construction Duration Scenarios (Reduced, Current and Increased)

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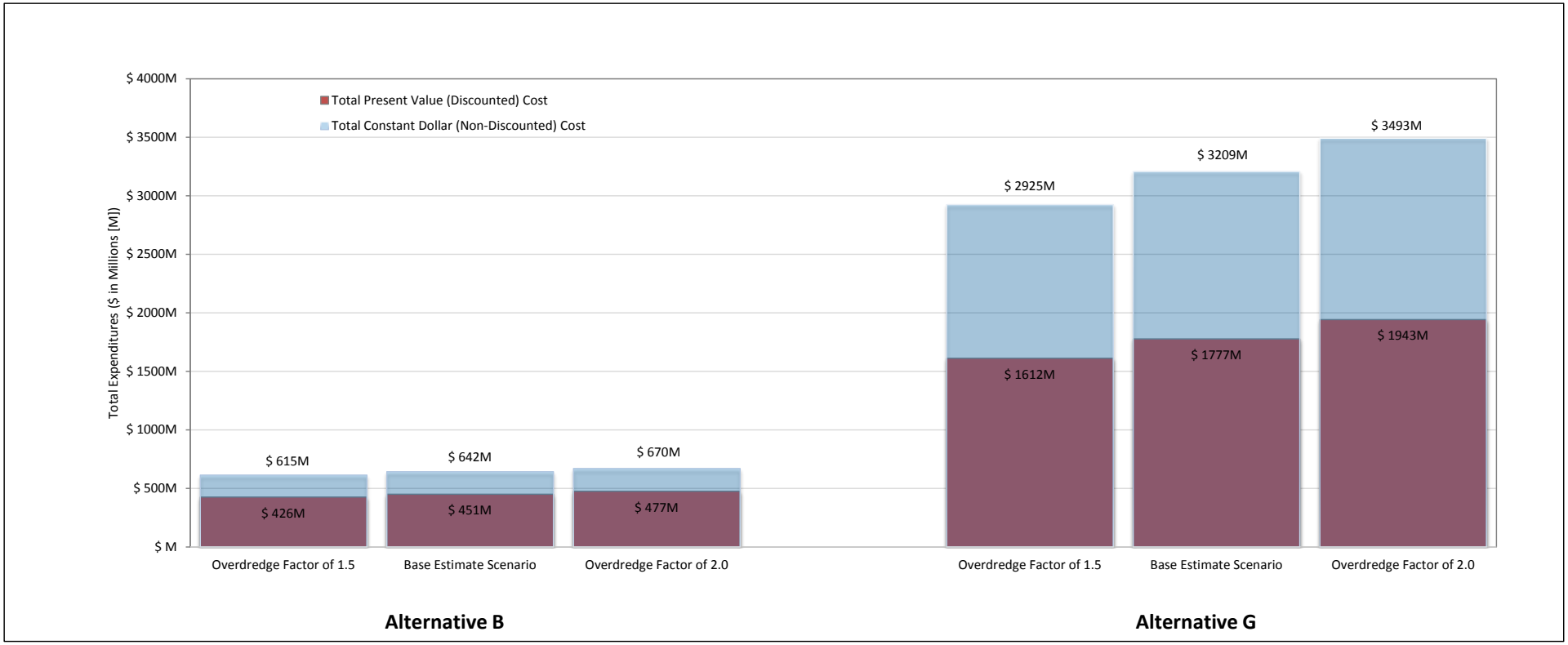

Figure N-5. Comparison of Constant Dollar Costs and Present Value Cost For Alternatives B and G Based on Three Overdredge Scenarios (Reduced, Current and Increased)

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Attachment N-1
Sensitivity Analysis - Cost Estimate Backup

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Attachment N-1
Sensitivity Analysis - Cost Estimate Backup

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Sensitivity Analysis

Period of Analysis Scenario
(100 Year)

Note: Costs presented herein are specific to DMM Scenario 2. All Cost Worksheets for the Period of Analysis Sensitivity Analysis Scenario are the same as the Cost Worksheets created for the base estimate, and can be found in Appendix G.

TABLE PV-B

PRESENT VALUE ANALYSIS

Alternative **B Sensitivity Analysis - Period of Analysis (100 Year)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$620,250	$10,912,000	$84,676,000	$0	$0	$0	$0	$96,208,250	1.0000	$96,208,250
1	$620,250	$0	$84,676,000	$0	$0	$0	$0	$85,296,250	0.9346	$79,717,875
2	$620,250	$0	$84,676,000	$0	$26,744,000	$0	$0	$112,040,250	0.8734	$97,855,954
3	$620,250	$0	$84,676,000	$0	$0	$0	$0	$85,296,250	0.8163	$69,627,329
4	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.7629	$20,402,998
5	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.7130	$2,719,382
6	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.6663	$17,819,527
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.5820	$15,565,008
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.5083	$15,532,631
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.3878	$10,371,323
15	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.3624	$1,382,194
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2959	$7,913,550
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.2584	$985,538
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2257	$6,036,121
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.1842	$702,539
26	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.1722	$4,605,317
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.1314	$4,015,321
31	$0	$0	$0	$0	$0	$0	$0	$0	0.1228	$0
32	$0	$0	$0	$0	$0	$0	$0	$0	0.1147	$0
33	$0	$0	$0	$0	$0	$0	$0	$0	0.1072	$0
34	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.1002	$2,679,749
35	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0937	$357,372
36	$0	$0	$0	$0	$0	$0	$0	$0	0.0875	$0
37	$0	$0	$0	$0	$0	$0	$0	$0	0.0818	$0
38	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0765	$2,045,916
39	$0	$0	$0	$0	$0	$0	$0	$0	0.0715	$0
40	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0668	$254,775
41	$0	$0	$0	$0	$0	$0	$0	$0	0.0624	$0
42	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0583	$1,559,175
43	$0	$0	$0	$0	$0	$0	$0	$0	0.0545	$0
44	$0	$0	$0	$0	$0	$0	$0	$0	0.0509	$0
45	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0476	$181,546
46	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0445	$1,190,108
47	$0	$0	$0	$0	$0	$0	$0	$0	0.0416	$0
48	$0	$0	$0	$0	$0	$0	$0	$0	0.0389	$0
49	$0	$0	$0	$0	$0	$0	$0	$0	0.0363	$0
50	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.0339	$1,035,916
51	$0	$0	$0	$0	$0	$0	$0	$0	0.0317	$0
52	$0	$0	$0	$0	$0	$0	$0	$0	0.0297	$0
53	$0	$0	$0	$0	$0	$0	$0	$0	0.0277	$0
54	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0259	$692,670
55	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0242	$92,299
56	$0	$0	$0	$0	$0	$0	$0	$0	0.0226	$0
57	$0	$0	$0	$0	$0	$0	$0	$0	0.0211	$0
58	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0198	$529,531
59	$0	$0	$0	$0	$0	$0	$0	$0	0.0185	$0
60	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0173	$65,982
61	$0	$0	$0	$0	$0	$0	$0	$0	0.0161	$0
62	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0151	$403,834
63	$0	$0	$0	$0	$0	$0	$0	$0	0.0141	$0
64	$0	$0	$0	$0	$0	$0	$0	$0	0.0132	$0
65	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0123	$46,912
66	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0115	$307,556
67	$0	$0	$0	$0	$0	$0	$0	$0	0.0107	$0
68	$0	$0	$0	$0	$0	$0	$0	$0	0.0100	$0
69	$0	$0	$0	$0	$0	$0	$0	$0	0.0094	$0
70	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.0088	$268,910
71	$0	$0	$0	$0	$0	$0	$0	$0	0.0082	$0
72	$0	$0	$0	$0	$0	$0	$0	$0	0.0077	$0
73	$0	$0	$0	$0	$0	$0	$0	$0	0.0072	$0
74	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0067	$179,185
75	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0063	$24,028

TABLE PV-B

PRESENT VALUE ANALYSIS

Alternative **B Sensitivity Analysis - Period of Analysis (100 Year)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
76	$0	$0	$0	$0	$0	$0	$0	$0	0.0058	$0
77	$0	$0	$0	$0	$0	$0	$0	$0	0.0055	$0
78	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0051	$136,394
79	$0	$0	$0	$0	$0	$0	$0	$0	0.0048	$0
80	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0045	$17,163
81	$0	$0	$0	$0	$0	$0	$0	$0	0.0042	$0
82	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0039	$104,302
83	$0	$0	$0	$0	$0	$0	$0	$0	0.0036	$0
84	$0	$0	$0	$0	$0	$0	$0	$0	0.0034	$0
85	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0032	$12,205
86	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0030	$80,232
87	$0	$0	$0	$0	$0	$0	$0	$0	0.0028	$0
88	$0	$0	$0	$0	$0	$0	$0	$0	0.0026	$0
89	$0	$0	$0	$0	$0	$0	$0	$0	0.0024	$0
90	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.0023	$70,283
91	$0	$0	$0	$0	$0	$0	$0	$0	0.0021	$0
92	$0	$0	$0	$0	$0	$0	$0	$0	0.0020	$0
93	$0	$0	$0	$0	$0	$0	$0	$0	0.0019	$0
94	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0017	$45,465
95	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0016	$6,102
96	$0	$0	$0	$0	$0	$0	$0	$0	0.0015	$0
97	$0	$0	$0	$0	$0	$0	$0	$0	0.0014	$0
98	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.0013	$34,767
99	$0	$0	$0	$0	$0	$0	$0	$0	0.0012	$0
100	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.0012	$4,577
TOTALS:	$2,481,000	$10,912,000	$338,704,000	$0	$722,088,000	$70,120,000	$6,160,000	$1,150,465,000		$463,887,811
TOTAL PRESENT VALUE OF ALTERNATIVE B[5]										**$463,890,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 100 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-B.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-B

Alternative **B Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 3)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-B2	1	LS	$2,016,443	$2,016,443	
SUBTOTAL					$2,016,443	
Contingency (Scope and Bid)		15%			$302,466	10% Scope, 5% Bid as documented in Attachment A.
SUBTOTAL					$2,318,909	
Project Management		2%			$46,378	Percentage modified as documented in Attachment A.
Remedial Design		2%			$46,378	Percentage modified as documented in Attachment A.
Construction Management		3%			$69,567	Percentage modified as documented in Attachment A.
TOTAL					$2,481,232	
TOTAL CAPITAL COST					**$2,481,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,641,756	
Contingency (Scope and Bid)		20%			$1,528,351	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,170,107	
Project Management		5%			$458,505	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$733,609	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$550,206	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,912,427	
TOTAL CAPITAL COST					**$10,912,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 3)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-B1	1	LS	$4,155,000	$4,155,000	
Transload Facility Development	CW-B21	1	LS	$7,967,890	$7,967,890	
Debris Removal and Disposal	CW-B5	202	AC	$13,107	$2,647,616	
Obstruction Removal and Relocation	CW-B6	1	LS	$3,907,503	$3,907,503	
Erosion/Residual Control Measures	CW-B7	1	LS	$22,320,235	$22,320,235	
Dredging of Contaminated Sediments (Open Water)	CW-B8	513,841	CY	$24.53	$12,604,520	
Dredging of Contaminated Sediments (Confined)	CW-B9	63,042	CY	$31.10	$1,960,606	
Excavation of Riverbanks	CW-B10	50,769	CY	$5.19	$263,490	
Dewatering and Water Treatment for Dredging Operations	CW-B11	1	LS	$2,595,467	$2,595,467	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-B12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-B13	693,843	TON	$111	$76,847,281	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-B14	15	AC	$1,070,827	$16,062,405	
Sand Placement for Technology Assignments	CW-B15	342,033	CY	$33.89	$11,591,596	
Beach Mix Placement for Technology Assignments	CW-B16	18,563	CY	$74.24	$1,378,163	
Armor Placement for Technology Assignments	CW-B17	29,533	CY	$72.42	$2,138,814	
Reactive/GAC Placement for Technology Assignments	CW-B18	1	LS	$27,488,372	$27,488,372	
Geofabric for Riverbanks	CW-B19	10.5	AC	$14,311	$150,268	
Organoclay Mat Placement for Technology Assignments	CW-B20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$263,787,994	
Contingency (Scope and Bid)		20%			$52,757,599	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$316,545,593	
Project Management		2%			$6,330,912	Percentage modified as documented in Attachment A.
Remedial Design		2%			$6,330,912	Percentage modified as documented in Attachment A.
Construction Management		3%			$9,496,368	Percentage modified as documented in Attachment A.
TOTAL					$338,703,785	
TOTAL CAPITAL COST					**$338,704,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	
Site-Wide Monitoring	CW-B23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-B24	1	LS	$12,228,875	$12,228,875	
SUBTOTAL					$20,828,290	
Contingency (Scope and Bid)		20%			$4,165,658	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$24,993,948	
Project Management		2%			$499,879	Percentage modified as documented in Attachment A.
Technical Support		5%			$1,249,697	Percentage modified as documented in Attachment A.
TOTAL					$26,743,524	
TOTAL PERIODIC COST					**$26,744,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-B25	1	LS	$2,230,955	$2,230,955	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$2,230,955	
Contingency (Scope and Bid)		20%			$446,191	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,677,146	
Project Management		5%			$133,857	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$267,715	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$3,078,718	
TOTAL PERIODIC COST					**$3,079,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-B3	1	LS	$337,883	$337,883	
SUBTOTAL					$337,883	
Contingency (Scope and Bid)		10%			$33,788	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$371,671	
Project Management		5%			$18,584	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$37,167	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$427,422	
TOTAL PERIODIC COST					**$427,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-B26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-D

PRESENT VALUE ANALYSIS

Alternative D Sensitivity Analysis - Period of Analysis (100 Year)

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$517,500	$10,481,000	$90,403,000	$0	$0	$0	$0	$101,401,500	1.0000	$101,401,500
1	$517,500	$0	$90,403,000	$0	$0	$0	$0	$90,920,500	0.9346	$84,974,299
2	$517,500	$0	$90,403,000	$0	$36,374,000	$0	$0	$127,294,500	0.8734	$111,179,016
3	$517,500	$0	$90,403,000	$0	$0	$0	$0	$90,920,500	0.8163	$74,218,404
4	$517,500	$0	$90,403,000	$0	$36,374,000	$0	$0	$127,294,500	0.7629	$97,112,974
5	$517,500	$0	$90,403,000	$0	$0	$5,240,000	$308,000	$96,468,500	0.7130	$68,782,041
6	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.6663	$24,235,996
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.5820	$21,169,668
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.5083	$21,308,953
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.3878	$14,105,837
15	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.3624	$2,010,595
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2959	$10,763,067
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.2584	$1,433,603
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2257	$8,209,612
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.1842	$1,021,942
26	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.1722	$6,263,603
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.1314	$5,508,551
31	$0	$0	$0	$0	$0	$0	$0	$0	0.1228	$0
32	$0	$0	$0	$0	$0	$0	$0	$0	0.1147	$0
33	$0	$0	$0	$0	$0	$0	$0	$0	0.1072	$0
34	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.1002	$3,644,675
35	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0937	$519,848
36	$0	$0	$0	$0	$0	$0	$0	$0	0.0875	$0
37	$0	$0	$0	$0	$0	$0	$0	$0	0.0818	$0
38	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0765	$2,782,611
39	$0	$0	$0	$0	$0	$0	$0	$0	0.0715	$0
40	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0668	$370,606
41	$0	$0	$0	$0	$0	$0	$0	$0	0.0624	$0
42	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0583	$2,120,604
43	$0	$0	$0	$0	$0	$0	$0	$0	0.0545	$0
44	$0	$0	$0	$0	$0	$0	$0	$0	0.0509	$0
45	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0476	$264,085
46	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0445	$1,618,643
47	$0	$0	$0	$0	$0	$0	$0	$0	0.0416	$0
48	$0	$0	$0	$0	$0	$0	$0	$0	0.0389	$0
49	$0	$0	$0	$0	$0	$0	$0	$0	0.0363	$0
50	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.0339	$1,421,156
51	$0	$0	$0	$0	$0	$0	$0	$0	0.0317	$0
52	$0	$0	$0	$0	$0	$0	$0	$0	0.0297	$0
53	$0	$0	$0	$0	$0	$0	$0	$0	0.0277	$0
54	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0259	$942,087
55	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0242	$134,262
56	$0	$0	$0	$0	$0	$0	$0	$0	0.0226	$0
57	$0	$0	$0	$0	$0	$0	$0	$0	0.0211	$0
58	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0198	$720,205
59	$0	$0	$0	$0	$0	$0	$0	$0	0.0185	$0
60	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0173	$95,980
61	$0	$0	$0	$0	$0	$0	$0	$0	0.0161	$0
62	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0151	$549,247
63	$0	$0	$0	$0	$0	$0	$0	$0	0.0141	$0
64	$0	$0	$0	$0	$0	$0	$0	$0	0.0132	$0
65	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0123	$68,240
66	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0115	$418,301
67	$0	$0	$0	$0	$0	$0	$0	$0	0.0107	$0
68	$0	$0	$0	$0	$0	$0	$0	$0	0.0100	$0
69	$0	$0	$0	$0	$0	$0	$0	$0	0.0094	$0
70	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.0088	$368,914
71	$0	$0	$0	$0	$0	$0	$0	$0	0.0082	$0
72	$0	$0	$0	$0	$0	$0	$0	$0	0.0077	$0
73	$0	$0	$0	$0	$0	$0	$0	$0	0.0072	$0
74	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0067	$243,706
75	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0063	$34,952

TABLE PV-D

PRESENT VALUE ANALYSIS

Alternative **D Sensitivity Analysis - Period of Analysis (100 Year)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
76	$0	$0	$0	$0	$0	$0	$0	$0	0.0058	$0
77	$0	$0	$0	$0	$0	$0	$0	$0	0.0055	$0
78	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0051	$185,507
79	$0	$0	$0	$0	$0	$0	$0	$0	0.0048	$0
80	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0045	$24,966
81	$0	$0	$0	$0	$0	$0	$0	$0	0.0042	$0
82	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0039	$141,859
83	$0	$0	$0	$0	$0	$0	$0	$0	0.0036	$0
84	$0	$0	$0	$0	$0	$0	$0	$0	0.0034	$0
85	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0032	$17,754
86	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0030	$109,122
87	$0	$0	$0	$0	$0	$0	$0	$0	0.0028	$0
88	$0	$0	$0	$0	$0	$0	$0	$0	0.0026	$0
89	$0	$0	$0	$0	$0	$0	$0	$0	0.0024	$0
90	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.0023	$96,421
91	$0	$0	$0	$0	$0	$0	$0	$0	0.0021	$0
92	$0	$0	$0	$0	$0	$0	$0	$0	0.0020	$0
93	$0	$0	$0	$0	$0	$0	$0	$0	0.0019	$0
94	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0017	$61,836
95	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0016	$8,877
96	$0	$0	$0	$0	$0	$0	$0	$0	0.0015	$0
97	$0	$0	$0	$0	$0	$0	$0	$0	0.0014	$0
98	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.0013	$47,286
99	$0	$0	$0	$0	$0	$0	$0	$0	0.0012	$0
100	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.0012	$6,658
TOTALS:	$3,105,000	$10,481,000	$542,418,000	$0	$982,098,000	$104,800,000	$6,160,000	$1,649,062,000		$670,718,069
TOTAL PRESENT VALUE OF ALTERNATIVE D[5]										**$670,720,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 100 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-D.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-D

Alternative D Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 5)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-D2	1	LS	$2,523,020	$2,523,020	
SUBTOTAL					$2,523,020	
Contingency (Scope and Bid)		15%			$378,453	10% Scope, 5% Bid as documented in Attachment A.
SUBTOTAL					$2,901,473	
Project Management		2%			$58,029	Percentage modified as documented in Attachment A.
Remedial Design		2%			$58,029	Percentage modified as documented in Attachment A.
Construction Management		3%			$87,044	Percentage modified as documented in Attachment A.
TOTAL					$3,104,575	
TOTAL CAPITAL COST					**$3,105,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,339,477	
Contingency (Scope and Bid)		20%			$1,467,895	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,807,372	
Project Management		5%			$440,369	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$704,590	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$528,442	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,480,773	
TOTAL CAPITAL COST					**$10,481,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 5)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-D1	1	LS	$6,653,000	$6,653,000	
Transload Facility Development	CW-D21	1	LS	$9,675,295	$9,675,295	
Debris Removal and Disposal	CW-D5	268	AC	$13,107	$3,512,679	
Obstruction Removal and Relocation	CW-D6	1	LS	$6,933,407	$6,933,407	
Erosion/Residual Control Measures	CW-D7	1	LS	$23,531,760	$23,531,760	
Dredging of Contaminated Sediments (Open Water)	CW-D8	1,035,580	CY	$24.53	$25,402,777	
Dredging of Contaminated Sediments (Confined)	CW-D9	72,466	CY	$31.10	$2,253,693	
Excavation of Riverbanks	CW-D10	73,192	CY	$5.19	$379,864	
Dewatering and Water Treatment for Dredging Operations	CW-D11	1	LS	$4,925,014	$4,925,014	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-D12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-D13	1,599,182	TON	$111	$177,119,261	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-D14	25	AC	$1,070,827	$26,770,675	
Sand Placement for Technology Assignments	CW-D15	475,860	CY	$33.82	$16,095,462	
Beach Mix Placement for Technology Assignments	CW-D16	32,441	CY	$73.59	$2,387,358	
Armor Placement for Technology Assignments	CW-D17	53,344	CY	$72.06	$3,844,036	
Reactive/GAC Placement for Technology Assignments	CW-D18	1	LS	$43,035,063	$43,035,063	
Geofabric for Riverbanks	CW-D19	15.1	AC	$14,311	$216,100	
Organoclay Mat Placement for Technology Assignments	CW-D20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$422,444,212	
Contingency (Scope and Bid)		20%			$84,488,842	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$506,933,054	
Project Management		2%			$10,138,661	Percentage modified as documented in Attachment A.
Remedial Design		2%			$10,138,661	Percentage modified as documented in Attachment A.
Construction Management		3%			$15,207,992	Percentage modified as documented in Attachment A.
TOTAL					$542,418,368	
TOTAL CAPITAL COST					**$542,418,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	
Site-Wide Monitoring	CW-D23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-D24	1	LS	$20,031,523	$20,031,523	
SUBTOTAL					$28,328,659	
Contingency (Scope and Bid)		20%			$5,665,732	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$33,994,391	
Project Management		2%			$679,888	Percentage modified as documented in Attachment A.
Technical Support		5%			$1,699,720	Percentage modified as documented in Attachment A.
TOTAL					$36,373,999	
TOTAL PERIODIC COST					**$36,374,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-D25	1	LS	$3,391,669	$3,391,669	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,391,669	
Contingency (Scope and Bid)		20%			$678,334	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,070,003	
Project Management		5%			$203,500	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$407,000	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$4,680,503	
TOTAL PERIODIC COST					**$4,681,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative **D Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-D3	1	LS	$441,761	$441,761	
SUBTOTAL					$441,761	
Contingency (Scope and Bid)		10%			$44,176	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$485,937	
Project Management		5%			$24,297	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$48,594	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$558,828	
TOTAL PERIODIC COST					**$559,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-D26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-E

PRESENT VALUE ANALYSIS

Alternative **E Sensitivity Analysis - Period of Analysis (100 Year)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$524,714	$9,991,000	$116,257,286	$0	$0	$0	$0	$126,773,000	1.0000	$126,773,000
1	$524,714	$0	$116,257,286	$0	$0	$0	$0	$116,782,000	0.9346	$109,144,457
2	$524,714	$0	$116,257,286	$0	$37,467,000	$0	$0	$154,249,000	0.8734	$134,721,077
3	$524,714	$0	$116,257,286	$0	$0	$0	$0	$116,782,000	0.8163	$95,329,147
4	$524,714	$0	$116,257,286	$0	$37,467,000	$0	$0	$154,249,000	0.7629	$117,676,562
5	$524,714	$0	$116,257,286	$0	$0	$5,969,000	$308,000	$123,059,000	0.7130	$87,741,067
6	$524,714	$0	$116,257,286	$0	$37,467,000	$0	$0	$154,249,000	0.6663	$102,776,109
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.5820	$21,805,794
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.5083	$22,235,075
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.3878	$14,529,703
15	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.3624	$2,274,785
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2959	$11,086,485
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.2584	$1,621,977
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2257	$8,456,302
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.1842	$1,156,223
26	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.1722	$6,451,817
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.1314	$5,747,962
31	$0	$0	$0	$0	$0	$0	$0	$0	0.1228	$0
32	$0	$0	$0	$0	$0	$0	$0	$0	0.1147	$0
33	$0	$0	$0	$0	$0	$0	$0	$0	0.1072	$0
34	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.1002	$3,754,193
35	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0937	$588,155
36	$0	$0	$0	$0	$0	$0	$0	$0	0.0875	$0
37	$0	$0	$0	$0	$0	$0	$0	$0	0.0818	$0
38	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0765	$2,866,226
39	$0	$0	$0	$0	$0	$0	$0	$0	0.0715	$0
40	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0668	$419,304
41	$0	$0	$0	$0	$0	$0	$0	$0	0.0624	$0
42	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0583	$2,184,326
43	$0	$0	$0	$0	$0	$0	$0	$0	0.0545	$0
44	$0	$0	$0	$0	$0	$0	$0	$0	0.0509	$0
45	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0476	$298,785
46	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0445	$1,667,282
47	$0	$0	$0	$0	$0	$0	$0	$0	0.0416	$0
48	$0	$0	$0	$0	$0	$0	$0	$0	0.0389	$0
49	$0	$0	$0	$0	$0	$0	$0	$0	0.0363	$0
50	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.0339	$1,482,922
51	$0	$0	$0	$0	$0	$0	$0	$0	0.0317	$0
52	$0	$0	$0	$0	$0	$0	$0	$0	0.0297	$0
53	$0	$0	$0	$0	$0	$0	$0	$0	0.0277	$0
54	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0259	$970,395
55	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0242	$151,903
56	$0	$0	$0	$0	$0	$0	$0	$0	0.0226	$0
57	$0	$0	$0	$0	$0	$0	$0	$0	0.0211	$0
58	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0198	$741,847
59	$0	$0	$0	$0	$0	$0	$0	$0	0.0185	$0
60	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0173	$108,592
61	$0	$0	$0	$0	$0	$0	$0	$0	0.0161	$0
62	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0151	$565,752
63	$0	$0	$0	$0	$0	$0	$0	$0	0.0141	$0
64	$0	$0	$0	$0	$0	$0	$0	$0	0.0132	$0
65	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0123	$77,207
66	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0115	$430,871
67	$0	$0	$0	$0	$0	$0	$0	$0	0.0107	$0
68	$0	$0	$0	$0	$0	$0	$0	$0	0.0100	$0
69	$0	$0	$0	$0	$0	$0	$0	$0	0.0094	$0
70	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.0088	$384,947
71	$0	$0	$0	$0	$0	$0	$0	$0	0.0082	$0
72	$0	$0	$0	$0	$0	$0	$0	$0	0.0077	$0
73	$0	$0	$0	$0	$0	$0	$0	$0	0.0072	$0
74	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0067	$251,029
75	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0063	$39,545

TABLE PV-E

PRESENT VALUE ANALYSIS

Alternative **E Sensitivity Analysis - Period of Analysis (100 Year)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
76	$0	$0	$0	$0	$0	$0	$0	$0	0.0058	$0
77	$0	$0	$0	$0	$0	$0	$0	$0	0.0055	$0
78	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0051	$191,082
79	$0	$0	$0	$0	$0	$0	$0	$0	0.0048	$0
80	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0045	$28,247
81	$0	$0	$0	$0	$0	$0	$0	$0	0.0042	$0
82	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0039	$146,121
83	$0	$0	$0	$0	$0	$0	$0	$0	0.0036	$0
84	$0	$0	$0	$0	$0	$0	$0	$0	0.0034	$0
85	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0032	$20,086
86	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0030	$112,401
87	$0	$0	$0	$0	$0	$0	$0	$0	0.0028	$0
88	$0	$0	$0	$0	$0	$0	$0	$0	0.0026	$0
89	$0	$0	$0	$0	$0	$0	$0	$0	0.0024	$0
90	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.0023	$100,611
91	$0	$0	$0	$0	$0	$0	$0	$0	0.0021	$0
92	$0	$0	$0	$0	$0	$0	$0	$0	0.0020	$0
93	$0	$0	$0	$0	$0	$0	$0	$0	0.0019	$0
94	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0017	$63,694
95	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0016	$10,043
96	$0	$0	$0	$0	$0	$0	$0	$0	0.0015	$0
97	$0	$0	$0	$0	$0	$0	$0	$0	0.0014	$0
98	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.0013	$48,707
99	$0	$0	$0	$0	$0	$0	$0	$0	0.0012	$0
100	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.0012	$7,532
TOTALS:	$3,673,000	$9,991,000	$813,801,000	$0	$1,011,609,000	$119,380,000	$6,160,000	$1,964,614,000		$887,239,347
TOTAL PRESENT VALUE OF ALTERNATIVE E[5]										**$887,240,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 100 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-E.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-E

Alternative **E Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-E2	1	LS	$2,985,246	$2,985,246	
SUBTOTAL					$2,985,246	
Contingency (Scope and Bid)		15%			$447,787	10% Scope, 5% Bid as documented in Attachment A.
SUBTOTAL					$3,433,033	
Project Management		2%			$68,661	Percentage modified as documented in Attachment A.
Remedial Design		2%			$68,661	Percentage modified as documented in Attachment A.
Construction Management		3%			$102,991	Percentage modified as documented in Attachment A.
TOTAL					$3,673,346	
TOTAL CAPITAL COST					**$3,673,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,996,648	
Contingency (Scope and Bid)		20%			$1,399,330	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,395,978	
Project Management		5%			$419,799	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$671,678	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$503,759	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$9,991,214	
TOTAL CAPITAL COST					**$9,991,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative **E Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-E1	1	LS	$9,982,000	$9,982,000	
Transload Facility Development	CW-E21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-E5	330	AC	$13,107	$4,325,313	
Obstruction Removal and Relocation	CW-E6	1	LS	$15,701,434	$15,701,434	
Erosion/Residual Control Measures	CW-E7	1	LS	$24,743,285	$24,743,285	
Dredging of Contaminated Sediments (Open Water)	CW-E8	1,835,521	CY	$24.53	$45,025,330	
Dredging of Contaminated Sediments (Confined)	CW-E9	92,616	CY	$31.10	$2,880,358	
Excavation of Riverbanks	CW-E10	96,086	CY	$5.19	$498,687	
Dewatering and Water Treatment for Dredging Operations	CW-E11	1	LS	$8,443,577	$8,443,577	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-E12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-E13	2,975,613	TON	$111	$329,567,250	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-E14	35	AC	$1,070,827	$37,478,945	
Sand Placement for Technology Assignments	CW-E15	665,248	CY	$33.73	$22,437,471	
Beach Mix Placement for Technology Assignments	CW-E16	48,189	CY	$73.34	$3,534,049	
Armor Placement for Technology Assignments	CW-E17	79,256	CY	$72.14	$5,717,178	
Reactive/GAC Placement for Technology Assignments	CW-E18	1	LS	$42,943,721	$42,943,721	
Geofabric for Riverbanks	CW-E19	19.9	AC	$14,311	$284,794	
Organoclay Mat Placement for Technology Assignments	CW-E20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$633,801,158	
Contingency (Scope and Bid)		20%			$126,760,232	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$760,561,390	
Project Management		2%			$15,211,228	Percentage modified as documented in Attachment A.
Remedial Design		2%			$15,211,228	Percentage modified as documented in Attachment A.
Construction Management		3%			$22,816,842	Percentage modified as documented in Attachment A.
TOTAL					$813,800,688	
TOTAL CAPITAL COST					**$813,801,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative **E Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	
Site-Wide Monitoring	CW-E23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-E24	1	LS	$21,225,951	$21,225,951	
SUBTOTAL					$29,180,258	
Contingency (Scope and Bid)		20%			$5,836,052	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,016,310	
Project Management		2%			$700,326	Percentage modified as documented in Attachment A.
Technical Support		5%			$1,750,816	Percentage modified as documented in Attachment A.
TOTAL					$37,467,452	
TOTAL PERIODIC COST					**$37,467,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-E25	1	LS	$3,865,618	$3,865,618	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,865,618	
Contingency (Scope and Bid)		20%			$773,124	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,638,742	
Project Management		5%			$231,937	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,874	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,334,553	
TOTAL PERIODIC COST					**$5,335,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative **E Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-E3	1	LS	$501,289	$501,289	
SUBTOTAL					$501,289	
Contingency (Scope and Bid)		10%			$50,129	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$551,418	
Project Management		5%			$27,571	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,142	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$634,131	
TOTAL PERIODIC COST					**$634,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-E26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-F

PRESENT VALUE ANALYSIS

Alternative F Sensitivity Analysis - Period of Analysis (100 Year)

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$353,000	$8,749,000	$124,313,000	$0	$0	$0	$0	$133,415,000	1.0000	$133,415,000
1	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.9346	$116,512,844
2	$353,000	$0	$124,313,000	$0	$49,499,000	$0	$0	$174,165,000	0.8734	$152,115,711
3	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.8163	$101,764,856
4	$353,000	$0	$124,313,000	$0	$49,499,000	$0	$0	$174,165,000	0.7629	$132,870,479
5	$353,000	$0	$124,313,000	$0	$0	$8,779,000	$308,000	$133,753,000	0.7130	$95,365,889
6	$353,000	$0	$124,313,000	$0	$49,499,000	$0	$0	$174,165,000	0.6663	$116,046,140
7	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.6227	$77,629,518
8	$353,000	$0	$124,313,000	$0	$49,499,000	$0	$0	$174,165,000	0.5820	$101,364,030
9	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.5439	$67,805,837
10	$353,000	$0	$124,313,000	$0	$49,499,000	$8,779,000	$308,000	$183,252,000	0.5083	$93,146,992
11	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.4751	$59,228,817
12	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.4440	$55,351,704
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.3878	$19,195,712
15	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.3624	$3,293,129
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2959	$14,646,754
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.2584	$2,348,081
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2257	$11,171,924
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.1842	$1,673,825
26	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.1722	$8,523,728
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.1314	$7,698,200
31	$0	$0	$0	$0	$0	$0	$0	$0	0.1228	$0
32	$0	$0	$0	$0	$0	$0	$0	$0	0.1147	$0
33	$0	$0	$0	$0	$0	$0	$0	$0	0.1072	$0
34	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.1002	$4,959,800
35	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0937	$851,452
36	$0	$0	$0	$0	$0	$0	$0	$0	0.0875	$0
37	$0	$0	$0	$0	$0	$0	$0	$0	0.0818	$0
38	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0765	$3,786,674
39	$0	$0	$0	$0	$0	$0	$0	$0	0.0715	$0
40	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0668	$607,012
41	$0	$0	$0	$0	$0	$0	$0	$0	0.0624	$0
42	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0583	$2,885,792
43	$0	$0	$0	$0	$0	$0	$0	$0	0.0545	$0
44	$0	$0	$0	$0	$0	$0	$0	$0	0.0509	$0
45	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0476	$432,541
46	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0445	$2,202,706
47	$0	$0	$0	$0	$0	$0	$0	$0	0.0416	$0
48	$0	$0	$0	$0	$0	$0	$0	$0	0.0389	$0
49	$0	$0	$0	$0	$0	$0	$0	$0	0.0363	$0
50	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.0339	$1,986,065
51	$0	$0	$0	$0	$0	$0	$0	$0	0.0317	$0
52	$0	$0	$0	$0	$0	$0	$0	$0	0.0297	$0
53	$0	$0	$0	$0	$0	$0	$0	$0	0.0277	$0
54	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0259	$1,282,024
55	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0242	$219,905
56	$0	$0	$0	$0	$0	$0	$0	$0	0.0226	$0
57	$0	$0	$0	$0	$0	$0	$0	$0	0.0211	$0
58	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0198	$980,080
59	$0	$0	$0	$0	$0	$0	$0	$0	0.0185	$0
60	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0173	$157,205
61	$0	$0	$0	$0	$0	$0	$0	$0	0.0161	$0
62	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0151	$747,435
63	$0	$0	$0	$0	$0	$0	$0	$0	0.0141	$0
64	$0	$0	$0	$0	$0	$0	$0	$0	0.0132	$0
65	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0123	$111,770
66	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0115	$569,239
67	$0	$0	$0	$0	$0	$0	$0	$0	0.0107	$0
68	$0	$0	$0	$0	$0	$0	$0	$0	0.0100	$0
69	$0	$0	$0	$0	$0	$0	$0	$0	0.0094	$0
70	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.0088	$515,557
71	$0	$0	$0	$0	$0	$0	$0	$0	0.0082	$0
72	$0	$0	$0	$0	$0	$0	$0	$0	0.0077	$0
73	$0	$0	$0	$0	$0	$0	$0	$0	0.0072	$0
74	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0067	$331,643
75	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0063	$57,248

TABLE PV-F

PRESENT VALUE ANALYSIS

Alternative **F Sensitivity Analysis - Period of Analysis (100 Year)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
76	$0	$0	$0	$0	$0	$0	$0	$0	0.0058	$0
77	$0	$0	$0	$0	$0	$0	$0	$0	0.0055	$0
78	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0051	$252,445
79	$0	$0	$0	$0	$0	$0	$0	$0	0.0048	$0
80	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0045	$40,892
81	$0	$0	$0	$0	$0	$0	$0	$0	0.0042	$0
82	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0039	$193,046
83	$0	$0	$0	$0	$0	$0	$0	$0	0.0036	$0
84	$0	$0	$0	$0	$0	$0	$0	$0	0.0034	$0
85	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0032	$29,078
86	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0030	$148,497
87	$0	$0	$0	$0	$0	$0	$0	$0	0.0028	$0
88	$0	$0	$0	$0	$0	$0	$0	$0	0.0026	$0
89	$0	$0	$0	$0	$0	$0	$0	$0	0.0024	$0
90	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.0023	$134,748
91	$0	$0	$0	$0	$0	$0	$0	$0	0.0021	$0
92	$0	$0	$0	$0	$0	$0	$0	$0	0.0020	$0
93	$0	$0	$0	$0	$0	$0	$0	$0	0.0019	$0
94	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0017	$84,148
95	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0016	$14,539
96	$0	$0	$0	$0	$0	$0	$0	$0	0.0015	$0
97	$0	$0	$0	$0	$0	$0	$0	$0	0.0014	$0
98	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.0013	$64,349
99	$0	$0	$0	$0	$0	$0	$0	$0	0.0012	$0
100	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.0012	$10,904
TOTALS:	$4,589,000	$8,749,000	$1,616,069,000	$0	$1,336,473,000	$175,580,000	$6,160,000	$3,147,620,000		$1,394,825,964
TOTAL PRESENT VALUE OF ALTERNATIVE F[5]										**$1,394,830,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 100 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-F.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-F

Alternative **F Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW-F2	1	LS	$3,728,996	$3,728,996	
SUBTOTAL					$3,728,996	
Contingency (Scope and Bid)		15%			$559,349	10% Scope, 5% Bid as documented in Attachment A.
SUBTOTAL					$4,288,345	
Project Management		2%			$85,767	Percentage modified as documented in Attachment A.
Remedial Design		2%			$85,767	Percentage modified as documented in Attachment A.
Construction Management		3%			$128,650	Percentage modified as documented in Attachment A.
TOTAL					$4,588,529	
TOTAL CAPITAL COST					**$4,589,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,126,675	
Contingency (Scope and Bid)		20%			$1,225,335	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$7,352,010	
Project Management		5%			$367,601	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$588,161	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$441,121	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$8,748,893	
TOTAL CAPITAL COST					**$8,749,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-F1	1	LS	$19,821,000	$19,821,000	
Transload Facility Development	CW-F21	1	LS	$15,651,213	$15,651,213	
Debris Removal and Disposal	CW-F5	534	AC	$13,107	$6,999,143	
Obstruction Removal and Relocation	CW-F6	1	LS	$20,718,583	$20,718,583	
Erosion/Residual Control Measures	CW-F7	1	LS	$27,166,335	$27,166,335	
Dredging of Contaminated Sediments (Open Water)	CW-F8	4,339,288	CY	$24.53	$106,442,735	
Dredging of Contaminated Sediments (Confined)	CW-F9	123,286	CY	$31.10	$3,834,195	
Excavation of Riverbanks	CW-F10	122,827	CY	$5.19	$637,472	
Dewatering and Water Treatment for Dredging Operations	CW-F11	1	LS	$19,423,050	$19,423,050	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-F12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-F13	7,149,152	TON	$111	$791,812,106	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-F14	60	AC	$1,070,827	$64,249,620	
Sand Placement for Technology Assignments	CW-F15	1,119,996	CY	$33.48	$37,494,727	
Beach Mix Placement for Technology Assignments	CW-F16	69,510	CY	$72.97	$5,071,863	
Armor Placement for Technology Assignments	CW-F17	151,909	CY	$71.97	$10,932,677	
Reactive/GAC Placement for Technology Assignments	CW-F18	1	LS	$58,294,110	$58,294,110	
Geofabric for Riverbanks	CW-F19	25.4	AC	$14,311	$363,505	
Organoclay Mat Placement for Technology Assignments	CW-F20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,258,621,102	
Contingency (Scope and Bid)		20%			$251,724,220	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$1,510,345,322	
Project Management		2%			$30,206,906	Percentage modified as documented in Attachment A.
Remedial Design		2%			$30,206,906	Percentage modified as documented in Attachment A.
Construction Management		3%			$45,310,360	Percentage modified as documented in Attachment A.
TOTAL					$1,616,069,494	
TOTAL CAPITAL COST					**$1,616,069,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	
Site-Wide Monitoring	CW-F23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-F24	1	LS	$31,466,392	$31,466,392	
SUBTOTAL					$38,550,726	
Contingency (Scope and Bid)		20%			$7,710,145	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$46,260,871	
Project Management		2%			$925,217	Percentage modified as documented in Attachment A.
Technical Support		5%			$2,313,044	Percentage modified as documented in Attachment A.
TOTAL					$49,499,132	
TOTAL PERIODIC COST					**$49,499,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-F25	1	LS	$5,757,416	$5,757,416	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs
SUBTOTAL					$5,757,416	
Contingency (Scope and Bid)		20%			$1,151,483	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,908,899	
Project Management		5%			$345,445	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$690,890	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$7,945,234	
TOTAL PERIODIC COST					**$7,945,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Period of Analysis**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-F3	1	LS	$659,296	$659,296	
SUBTOTAL					$659,296	
Contingency (Scope and Bid)		10%			$65,930	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$725,226	
Project Management		5%			$36,261	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$72,523	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$834,010	
TOTAL PERIODIC COST					**$834,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-F26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-G

PRESENT VALUE ANALYSIS

Alternative G Sensitivity Analysis - Period of Analysis (100 Year)

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$264,579	$7,428,000	$130,952,105	$0	$0	$0	$0	$138,644,684	1.0000	$138,644,684
1	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.9346	$122,635,113
2	$264,579	$0	$130,952,105	$0	$63,513,000	$0	$0	$194,729,684	0.8734	$170,076,906
3	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.8163	$107,112,179
4	$264,579	$0	$130,952,105	$0	$63,513,000	$0	$0	$194,729,684	0.7629	$148,559,276
5	$264,579	$0	$130,952,105	$0	$0	$11,856,000	$308,000	$143,380,684	0.7130	$102,230,428
6	$264,579	$0	$130,952,105	$0	$63,513,000	$0	$0	$194,729,684	0.6663	$129,748,388
7	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.6227	$81,708,629
8	$264,579	$0	$130,952,105	$0	$63,513,000	$0	$0	$194,729,684	0.5820	$113,332,676
9	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.5439	$71,368,754
10	$264,579	$0	$130,952,105	$0	$63,513,000	$11,856,000	$308,000	$206,893,684	0.5083	$105,164,060
11	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.4751	$62,341,047
12	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.4440	$58,260,208
13	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.4150	$54,454,924
14	$264,579	$0	$130,952,105	$0	$63,513,000	$0	$0	$194,729,684	0.3878	$75,516,171
15	$264,579	$0	$130,952,105	$0	$0	$11,856,000	$308,000	$143,380,684	0.3624	$51,961,160
16	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.3387	$44,443,091
17	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.3166	$41,543,202
18	$264,579	$0	$130,952,105	$0	$63,513,000	$0	$0	$194,729,684	0.2959	$57,620,513
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.2584	$3,143,178
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.2257	$14,334,884
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.1842	$2,240,609
26	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.1722	$10,936,939
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.1314	$9,943,958
31	$0	$0	$0	$0	$0	$0	$0	$0	0.1228	$0
32	$0	$0	$0	$0	$0	$0	$0	$0	0.1147	$0
33	$0	$0	$0	$0	$0	$0	$0	$0	0.1072	$0
34	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.1002	$6,364,003
35	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0937	$1,139,767
36	$0	$0	$0	$0	$0	$0	$0	$0	0.0875	$0
37	$0	$0	$0	$0	$0	$0	$0	$0	0.0818	$0
38	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0765	$4,858,745
39	$0	$0	$0	$0	$0	$0	$0	$0	0.0715	$0
40	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0668	$812,555
41	$0	$0	$0	$0	$0	$0	$0	$0	0.0624	$0
42	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0583	$3,702,808
43	$0	$0	$0	$0	$0	$0	$0	$0	0.0545	$0
44	$0	$0	$0	$0	$0	$0	$0	$0	0.0509	$0
45	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0476	$579,006
46	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0445	$2,826,329
47	$0	$0	$0	$0	$0	$0	$0	$0	0.0416	$0
48	$0	$0	$0	$0	$0	$0	$0	$0	0.0389	$0
49	$0	$0	$0	$0	$0	$0	$0	$0	0.0363	$0
50	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.0339	$2,565,450
51	$0	$0	$0	$0	$0	$0	$0	$0	0.0317	$0
52	$0	$0	$0	$0	$0	$0	$0	$0	0.0297	$0
53	$0	$0	$0	$0	$0	$0	$0	$0	0.0277	$0
54	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0259	$1,644,987
55	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0242	$294,369
56	$0	$0	$0	$0	$0	$0	$0	$0	0.0226	$0
57	$0	$0	$0	$0	$0	$0	$0	$0	0.0211	$0
58	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0198	$1,257,557
59	$0	$0	$0	$0	$0	$0	$0	$0	0.0185	$0
60	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0173	$210,437
61	$0	$0	$0	$0	$0	$0	$0	$0	0.0161	$0
62	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0151	$959,046
63	$0	$0	$0	$0	$0	$0	$0	$0	0.0141	$0
64	$0	$0	$0	$0	$0	$0	$0	$0	0.0132	$0
65	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0123	$149,617
66	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0115	$730,400
67	$0	$0	$0	$0	$0	$0	$0	$0	0.0107	$0
68	$0	$0	$0	$0	$0	$0	$0	$0	0.0100	$0
69	$0	$0	$0	$0	$0	$0	$0	$0	0.0094	$0
70	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.0088	$665,958
71	$0	$0	$0	$0	$0	$0	$0	$0	0.0082	$0
72	$0	$0	$0	$0	$0	$0	$0	$0	0.0077	$0
73	$0	$0	$0	$0	$0	$0	$0	$0	0.0072	$0
74	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0067	$425,537
75	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0063	$76,633

TABLE PV-G

PRESENT VALUE ANALYSIS

Alternative **G Sensitivity Analysis - Period of Analysis (100 Year)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
76	$0	$0	$0	$0	$0	$0	$0	$0	0.0058	$0
77	$0	$0	$0	$0	$0	$0	$0	$0	0.0055	$0
78	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0051	$323,916
79	$0	$0	$0	$0	$0	$0	$0	$0	0.0048	$0
80	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0045	$54,738
81	$0	$0	$0	$0	$0	$0	$0	$0	0.0042	$0
82	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0039	$247,701
83	$0	$0	$0	$0	$0	$0	$0	$0	0.0036	$0
84	$0	$0	$0	$0	$0	$0	$0	$0	0.0034	$0
85	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0032	$38,925
86	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0030	$190,539
87	$0	$0	$0	$0	$0	$0	$0	$0	0.0028	$0
88	$0	$0	$0	$0	$0	$0	$0	$0	0.0026	$0
89	$0	$0	$0	$0	$0	$0	$0	$0	0.0024	$0
90	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.0023	$174,057
91	$0	$0	$0	$0	$0	$0	$0	$0	0.0021	$0
92	$0	$0	$0	$0	$0	$0	$0	$0	0.0020	$0
93	$0	$0	$0	$0	$0	$0	$0	$0	0.0019	$0
94	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0017	$107,972
95	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0016	$19,462
96	$0	$0	$0	$0	$0	$0	$0	$0	0.0015	$0
97	$0	$0	$0	$0	$0	$0	$0	$0	0.0014	$0
98	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.0013	$82,567
99	$0	$0	$0	$0	$0	$0	$0	$0	0.0012	$0
100	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.0012	$14,597
TOTALS:	$5,027,000	$7,428,000	$2,488,090,000	$0	$1,714,851,000	$237,120,000	$6,160,000	$4,458,676,000		$1,807,838,655
TOTAL PRESENT VALUE OF ALTERNATIVE G[5]										**$1,807,840,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 100 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-G.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-G

Alternative G Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 18)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-G2	1	LS	$4,084,988	$4,084,988	
SUBTOTAL					$4,084,988	
Contingency (Scope and Bid)		15%			$612,748	10% Scope, 5% Bid as documented in Attachment A.
SUBTOTAL					$4,697,736	
Project Management		2%			$93,955	Percentage modified as documented in Attachment A.
Remedial Design		2%			$93,955	Percentage modified as documented in Attachment A.
Construction Management		3%			$140,932	Percentage modified as documented in Attachment A.
TOTAL					$5,026,578	
TOTAL CAPITAL COST					**$5,027,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$5,201,407	
Contingency (Scope and Bid)		20%			$1,040,281	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,241,688	
Project Management		5%			$312,084	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$499,335	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$374,501	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$7,427,608	
TOTAL CAPITAL COST					**$7,428,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 18)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-G1	1	LS	$30,516,000	$30,516,000	
Transload Facility Development	CW-G21	1	LS	$20,773,428	$20,773,428	
Debris Removal and Disposal	CW-G5	776	AC	$13,107	$10,171,040	
Obstruction Removal and Relocation	CW-G6	1	LS	$22,638,241	$22,638,241	
Erosion/Residual Control Measures	CW-G7	1	LS	$28,135,555	$28,135,555	
Dredging of Contaminated Sediments (Open Water)	CW-G8	7,110,364	CY	$24.53	$174,417,229	
Dredging of Contaminated Sediments (Confined)	CW-G9	147,293	CY	$31.10	$4,580,812	
Excavation of Riverbanks	CW-G10	138,942	CY	$5.19	$721,107	
Dewatering and Water Treatment for Dredging Operations	CW-G11	1	LS	$31,511,207	$31,511,207	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-G12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-G13	11,727,524	TON	$111	$1,298,894,643	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-G14	86	AC	$1,070,827	$92,091,122	
Sand Placement for Technology Assignments	CW-G15	1,634,210	CY	$33.23	$54,304,680	
Beach Mix Placement for Technology Assignments	CW-G16	90,647	CY	$72.65	$6,585,212	
Armor Placement for Technology Assignments	CW-G17	245,586	CY	$71.57	$17,577,027	
Reactive/GAC Placement for Technology Assignments	CW-G18	1	LS	$74,728,183	$74,728,183	
Geofabric for Riverbanks	CW-G19	28.7	AC	$14,311	$410,732	
Organoclay Mat Placement for Technology Assignments	CW-G20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,937,764,986	
Contingency (Scope and Bid)		20%			$387,552,997	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,325,317,983	
Project Management		2%			$46,506,360	Percentage modified as documented in Attachment A.
Remedial Design		2%			$46,506,360	Percentage modified as documented in Attachment A.
Construction Management		3%			$69,759,539	Percentage modified as documented in Attachment A.
TOTAL					$2,488,090,242	
TOTAL CAPITAL COST					**$2,488,090,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-G23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-G24	1	LS	$43,306,076	$43,306,076	
SUBTOTAL					$49,465,142	
Contingency (Scope and Bid)		20%			$9,893,028	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$59,358,170	
Project Management		2%			$1,187,163	Percentage modified as documented in Attachment A.
Technical Support		5%			$2,967,909	Percentage modified as documented in Attachment A.
TOTAL					$63,513,242	
TOTAL PERIODIC COST					**$63,513,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-G25	1	LS	$7,862,382	$7,862,382	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$7,862,382	
Contingency (Scope and Bid)		20%			$1,572,476	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,434,858	
Project Management		5%			$471,743	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$943,486	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$10,850,087	
TOTAL PERIODIC COST					**$10,850,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-G3	1	LS	$795,634	$795,634	
SUBTOTAL					$795,634	
Contingency (Scope and Bid)		10%			$79,563	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$875,197	
Project Management		5%			$43,760	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$87,520	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$1,006,477	
TOTAL PERIODIC COST					**$1,006,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-G26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-I

PRESENT VALUE ANALYSIS

Alternative I Sensitivity Analysis - Period of Analysis (100 Year)

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$532,286	$10,197,000	$105,348,000	$0	$0	$0	$0	$116,077,286	1.0000	$116,077,286
1	$532,286	$0	$105,348,000	$0	$0	$0	$0	$105,880,286	0.9346	$98,955,715
2	$532,286	$0	$105,348,000	$0	$38,426,000	$0	$0	$144,306,286	0.8734	$126,037,110
3	$532,286	$0	$105,348,000	$0	$0	$0	$0	$105,880,286	0.8163	$86,430,077
4	$532,286	$0	$105,348,000	$0	$38,426,000	$0	$0	$144,306,286	0.7629	$110,091,266
5	$532,286	$0	$105,348,000	$0	$0	$5,972,000	$308,000	$112,160,286	0.7130	$79,970,284
6	$532,286	$0	$105,348,000	$0	$38,426,000	$0	$0	$144,306,286	0.6663	$96,151,278
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.5820	$22,363,932
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.5083	$22,724,060
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.3878	$14,901,603
15	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.3624	$2,275,872
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2959	$11,370,253
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.2584	$1,622,752
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2257	$8,672,748
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.1842	$1,156,776
26	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.1722	$6,616,957
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.1314	$5,874,368
31	$0	$0	$0	$0	$0	$0	$0	$0	0.1228	$0
32	$0	$0	$0	$0	$0	$0	$0	$0	0.1147	$0
33	$0	$0	$0	$0	$0	$0	$0	$0	0.1072	$0
34	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.1002	$3,850,285
35	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0937	$588,436
36	$0	$0	$0	$0	$0	$0	$0	$0	0.0875	$0
37	$0	$0	$0	$0	$0	$0	$0	$0	0.0818	$0
38	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0765	$2,939,589
39	$0	$0	$0	$0	$0	$0	$0	$0	0.0715	$0
40	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0668	$419,504
41	$0	$0	$0	$0	$0	$0	$0	$0	0.0624	$0
42	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0583	$2,240,236
43	$0	$0	$0	$0	$0	$0	$0	$0	0.0545	$0
44	$0	$0	$0	$0	$0	$0	$0	$0	0.0509	$0
45	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0476	$298,928
46	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0445	$1,709,957
47	$0	$0	$0	$0	$0	$0	$0	$0	0.0416	$0
48	$0	$0	$0	$0	$0	$0	$0	$0	0.0389	$0
49	$0	$0	$0	$0	$0	$0	$0	$0	0.0363	$0
50	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.0339	$1,515,533
51	$0	$0	$0	$0	$0	$0	$0	$0	0.0317	$0
52	$0	$0	$0	$0	$0	$0	$0	$0	0.0297	$0
53	$0	$0	$0	$0	$0	$0	$0	$0	0.0277	$0
54	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0259	$995,233
55	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0242	$151,976
56	$0	$0	$0	$0	$0	$0	$0	$0	0.0226	$0
57	$0	$0	$0	$0	$0	$0	$0	$0	0.0211	$0
58	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0198	$760,835
59	$0	$0	$0	$0	$0	$0	$0	$0	0.0185	$0
60	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0173	$108,644
61	$0	$0	$0	$0	$0	$0	$0	$0	0.0161	$0
62	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0151	$580,233
63	$0	$0	$0	$0	$0	$0	$0	$0	0.0141	$0
64	$0	$0	$0	$0	$0	$0	$0	$0	0.0132	$0
65	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0123	$77,244
66	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0115	$441,899
67	$0	$0	$0	$0	$0	$0	$0	$0	0.0107	$0
68	$0	$0	$0	$0	$0	$0	$0	$0	0.0100	$0
69	$0	$0	$0	$0	$0	$0	$0	$0	0.0094	$0
70	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.0088	$393,413
71	$0	$0	$0	$0	$0	$0	$0	$0	0.0082	$0
72	$0	$0	$0	$0	$0	$0	$0	$0	0.0077	$0
73	$0	$0	$0	$0	$0	$0	$0	$0	0.0072	$0
74	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0067	$257,454
75	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0063	$39,564

TABLE PV-I

PRESENT VALUE ANALYSIS

Alternative **I Sensitivity Analysis - Period of Analysis (100 Year)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
76	$0	$0	$0	$0	$0	$0	$0	$0	0.0058	$0
77	$0	$0	$0	$0	$0	$0	$0	$0	0.0055	$0
78	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0051	$195,973
79	$0	$0	$0	$0	$0	$0	$0	$0	0.0048	$0
80	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0045	$28,260
81	$0	$0	$0	$0	$0	$0	$0	$0	0.0042	$0
82	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0039	$149,861
83	$0	$0	$0	$0	$0	$0	$0	$0	0.0036	$0
84	$0	$0	$0	$0	$0	$0	$0	$0	0.0034	$0
85	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0032	$20,096
86	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0030	$115,278
87	$0	$0	$0	$0	$0	$0	$0	$0	0.0028	$0
88	$0	$0	$0	$0	$0	$0	$0	$0	0.0026	$0
89	$0	$0	$0	$0	$0	$0	$0	$0	0.0024	$0
90	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.0023	$102,824
91	$0	$0	$0	$0	$0	$0	$0	$0	0.0021	$0
92	$0	$0	$0	$0	$0	$0	$0	$0	0.0020	$0
93	$0	$0	$0	$0	$0	$0	$0	$0	0.0019	$0
94	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0017	$65,324
95	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0016	$10,048
96	$0	$0	$0	$0	$0	$0	$0	$0	0.0015	$0
97	$0	$0	$0	$0	$0	$0	$0	$0	0.0014	$0
98	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.0013	$49,954
99	$0	$0	$0	$0	$0	$0	$0	$0	0.0012	$0
100	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.0012	$7,536
TOTALS:	$3,726,000	$10,197,000	$737,436,000	$0	$1,037,502,000	$119,440,000	$6,160,000	$1,914,461,000		$829,406,454
TOTAL PRESENT VALUE OF ALTERNATIVE I[5]										**$829,410,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 100 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-I.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-I

Alternative I Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-I2	1	LS	$3,028,033	$3,028,033	
SUBTOTAL					$3,028,033	
Contingency (Scope and Bid)		15%			$454,205	10% Scope, 5% Bid as documented in Attachment A.
SUBTOTAL					$3,482,238	
Project Management		2%			$69,645	Percentage modified as documented in Attachment A.
Remedial Design		2%			$69,645	Percentage modified as documented in Attachment A.
Construction Management		3%			$104,467	Percentage modified as documented in Attachment A.
TOTAL					$3,725,995	
TOTAL CAPITAL COST					**$3,726,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,140,415	
Contingency (Scope and Bid)		20%			$1,428,083	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,568,498	
Project Management		5%			$428,425	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$685,480	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$514,110	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,196,513	
TOTAL CAPITAL COST					**$10,197,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-I1	1	LS	$9,045,000	$9,045,000	
Transload Facility Development	CW-I21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-I5	292	AC	$13,107	$3,827,247	
Obstruction Removal and Relocation	CW-I6	1	LS	$15,146,379	$15,146,379	
Erosion/Residual Control Measures	CW-I7	1	LS	$25,227,895	$25,227,895	
Dredging of Contaminated Sediments (Open Water)	CW-I8	1,556,599	CY	$24.53	$38,183,373	
Dredging of Contaminated Sediments (Confined)	CW-I9	93,151	CY	$31.10	$2,896,996	
Excavation of Riverbanks	CW-I10	102,624	CY	$5.19	$532,618	
Dewatering and Water Treatment for Dredging Operations	CW-I11	1	LS	$7,261,269	$7,261,269	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-I12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-I13	2,534,454	TON	$111	$280,706,119	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-I14	34	AC	$1,070,827	$36,408,118	
Sand Placement for Technology Assignments	CW-I15	598,578	CY	$34.00	$20,353,254	
Beach Mix Placement for Technology Assignments	CW-I16	49,511	CY	$73.43	$3,635,422	
Armor Placement for Technology Assignments	CW-I17	80,297	CY	$72.27	$5,802,915	
Reactive/GAC Placement for Technology Assignments	CW-I18	1	LS	$44,759,377	$44,759,377	
Geofabric for Riverbanks	CW-I19	21.2	AC	$14,311	$303,398	
Organoclay Mat Placement for Technology Assignments	CW-I20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$574,327,146	
Contingency (Scope and Bid)		20%			$114,865,429	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$689,192,575	
Project Management		2%			$13,783,852	Percentage modified as documented in Attachment A.
Remedial Design		2%			$13,783,852	Percentage modified as documented in Attachment A.
Construction Management		3%			$20,675,777	Percentage modified as documented in Attachment A.
TOTAL					$737,436,056	
TOTAL CAPITAL COST					**$737,436,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-I23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-I24	1	LS	$21,828,717	$21,828,717	
SUBTOTAL					$29,926,791	
Contingency (Scope and Bid)		20%			$5,985,358	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,912,149	
Project Management		2%			$718,243	Percentage modified as documented in Attachment A.
Technical Support		5%			$1,795,607	Percentage modified as documented in Attachment A.
TOTAL					$38,425,999	
TOTAL PERIODIC COST					**$38,426,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-I25	1	LS	$3,862,654	$3,862,654	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,862,654	
Contingency (Scope and Bid)		20%			$772,531	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,635,185	
Project Management		5%			$231,759	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,519	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,330,463	
TOTAL PERIODIC COST					**$5,330,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Period of Analysis

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-I3	1	LS	$507,467	$507,467	
SUBTOTAL					$507,467	
Contingency (Scope and Bid)		10%			$50,747	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$558,214	
Project Management		5%			$27,911	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,821	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$641,946	
TOTAL PERIODIC COST					**$642,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-I26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

Sensitivity Analysis

Monitoring Frequency Scenario
(5-Year Frequency for Monitoring)

Note: Costs presented herein are specific to DMM Scenario 2. All Cost Worksheets for the Monitoring Frequency Sensitivity Analysis Scenario are the same as the Cost Worksheets created for the base estimate, and can be found in Appendix G.

TABLE PV-B

PRESENT VALUE ANALYSIS

Alternative **B Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$620,250	$10,912,000	$84,676,000	$0	$0	$0	$0	$96,208,250	1.0000	$96,208,250
1	$620,250	$0	$84,676,000	$0	$0	$0	$0	$85,296,250	0.9346	$79,717,875
2	$620,250	$0	$84,676,000	$0	$0	$0	$0	$85,296,250	0.8734	$74,497,745
3	$620,250	$0	$84,676,000	$0	$0	$0	$0	$85,296,250	0.8163	$69,627,329
4	$0	$0	$0	$0	$0	$0	$0	$0	0.7629	$0
5	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.7130	$21,787,854
6	$0	$0	$0	$0	$0	$0	$0	$0	0.6663	$0
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$0	$0	$0	$0	0.5820	$0
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.5083	$15,532,631
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$0	$0	$0	$0	0.3878	$0
15	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.3624	$11,074,219
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$0	$0	$0	$0	0.2959	$0
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.2584	$7,896,187
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.1842	$5,628,784
26	$0	$0	$0	$0	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.1314	$4,015,321
TOTALS:	$2,481,000	$10,912,000	$338,704,000	$0	$160,464,000	$21,036,000	$1,848,000	$535,445,000		$385,986,195
TOTAL PRESENT VALUE OF ALTERNATIVE B[5]										**$385,990,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-B.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-B

Alternative **B Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 3)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-B2	1	LS	$2,016,443	$2,016,443	
SUBTOTAL					$2,016,443	
Contingency (Scope and Bid)		15%			$302,466	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$2,318,909	
Project Management		2%			$46,378	Percentage modified as documented in Attachment A
Remedial Design		2%			$46,378	Percentage modified as documented in Attachment A
Construction Management		3%			$69,567	Percentage modified as documented in Attachment A
TOTAL					$2,481,232	
TOTAL CAPITAL COST					**$2,481,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,641,756	
Contingency (Scope and Bid)		20%			$1,528,351	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,170,107	
Project Management		5%			$458,505	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$733,609	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$550,206	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,912,427	
TOTAL CAPITAL COST					**$10,912,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 3)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-B1	1	LS	$4,155,000	$4,155,000	
Transload Facility Development	CW-B21	1	LS	$7,967,890	$7,967,890	
Debris Removal and Disposal	CW-B5	202	AC	$13,107	$2,647,616	
Obstruction Removal and Relocation	CW-B6	1	LS	$3,907,503	$3,907,503	
Erosion/Residual Control Measures	CW-B7	1	LS	$22,320,235	$22,320,235	
Dredging of Contaminated Sediments (Open Water)	CW-B8	513,841	CY	$24.53	$12,604,520	
Dredging of Contaminated Sediments (Confined)	CW-B9	63,042	CY	$31.10	$1,960,606	
Excavation of Riverbanks	CW-B10	50,769	CY	$5.19	$263,490	
Dewatering and Water Treatment for Dredging Operations	CW-B11	1	LS	$2,595,467	$2,595,467	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-B12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-B13	693,843	TON	$111	$76,847,281	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-B14	15	AC	$1,070,827	$16,062,405	
Sand Placement for Technology Assignments	CW-B15	342,033	CY	$33.89	$11,591,596	
Beach Mix Placement for Technology Assignments	CW-B16	18,563	CY	$74.24	$1,378,163	
Armor Placement for Technology Assignments	CW-B17	29,533	CY	$72.42	$2,138,814	
Reactive/GAC Placement for Technology Assignments	CW-B18	1	LS	$27,488,372	$27,488,372	
Geofabric for Riverbanks	CW-B19	10.5	AC	$14,311	$150,268	
Organoclay Mat Placement for Technology Assignments	CW-B20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$263,787,994	
Contingency (Scope and Bid)		20%			$52,757,599	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$316,545,593	
Project Management		2%			$6,330,912	Percentage modified as documented in Attachment A
Remedial Design		2%			$6,330,912	Percentage modified as documented in Attachment A
Construction Management		3%			$9,496,368	Percentage modified as documented in Attachment A
TOTAL					$338,703,785	
TOTAL CAPITAL COST					**$338,704,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative B Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	
Site-Wide Monitoring	CW-B23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-B24	1	LS	$12,228,875	$12,228,875	
SUBTOTAL					$20,828,290	
Contingency (Scope and Bid)		20%			$4,165,658	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$24,993,948	
Project Management		2%			$499,879	Percentage modified as documented in Attachment A
Technical Support		5%			$1,249,697	Percentage modified as documented in Attachment A
TOTAL					$26,743,524	
TOTAL PERIODIC COST					**$26,744,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-B25	1	LS	$2,230,955	$2,230,955	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$2,230,955	
Contingency (Scope and Bid)		20%			$446,191	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,677,146	
Project Management		5%			$133,857	Middle value of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$267,715	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$3,078,718	
TOTAL PERIODIC COST					**$3,079,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative B Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-B3	1	LS	$337,883	$337,883	
SUBTOTAL					$337,883	
Contingency (Scope and Bid)		10%			$33,788	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$371,671	
Project Management		5%			$18,584	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$37,167	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$427,422	
TOTAL PERIODIC COST					**$427,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-B26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-D

PRESENT VALUE ANALYSIS

Alternative **D Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$517,500	$10,481,000	$90,403,000	$0	$0	$0	$0	$101,401,500	1.0000	$101,401,500
1	$517,500	$0	$90,403,000	$0	$0	$0	$0	$90,920,500	0.9346	$84,974,299
2	$517,500	$0	$90,403,000	$0	$0	$0	$0	$90,920,500	0.8734	$79,409,965
3	$517,500	$0	$90,403,000	$0	$0	$0	$0	$90,920,500	0.8163	$74,218,404
4	$517,500	$0	$90,403,000	$0	$0	$0	$0	$90,920,500	0.7629	$69,363,249
5	$517,500	$0	$90,403,000	$0	$36,374,000	$5,240,000	$308,000	$132,842,500	0.7130	$94,716,703
6	$0	$0	$0	$0	$0	$0	$0	$0	0.6663	$0
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$0	$0	$0	$0	0.5820	$0
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.5083	$21,308,953
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$0	$0	$0	$0	0.3878	$0
15	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.3624	$15,192,533
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$0	$0	$0	$0	0.2959	$0
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.2584	$10,832,645
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.1842	$7,722,032
26	$0	$0	$0	$0	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.1314	$5,508,551
TOTALS:	$3,105,000	$10,481,000	$542,418,000	$0	$218,244,000	$31,440,000	$1,848,000	$807,536,000		$564,648,834
TOTAL PRESENT VALUE OF ALTERNATIVE D[5]										**$564,650,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-D.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-D

Alternative D Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 5)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-D2	1	LS	$2,523,020	$2,523,020	
SUBTOTAL					$2,523,020	
Contingency (Scope and Bid)		15%			$378,453	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$2,901,473	
Project Management		2%			$58,029	Percentage modified as documented in Attachment A
Remedial Design		2%			$58,029	Percentage modified as documented in Attachment A
Construction Management		3%			$87,044	Percentage modified as documented in Attachment A
TOTAL					$3,104,575	
TOTAL CAPITAL COST					**$3,105,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,339,477	
Contingency (Scope and Bid)		20%			$1,467,895	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,807,372	
Project Management		5%			$440,369	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$704,590	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$528,442	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,480,773	
TOTAL CAPITAL COST					**$10,481,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 5)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-D1	1	LS	$6,653,000	$6,653,000	
Transload Facility Development	CW-D21	1	LS	$9,675,295	$9,675,295	
Debris Removal and Disposal	CW-D5	268	AC	$13,107	$3,512,679	
Obstruction Removal and Relocation	CW-D6	1	LS	$6,933,407	$6,933,407	
Erosion/Residual Control Measures	CW-D7	1	LS	$23,531,760	$23,531,760	
Dredging of Contaminated Sediments (Open Water)	CW-D8	1,035,580	CY	$24.53	$25,402,777	
Dredging of Contaminated Sediments (Confined)	CW-D9	72,466	CY	$31.10	$2,253,693	
Excavation of Riverbanks	CW-D10	73,192	CY	$5.19	$379,864	
Dewatering and Water Treatment for Dredging Operations	CW-D11	1	LS	$4,925,014	$4,925,014	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-D12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-D13	1,599,182	TON	$111	$177,119,261	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-D14	25	AC	$1,070,827	$26,770,675	
Sand Placement for Technology Assignments	CW-D15	475,860	CY	$33.82	$16,095,462	
Beach Mix Placement for Technology Assignments	CW-D16	32,441	CY	$73.59	$2,387,358	
Armor Placement for Technology Assignments	CW-D17	53,344	CY	$72.06	$3,844,036	
Reactive/GAC Placement for Technology Assignments	CW-D18	1	LS	$43,035,063	$43,035,063	
Geofabric for Riverbanks	CW-D19	15.1	AC	$14,311	$216,100	
Organoclay Mat Placement for Technology Assignments	CW-D20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$422,444,212	
Contingency (Scope and Bid)		20%			$84,488,842	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$506,933,054	
Project Management		2%			$10,138,661	Percentage modified as documented in Attachment A
Remedial Design		2%			$10,138,661	Percentage modified as documented in Attachment A
Construction Management		3%			$15,207,992	Percentage modified as documented in Attachment A
TOTAL					$542,418,368	
TOTAL CAPITAL COST					**$542,418,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	
Site-Wide Monitoring	CW-D23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-D24	1	LS	$20,031,523	$20,031,523	
SUBTOTAL					$28,328,659	
Contingency (Scope and Bid)		20%			$5,665,732	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$33,994,391	
Project Management		2%			$679,888	Percentage modified as documented in Attachment A
Technical Support		5%			$1,699,720	Percentage modified as documented in Attachment A
TOTAL					$36,373,999	
TOTAL PERIODIC COST					**$36,374,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-D25	1	LS	$3,391,669	$3,391,669	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,391,669	
Contingency (Scope and Bid)		20%			$678,334	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,070,003	
Project Management		5%			$203,500	Middle value of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$407,000	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$4,680,503	
TOTAL PERIODIC COST					**$4,681,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-D3	1	LS	$441,761	$441,761	
SUBTOTAL					$441,761	
Contingency (Scope and Bid)		10%			$44,176	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$485,937	
Project Management		5%			$24,297	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$48,594	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$558,828	
TOTAL PERIODIC COST					**$559,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-D26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-E

PRESENT VALUE ANALYSIS

Alternative **E Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$524,714	$9,991,000	$116,257,286	$0	$0	$0	$0	$126,773,000	1.0000	$126,773,000
1	$524,714	$0	$116,257,286	$0	$0	$0	$0	$116,782,000	0.9346	$109,144,457
2	$524,714	$0	$116,257,286	$0	$0	$0	$0	$116,782,000	0.8734	$101,997,399
3	$524,714	$0	$116,257,286	$0	$0	$0	$0	$116,782,000	0.8163	$95,329,147
4	$524,714	$0	$116,257,286	$0	$0	$0	$0	$116,782,000	0.7629	$89,092,988
5	$524,714	$0	$116,257,286	$0	$37,467,000	$5,969,000	$308,000	$160,526,000	0.7130	$114,455,038
6	$524,714	$0	$116,257,286	$0	$0	$0	$0	$116,782,000	0.6663	$77,811,847
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$0	$0	$0	$0	0.5820	$0
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.5083	$22,235,075
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$0	$0	$0	$0	0.3878	$0
15	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.3624	$15,852,826
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$0	$0	$0	$0	0.2959	$0
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.2584	$11,303,450
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.1842	$8,057,645
26	$0	$0	$0	$0	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.1314	$5,747,962
TOTALS:	$3,673,000	$9,991,000	$813,801,000	$0	$224,802,000	$35,814,000	$1,848,000	$1,089,929,000		$777,800,834
TOTAL PRESENT VALUE OF ALTERNATIVE E[5]										**$777,800,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-E.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-E

Alternative E Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-E2	1	LS	$2,985,246	$2,985,246	
SUBTOTAL					$2,985,246	
Contingency (Scope and Bid)		15%			$447,787	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$3,433,033	
Project Management		2%			$68,661	Percentage modified as documented in Attachment A
Remedial Design		2%			$68,661	Percentage modified as documented in Attachment A
Construction Management		3%			$102,991	Percentage modified as documented in Attachment A
TOTAL					$3,673,346	
TOTAL CAPITAL COST					**$3,673,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,996,648	
Contingency (Scope and Bid)		20%			$1,399,330	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,395,978	
Project Management		5%			$419,799	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$671,678	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$503,759	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$9,991,214	
TOTAL CAPITAL COST					**$9,991,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-E1	1	LS	$9,982,000	$9,982,000	
Transload Facility Development	CW-E21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-E5	330	AC	$13,107	$4,325,313	
Obstruction Removal and Relocation	CW-E6	1	LS	$15,701,434	$15,701,434	
Erosion/Residual Control Measures	CW-E7	1	LS	$24,743,285	$24,743,285	
Dredging of Contaminated Sediments (Open Water)	CW-E8	1,835,521	CY	$24.53	$45,025,330	
Dredging of Contaminated Sediments (Confined)	CW-E9	92,616	CY	$31.10	$2,880,358	
Excavation of Riverbanks	CW-E10	96,086	CY	$5.19	$498,687	
Dewatering and Water Treatment for Dredging Operations	CW-E11	1	LS	$8,443,577	$8,443,577	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-E12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-E13	2,975,613	TON	$111	$329,567,250	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-E14	35	AC	$1,070,827	$37,478,945	
Sand Placement for Technology Assignments	CW-E15	665,248	CY	$33.73	$22,437,471	
Beach Mix Placement for Technology Assignments	CW-E16	48,189	CY	$73.34	$3,534,049	
Armor Placement for Technology Assignments	CW-E17	79,256	CY	$72.14	$5,717,178	
Reactive/GAC Placement for Technology Assignments	CW-E18	1	LS	$42,943,721	$42,943,721	
Geofabric for Riverbanks	CW-E19	19.9	AC	$14,311	$284,794	
Organoclay Mat Placement for Technology Assignments	CW-E20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$633,801,158	
Contingency (Scope and Bid)		20%			$126,760,232	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$760,561,390	
Project Management		2%			$15,211,228	Percentage modified as documented in Attachment A
Remedial Design		2%			$15,211,228	Percentage modified as documented in Attachment A
Construction Management		3%			$22,816,842	Percentage modified as documented in Attachment A
TOTAL					$813,800,688	
TOTAL CAPITAL COST					**$813,801,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	
Site-Wide Monitoring	CW-E23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-E24	1	LS	$21,225,951	$21,225,951	
SUBTOTAL					$29,180,258	
Contingency (Scope and Bid)		20%			$5,836,052	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,016,310	
Project Management		2%			$700,326	Percentage modified as documented in Attachment A
Technical Support		5%			$1,750,816	Percentage modified as documented in Attachment A
TOTAL					$37,467,452	
TOTAL PERIODIC COST					**$37,467,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-E25	1	LS	$3,865,618	$3,865,618	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,865,618	
Contingency (Scope and Bid)		20%			$773,124	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,638,742	
Project Management		5%			$231,937	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,874	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,334,553	
TOTAL PERIODIC COST					**$5,335,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-E3	1	LS	$501,289	$501,289	
SUBTOTAL					$501,289	
Contingency (Scope and Bid)		10%			$50,129	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$551,418	
Project Management		5%			$27,571	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,142	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$634,131	
TOTAL PERIODIC COST					**$634,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-E26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-F

PRESENT VALUE ANALYSIS

Alternative **F Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$353,000	$8,749,000	$124,313,000	$0	$0	$0	$0	$133,415,000	1.0000	$133,415,000
1	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.9346	$116,512,844
2	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.8734	$108,883,284
3	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.8163	$101,764,856
4	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.7629	$95,107,691
5	$353,000	$0	$124,313,000	$0	$49,499,000	$8,779,000	$308,000	$183,252,000	0.7130	$130,658,676
6	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.6663	$83,064,956
7	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.6227	$77,629,518
8	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.5820	$72,555,612
9	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.5439	$67,805,837
10	$353,000	$0	$124,313,000	$0	$49,499,000	$8,779,000	$308,000	$183,252,000	0.5083	$93,146,992
11	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.4751	$59,228,817
12	$353,000	$0	$124,313,000	$0	$0	$0	$0	$124,666,000	0.4440	$55,351,704
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$0	$0	$0	$0	0.3878	$0
15	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.3624	$21,231,566
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$0	$0	$0	$0	0.2959	$0
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.2584	$15,138,622
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.1842	$10,791,541
26	$0	$0	$0	$0	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.1314	$7,698,200
TOTALS:	$4,589,000	$8,749,000	$1,616,069,000	$0	$296,994,000	$52,674,000	$1,848,000	$1,980,923,000		$1,249,985,716
TOTAL PRESENT VALUE OF ALTERNATIVE F[5]										**$1,249,990,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-F.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-F

Alternative **F Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW-F2	1	LS	$3,728,996	$3,728,996	
SUBTOTAL					$3,728,996	
Contingency (Scope and Bid)		15%			$559,349	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$4,288,345	
Project Management		2%			$85,767	Percentage modified as documented in Attachment A
Remedial Design		2%			$85,767	Percentage modified as documented in Attachment A
Construction Management		3%			$128,650	Percentage modified as documented in Attachment A
TOTAL					$4,588,529	
TOTAL CAPITAL COST					**$4,589,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,126,675	
Contingency (Scope and Bid)		20%			$1,225,335	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$7,352,010	
Project Management		5%			$367,601	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$588,161	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$441,121	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$8,748,893	
TOTAL CAPITAL COST					**$8,749,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-F1	1	LS	$19,821,000	$19,821,000	
Transload Facility Development	CW-F21	1	LS	$15,651,213	$15,651,213	
Debris Removal and Disposal	CW-F5	534	AC	$13,107	$6,999,143	
Obstruction Removal and Relocation	CW-F6	1	LS	$20,718,583	$20,718,583	
Erosion/Residual Control Measures	CW-F7	1	LS	$27,166,335	$27,166,335	
Dredging of Contaminated Sediments (Open Water)	CW-F8	4,339,288	CY	$24.53	$106,442,735	
Dredging of Contaminated Sediments (Confined)	CW-F9	123,286	CY	$31.10	$3,834,195	
Excavation of Riverbanks	CW-F10	122,827	CY	$5.19	$637,472	
Dewatering and Water Treatment for Dredging Operations	CW-F11	1	LS	$19,423,050	$19,423,050	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-F12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-F13	7,149,152	TON	$111	$791,812,106	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-F14	60	AC	$1,070,827	$64,249,620	
Sand Placement for Technology Assignments	CW-F15	1,119,996	CY	$33.48	$37,494,727	
Beach Mix Placement for Technology Assignments	CW-F16	69,510	CY	$72.97	$5,071,863	
Armor Placement for Technology Assignments	CW-F17	151,909	CY	$71.97	$10,932,677	
Reactive/GAC Placement for Technology Assignments	CW-F18	1	LS	$58,294,110	$58,294,110	
Geofabric for Riverbanks	CW-F19	25.4	AC	$14,311	$363,505	
Organoclay Mat Placement for Technology Assignments	CW-F20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,258,621,102	
Contingency (Scope and Bid)		20%			$251,724,220	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$1,510,345,322	
Project Management		2%			$30,206,906	Percentage modified as documented in Attachment A
Remedial Design		2%			$30,206,906	Percentage modified as documented in Attachment A
Construction Management		3%			$45,310,360	Percentage modified as documented in Attachment A
TOTAL					$1,616,069,494	
TOTAL CAPITAL COST					**$1,616,069,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	
Site-Wide Monitoring	CW-F23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-F24	1	LS	$31,466,392	$31,466,392	
SUBTOTAL					$38,550,726	
Contingency (Scope and Bid)		20%			$7,710,145	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$46,260,871	
Project Management		2%			$925,217	Percentage modified as documented in Attachment A
Technical Support		5%			$2,313,044	Percentage modified as documented in Attachment A
TOTAL					$49,499,132	
TOTAL PERIODIC COST					**$49,499,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-F25	1	LS	$5,757,416	$5,757,416	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs
SUBTOTAL					$5,757,416	
Contingency (Scope and Bid)		20%			$1,151,483	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,908,899	
Project Management		5%			$345,445	Percentage modified as documented in Attachment A
Technical Support		10%			$690,890	Percentage modified as documented in Attachment A
TOTAL					$7,945,234	
TOTAL PERIODIC COST					**$7,945,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-F3	1	LS	$659,296	$659,296	
SUBTOTAL					$659,296	
Contingency (Scope and Bid)		10%			$65,930	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$725,226	
Project Management		5%			$36,261	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$72,523	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$834,010	
TOTAL PERIODIC COST					**$834,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-F26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-G

PRESENT VALUE ANALYSIS

Alternative **G Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$264,579	$7,428,000	$130,952,105	$0	$0	$0	$0	$138,644,684	1.0000	$138,644,684
1	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.9346	$122,635,113
2	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.8734	$114,604,652
3	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.8163	$107,112,179
4	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.7629	$100,105,208
5	$264,579	$0	$130,952,105	$0	$63,513,000	$11,856,000	$308,000	$206,893,684	0.7130	$147,515,197
6	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.6663	$87,429,677
7	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.6227	$81,708,629
8	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.5820	$76,368,110
9	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.5439	$71,368,754
10	$264,579	$0	$130,952,105	$0	$63,513,000	$11,856,000	$308,000	$206,893,684	0.5083	$105,164,060
11	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.4751	$62,341,047
12	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.4440	$58,260,208
13	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.4150	$54,454,924
14	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.3878	$50,885,830
15	$264,579	$0	$130,952,105	$0	$63,513,000	$11,856,000	$308,000	$206,893,684	0.3624	$74,978,271
16	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.3387	$44,443,091
17	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.3166	$41,543,202
18	$264,579	$0	$130,952,105	$0	$0	$0	$0	$131,216,684	0.2959	$38,827,017
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.2584	$19,554,937
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.1842	$13,939,703
26	$0	$0	$0	$0	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.1314	$9,943,958
TOTALS:	$5,027,000	$7,428,000	$2,488,090,000	$0	$381,078,000	$71,136,000	$1,848,000	$2,954,607,000		$1,621,828,451
TOTAL PRESENT VALUE OF ALTERNATIVE G[5]										**$1,621,830,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-G.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-G

Alternative G Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 18)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-G2	1	LS	$4,084,988	$4,084,988	
SUBTOTAL					$4,084,988	
Contingency (Scope and Bid)		15%			$612,748	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$4,697,736	
Project Management		2%			$93,955	Percentage modified as documented in Attachment A
Remedial Design		2%			$93,955	Percentage modified as documented in Attachment A
Construction Management		3%			$140,932	Percentage modified as documented in Attachment A
TOTAL					$5,026,578	
TOTAL CAPITAL COST					**$5,027,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$5,201,407	
Contingency (Scope and Bid)		20%			$1,040,281	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,241,688	
Project Management		5%			$312,084	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$499,335	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$374,501	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$7,427,608	
TOTAL CAPITAL COST					**$7,428,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 18)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-G1	1	LS	$30,516,000	$30,516,000	
Transload Facility Development	CW-G21	1	LS	$20,773,428	$20,773,428	
Debris Removal and Disposal	CW-G5	776	AC	$13,107	$10,171,040	
Obstruction Removal and Relocation	CW-G6	1	LS	$22,638,241	$22,638,241	
Erosion/Residual Control Measures	CW-G7	1	LS	$28,135,555	$28,135,555	
Dredging of Contaminated Sediments (Open Water)	CW-G8	7,110,364	CY	$24.53	$174,417,229	
Dredging of Contaminated Sediments (Confined)	CW-G9	147,293	CY	$31.10	$4,580,812	
Excavation of Riverbanks	CW-G10	138,942	CY	$5.19	$721,107	
Dewatering and Water Treatment for Dredging Operations	CW-G11	1	LS	$31,511,207	$31,511,207	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-G12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-G13	11,727,524	TON	$111	$1,298,894,643	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-G14	86	AC	$1,070,827	$92,091,122	
Sand Placement for Technology Assignments	CW-G15	1,634,210	CY	$33.23	$54,304,680	
Beach Mix Placement for Technology Assignments	CW-G16	90,647	CY	$72.65	$6,585,212	
Armor Placement for Technology Assignments	CW-G17	245,586	CY	$71.57	$17,577,027	
Reactive/GAC Placement for Technology Assignments	CW-G18	1	LS	$74,728,183	$74,728,183	
Geofabric for Riverbanks	CW-G19	28.7	AC	$14,311	$410,732	
Organoclay Mat Placement for Technology Assignments	CW-G20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,937,764,986	
Contingency (Scope and Bid)		20%			$387,552,997	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,325,317,983	
Project Management		2%			$46,506,360	Percentage modified as documented in Attachment A
Remedial Design		2%			$46,506,360	Percentage modified as documented in Attachment A
Construction Management		3%			$69,759,539	Percentage modified as documented in Attachment A
TOTAL					$2,488,090,242	
TOTAL CAPITAL COST					**$2,488,090,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-G23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-G24	1	LS	$43,306,076	$43,306,076	
SUBTOTAL					$49,465,142	
Contingency (Scope and Bid)		20%			$9,893,028	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$59,358,170	
Project Management		2%			$1,187,163	Percentage modified as documented in Attachment A
Technical Support		5%			$2,967,909	Percentage modified as documented in Attachment A
TOTAL					$63,513,242	
TOTAL PERIODIC COST					**$63,513,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-G25	1	LS	$7,862,382	$7,862,382	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$7,862,382	
Contingency (Scope and Bid)		20%			$1,572,476	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,434,858	
Project Management		5%			$471,743	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$943,486	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$10,850,087	
TOTAL PERIODIC COST					**$10,850,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-G3	1	LS	$795,634	$795,634	
SUBTOTAL					$795,634	
Contingency (Scope and Bid)		10%			$79,563	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$875,197	
Project Management		5%			$43,760	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$87,520	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$1,006,477	
TOTAL PERIODIC COST					**$1,006,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-G26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-I

PRESENT VALUE ANALYSIS

Alternative **I Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$532,286	$10,197,000	$105,348,000	$0	$0	$0	$0	$116,077,286	1.0000	$116,077,286
1	$532,286	$0	$105,348,000	$0	$0	$0	$0	$105,880,286	0.9346	$98,955,715
2	$532,286	$0	$105,348,000	$0	$0	$0	$0	$105,880,286	0.8734	$92,475,842
3	$532,286	$0	$105,348,000	$0	$0	$0	$0	$105,880,286	0.8163	$86,430,077
4	$532,286	$0	$105,348,000	$0	$0	$0	$0	$105,880,286	0.7629	$80,776,070
5	$532,286	$0	$105,348,000	$0	$38,426,000	$5,972,000	$308,000	$150,586,286	0.7130	$107,368,022
6	$532,286	$0	$105,348,000	$0	$0	$0	$0	$105,880,286	0.6663	$70,548,035
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$0	$0	$0	$0	0.5820	$0
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.5083	$22,724,060
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$0	$0	$0	$0	0.3878	$0
15	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.3624	$16,201,454
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$0	$0	$0	$0	0.2959	$0
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.2584	$11,552,030
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.1842	$8,234,845
26	$0	$0	$0	$0	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.1314	$5,874,368
TOTALS:	$3,726,000	$10,197,000	$737,436,000	$0	$230,556,000	$35,832,000	$1,848,000	$1,019,595,000		$717,217,804
TOTAL PRESENT VALUE OF ALTERNATIVE I[5]										**$717,220,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-I.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-I

Alternative I Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-I2	1	LS	$3,028,033	$3,028,033	
SUBTOTAL					$3,028,033	
Contingency (Scope and Bid)		15%			$454,205	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$3,482,238	
Project Management		2%			$69,645	Percentage modified as documented in Attachment A
Remedial Design		2%			$69,645	Percentage modified as documented in Attachment A
Construction Management		3%			$104,467	Percentage modified as documented in Attachment A
TOTAL					$3,725,995	
TOTAL CAPITAL COST					**$3,726,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,140,415	
Contingency (Scope and Bid)		20%			$1,428,083	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,568,498	
Project Management		5%			$428,425	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$685,480	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$514,110	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,196,513	
TOTAL CAPITAL COST					**$10,197,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-I1	1	LS	$9,045,000	$9,045,000	
Transload Facility Development	CW-I21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-I5	292	AC	$13,107	$3,827,247	
Obstruction Removal and Relocation	CW-I6	1	LS	$15,146,379	$15,146,379	
Erosion/Residual Control Measures	CW-I7	1	LS	$25,227,895	$25,227,895	
Dredging of Contaminated Sediments (Open Water)	CW-I8	1,556,599	CY	$24.53	$38,183,373	
Dredging of Contaminated Sediments (Confined)	CW-I9	93,151	CY	$31.10	$2,896,996	
Excavation of Riverbanks	CW-I10	102,624	CY	$5.19	$532,618	
Dewatering and Water Treatment for Dredging Operations	CW-I11	1	LS	$7,261,269	$7,261,269	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-I12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-I13	2,534,454	TON	$111	$280,706,119	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-I14	34	AC	$1,070,827	$36,408,118	
Sand Placement for Technology Assignments	CW-I15	598,578	CY	$34.00	$20,353,254	
Beach Mix Placement for Technology Assignments	CW-I16	49,511	CY	$73.43	$3,635,422	
Armor Placement for Technology Assignments	CW-I17	80,297	CY	$72.27	$5,802,915	
Reactive/GAC Placement for Technology Assignments	CW-I18	1	LS	$44,759,377	$44,759,377	
Geofabric for Riverbanks	CW-I19	21.2	AC	$14,311	$303,398	
Organoclay Mat Placement for Technology Assignments	CW-I20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$574,327,146	
Contingency (Scope and Bid)		20%			$114,865,429	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$689,192,575	
Project Management		2%			$13,783,852	Percentage modified as documented in Attachment A
Remedial Design		2%			$13,783,852	Percentage modified as documented in Attachment A
Construction Management		3%			$20,675,777	Percentage modified as documented in Attachment A
TOTAL					$737,436,056	
TOTAL CAPITAL COST					**$737,436,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-I23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-I24	1	LS	$21,828,717	$21,828,717	
SUBTOTAL					$29,926,791	
Contingency (Scope and Bid)		20%			$5,985,358	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,912,149	
Project Management		2%			$718,243	Percentage modified as documented in Attachment A
Technical Support		5%			$1,795,607	Percentage modified as documented in Attachment A
TOTAL					$38,425,999	
TOTAL PERIODIC COST					**$38,426,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-I25	1	LS	$3,862,654	$3,862,654	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,862,654	
Contingency (Scope and Bid)		20%			$772,531	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,635,185	
Project Management		5%			$231,759	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,519	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,330,463	
TOTAL PERIODIC COST					**$5,330,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Monitoring Frequency (5-Year Frequency for Monitoring)

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-I3	1	LS	$507,467	$507,467	
SUBTOTAL					$507,467	
Contingency (Scope and Bid)		10%			$50,747	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$558,214	
Project Management		5%			$27,911	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,821	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$641,946	
TOTAL PERIODIC COST					**$642,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-I26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

Sensitivity Analysis

Subtitle C Disposal Volume Scenarios
(± 15% Subtitle C Volume)

Note: Costs presented herein are specific to DMM Scenario 2. Cost Worksheets presented herein are specific to the Subtitle C Disposal Volume Sensitivity Analysis Scenarios. All other Cost Worksheets are the same as the Cost Worksheets created for the base estimate, and can be found in Appendix G.

TABLE PV-B

PRESENT VALUE ANALYSIS

Alternative **B Sensitivity Analysis - Subtitle C Volume (15% Less Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$620,250	$10,912,000	$83,176,500	$0	$0	$0	$0	$94,708,750	1.0000	$94,708,750
1	$620,250	$0	$83,176,500	$0	$0	$0	$0	$83,796,750	0.9346	$78,316,443
2	$620,250	$0	$83,176,500	$0	$26,744,000	$0	$0	$110,540,750	0.8734	$96,546,291
3	$620,250	$0	$83,176,500	$0	$0	$0	$0	$83,796,750	0.8163	$68,403,287
4	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.7629	$20,402,998
5	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.7130	$2,719,382
6	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.6663	$17,819,527
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.5820	$15,565,008
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.5083	$15,532,631
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.3878	$10,371,323
15	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.3624	$1,382,194
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2959	$7,913,550
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.2584	$985,538
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2257	$6,036,121
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.1842	$702,539
26	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.1722	$4,605,317
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.1314	$4,015,321
TOTALS:	$2,481,000	$10,912,000	$332,706,000	$0	$267,440,000	$21,036,000	$1,848,000	$636,423,000		$446,026,220
TOTAL PRESENT VALUE OF ALTERNATIVE B[5]										**$446,030,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-B.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-B

PRESENT VALUE ANALYSIS

Alternative **B Sensitivity Analysis - Subtitle C Volume (15% More Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$620,250	$10,912,000	$86,176,250	$0	$0	$0	$0	$97,708,500	1.0000	$97,708,500
1	$620,250	$0	$86,176,250	$0	$0	$0	$0	$86,796,500	0.9346	$81,120,009
2	$620,250	$0	$86,176,250	$0	$26,744,000	$0	$0	$113,540,500	0.8734	$99,166,273
3	$620,250	$0	$86,176,250	$0	$0	$0	$0	$86,796,500	0.8163	$70,851,983
4	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.7629	$20,402,998
5	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.7130	$2,719,382
6	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.6663	$17,819,527
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.5820	$15,565,008
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.5083	$15,532,631
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.3878	$10,371,323
15	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.3624	$1,382,194
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2959	$7,913,550
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.2584	$985,538
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2257	$6,036,121
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.1842	$702,539
26	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.1722	$4,605,317
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.1314	$4,015,321
TOTALS:	$2,481,000	$10,912,000	$344,705,000	$0	$267,440,000	$21,036,000	$1,848,000	$648,422,000		$456,898,214
TOTAL PRESENT VALUE OF ALTERNATIVE B[5]										**$456,900,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-B.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-B

Alternative **B Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 3)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-B2	1	LS	$2,016,443	$2,016,443	
SUBTOTAL					$2,016,443	
Contingency (Scope and Bid)		15%			$302,466	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$2,318,909	
Project Management		2%			$46,378	Percentage modified as documented in Attachment A
Remedial Design		2%			$46,378	Percentage modified as documented in Attachment A
Construction Management		3%			$69,567	Percentage modified as documented in Attachment A
TOTAL					$2,481,232	
TOTAL CAPITAL COST					**$2,481,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,641,756	
Contingency (Scope and Bid)		20%			$1,528,351	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,170,107	
Project Management		5%			$458,505	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$733,609	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$550,206	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,912,427	
TOTAL CAPITAL COST					**$10,912,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 3) - 15% Less Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-B1	1	LS	$4,155,000	$4,155,000	
Transload Facility Development	CW-B21	1	LS	$7,967,890	$7,967,890	
Debris Removal and Disposal	CW-B5	202	AC	$13,107	$2,647,616	
Obstruction Removal and Relocation	CW-B6	1	LS	$3,907,503	$3,907,503	
Erosion/Residual Control Measures	CW-B7	1	LS	$22,320,235	$22,320,235	
Dredging of Contaminated Sediments (Open Water)	CW-B8	513,841	CY	$24.53	$12,604,520	
Dredging of Contaminated Sediments (Confined)	CW-B9	63,042	CY	$31.10	$1,960,606	
Excavation of Riverbanks	CW-B10	50,769	CY	$5.19	$263,490	
Dewatering and Water Treatment for Dredging Operations	CW-B11	1	LS	$2,595,467	$2,595,467	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C	CW-B12A	305,057	TON	$191	$58,256,201	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C	CW-B13A	744,477	TON	$111	$82,455,283	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-B14	15	AC	$1,070,827	$16,062,405	
Sand Placement for Technology Assignments	CW-B15	342,033	CY	$33.89	$11,591,596	
Beach Mix Placement for Technology Assignments	CW-B16	18,563	CY	$74.24	$1,378,163	
Armor Placement for Technology Assignments	CW-B17	29,533	CY	$72.42	$2,138,814	
Reactive/GAC Placement for Technology Assignments	CW-B18	1	LS	$27,488,372	$27,488,372	
Geofabric for Riverbanks	CW-B19	10.5	AC	$14,311	$150,268	
Organoclay Mat Placement for Technology Assignments	CW-B20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$259,116,468	
Contingency (Scope and Bid)		20%			$51,823,294	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$310,939,762	
Project Management		2%			$6,218,795	Percentage modified as documented in Attachment A
Remedial Design		2%			$6,218,795	Percentage modified as documented in Attachment A
Construction Management		3%			$9,328,193	Percentage modified as documented in Attachment A
TOTAL					$332,705,545	
TOTAL CAPITAL COST					**$332,706,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative B Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 3) - 15% More Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-B1	1	LS	$4,155,000	$4,155,000	
Transload Facility Development	CW-B21	1	LS	$7,967,890	$7,967,890	
Debris Removal and Disposal	CW-B5	202	AC	$13,107	$2,647,616	
Obstruction Removal and Relocation	CW-B6	1	LS	$3,907,503	$3,907,503	
Erosion/Residual Control Measures	CW-B7	1	LS	$22,320,235	$22,320,235	
Dredging of Contaminated Sediments (Open Water)	CW-B8	513,841	CY	$24.53	$12,604,520	
Dredging of Contaminated Sediments (Confined)	CW-B9	63,042	CY	$31.10	$1,960,606	
Excavation of Riverbanks	CW-B10	50,769	CY	$5.19	$263,490	
Dewatering and Water Treatment for Dredging Operations	CW-B11	1	LS	$2,595,467	$2,595,467	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C	CW-B12B	412,725	TON	$191	$78,817,704	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C	CW-B13B	643,205	TON	$111	$71,238,899	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-B14	15	AC	$1,070,827	$16,062,405	
Sand Placement for Technology Assignments	CW-B15	342,033	CY	$33.89	$11,591,596	
Beach Mix Placement for Technology Assignments	CW-B16	18,563	CY	$74.24	$1,378,163	
Armor Placement for Technology Assignments	CW-B17	29,533	CY	$72.42	$2,138,814	
Reactive/GAC Placement for Technology Assignments	CW-B18	1	LS	$27,488,372	$27,488,372	
Geofabric for Riverbanks	CW-B19	10.5	AC	$14,311	$150,268	
Organoclay Mat Placement for Technology Assignments	CW-B20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$268,461,587	
Contingency (Scope and Bid)		20%			$53,692,317	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$322,153,904	
Project Management		2%			$6,443,078	Percentage modified as documented in Attachment A
Remedial Design		2%			$6,443,078	Percentage modified as documented in Attachment A
Construction Management		3%			$9,664,617	Percentage modified as documented in Attachment A
TOTAL					$344,704,677	
TOTAL CAPITAL COST					**$344,705,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	
Site-Wide Monitoring	CW-B23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-B24	1	LS	$12,228,875	$12,228,875	
SUBTOTAL					$20,828,290	
Contingency (Scope and Bid)		20%			$4,165,658	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$24,993,948	
Project Management		2%			$499,879	Percentage modified as documented in Attachment A
Technical Support		5%			$1,249,697	Percentage modified as documented in Attachment A
TOTAL					$26,743,524	
TOTAL PERIODIC COST					**$26,744,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-B25	1	LS	$2,230,955	$2,230,955	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$2,230,955	
Contingency (Scope and Bid)		20%			$446,191	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,677,146	
Project Management		5%			$133,857	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$267,715	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$3,078,718	
TOTAL PERIODIC COST					**$3,079,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-B3	1	LS	$337,883	$337,883	
SUBTOTAL					$337,883	
Contingency (Scope and Bid)		10%			$33,788	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$371,671	
Project Management		5%			$18,584	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$37,167	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$427,422	
TOTAL PERIODIC COST					**$427,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-B26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-D

PRESENT VALUE ANALYSIS

Alternative **D Sensitivity Analysis - Subtitle C Volume (15% Less Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$517,500	$10,481,000	$89,403,333	$0	$0	$0	$0	$100,401,833	1.0000	$100,401,833
1	$517,500	$0	$89,403,333	$0	$0	$0	$0	$89,920,833	0.9346	$84,040,011
2	$517,500	$0	$89,403,333	$0	$36,374,000	$0	$0	$126,294,833	0.8734	$110,305,907
3	$517,500	$0	$89,403,333	$0	$0	$0	$0	$89,920,833	0.8163	$73,402,376
4	$517,500	$0	$89,403,333	$0	$36,374,000	$0	$0	$126,294,833	0.7629	$96,350,328
5	$517,500	$0	$89,403,333	$0	$0	$5,240,000	$308,000	$95,468,833	0.7130	$68,069,278
6	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.6663	$24,235,996
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.5820	$21,169,668
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.5083	$21,308,953
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.3878	$14,105,837
15	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.3624	$2,010,595
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2959	$10,763,067
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.2584	$1,433,603
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2257	$8,209,612
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.1842	$1,021,942
26	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.1722	$6,263,603
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.1314	$5,508,551
TOTALS:	$3,105,000	$10,481,000	$536,420,000	$0	$363,740,000	$31,440,000	$1,848,000	$947,034,000		$648,601,160
TOTAL PRESENT VALUE OF ALTERNATIVE D[5]										**$648,600,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-D.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-D

PRESENT VALUE ANALYSIS

Alternative **D Sensitivity Analysis - Subtitle C Volume (15% More Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$517,500	$10,481,000	$91,403,167	$0	$0	$0	$0	$102,401,667	1.0000	$102,401,667
1	$517,500	$0	$91,403,167	$0	$0	$0	$0	$91,920,667	0.9346	$85,909,055
2	$517,500	$0	$91,403,167	$0	$36,374,000	$0	$0	$128,294,667	0.8734	$112,052,562
3	$517,500	$0	$91,403,167	$0	$0	$0	$0	$91,920,667	0.8163	$75,034,840
4	$517,500	$0	$91,403,167	$0	$36,374,000	$0	$0	$128,294,667	0.7629	$97,876,001
5	$517,500	$0	$91,403,167	$0	$0	$5,240,000	$308,000	$97,468,667	0.7130	$69,495,160
6	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.6663	$24,235,996
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.5820	$21,169,668
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.5083	$21,308,953
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.3878	$14,105,837
15	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.3624	$2,010,595
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2959	$10,763,067
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.2584	$1,433,603
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2257	$8,209,612
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.1842	$1,021,942
26	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.1722	$6,263,603
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.1314	$5,508,551
TOTALS:	$3,105,000	$10,481,000	$548,419,000	$0	$363,740,000	$31,440,000	$1,848,000	$959,033,000		$658,800,712
TOTAL PRESENT VALUE OF ALTERNATIVE D[5]										**$658,800,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-D.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-D

Alternative D Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 5)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-D2	1	LS	$2,523,020	$2,523,020	
SUBTOTAL					$2,523,020	
Contingency (Scope and Bid)		15%			$378,453	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$2,901,473	
Project Management		2%			$58,029	Percentage modified as documented in Attachment A
Remedial Design		2%			$58,029	Percentage modified as documented in Attachment A
Construction Management		3%			$87,044	Percentage modified as documented in Attachment A
TOTAL					$3,104,575	
TOTAL CAPITAL COST					**$3,105,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,339,477	
Contingency (Scope and Bid)		20%			$1,467,895	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,807,372	
Project Management		5%			$440,369	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$704,590	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$528,442	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,480,773	
TOTAL CAPITAL COST					**$10,481,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative **D Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 5) - 15% Less Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-D1	1	LS	$6,653,000	$6,653,000	
Transload Facility Development	CW-D21	1	LS	$9,675,295	$9,675,295	
Debris Removal and Disposal	CW-D5	268	AC	$13,107	$3,512,679	
Obstruction Removal and Relocation	CW-D6	1	LS	$6,933,407	$6,933,407	
Erosion/Residual Control Measures	CW-D7	1	LS	$23,531,760	$23,531,760	
Dredging of Contaminated Sediments (Open Water)	CW-D8	1,035,580	CY	$24.53	$25,402,777	
Dredging of Contaminated Sediments (Confined)	CW-D9	72,466	CY	$31.10	$2,253,693	
Excavation of Riverbanks	CW-D10	73,192	CY	$5.19	$379,864	
Dewatering and Water Treatment for Dredging Operations	CW-D11	1	LS	$4,925,014	$4,925,014	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C	CW-D12A	305,057	TON	$191	$58,256,201	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C	CW-D13A	1,649,817	TON	$111	$182,727,338	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-D14	25	AC	$1,070,827	$26,770,675	
Sand Placement for Technology Assignments	CW-D15	475,860	CY	$33.82	$16,095,462	
Beach Mix Placement for Technology Assignments	CW-D16	32,441	CY	$73.59	$2,387,358	
Armor Placement for Technology Assignments	CW-D17	53,344	CY	$72.06	$3,844,036	
Reactive/GAC Placement for Technology Assignments	CW-D18	1	LS	$43,035,063	$43,035,063	
Geofabric for Riverbanks	CW-D19	15.1	AC	$14,311	$216,100	
Organoclay Mat Placement for Technology Assignments	CW-D20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$417,772,761	
Contingency (Scope and Bid)		20%			$83,554,552	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$501,327,313	
Project Management		2%			$10,026,546	Percentage modified as documented in Attachment A
Remedial Design		2%			$10,026,546	Percentage modified as documented in Attachment A
Construction Management		3%			$15,039,819	Percentage modified as documented in Attachment A
TOTAL					$536,420,224	
TOTAL CAPITAL COST					**$536,420,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 5) - 15% More Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-D1	1	LS	$6,653,000	$6,653,000	
Transload Facility Development	CW-D21	1	LS	$9,675,295	$9,675,295	
Debris Removal and Disposal	CW-D5	268	AC	$13,107	$3,512,679	
Obstruction Removal and Relocation	CW-D6	1	LS	$6,933,407	$6,933,407	
Erosion/Residual Control Measures	CW-D7	1	LS	$23,531,760	$23,531,760	
Dredging of Contaminated Sediments (Open Water)	CW-D8	1,035,580	CY	$24.53	$25,402,777	
Dredging of Contaminated Sediments (Confined)	CW-D9	72,466	CY	$31.10	$2,253,693	
Excavation of Riverbanks	CW-D10	73,192	CY	$5.19	$379,864	
Dewatering and Water Treatment for Dredging Operations	CW-D11	1	LS	$4,925,014	$4,925,014	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C	CW-D12B	412,725	TON	$191	$78,817,704	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C	CW-D13B	1,548,544	TON	$111	$171,510,622	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-D14	25	AC	$1,070,827	$26,770,675	
Sand Placement for Technology Assignments	CW-D15	475,860	CY	$33.82	$16,095,462	
Beach Mix Placement for Technology Assignments	CW-D16	32,441	CY	$73.59	$2,387,358	
Armor Placement for Technology Assignments	CW-D17	53,344	CY	$72.06	$3,844,036	
Reactive/GAC Placement for Technology Assignments	CW-D18	1	LS	$43,035,063	$43,035,063	
Geofabric for Riverbanks	CW-D19	15.1	AC	$14,311	$216,100	
Organoclay Mat Placement for Technology Assignments	CW-D20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$427,117,548	
Contingency (Scope and Bid)		20%			$85,423,510	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$512,541,058	
Project Management		2%			$10,250,821	Percentage modified as documented in Attachment A
Remedial Design		2%			$10,250,821	Percentage modified as documented in Attachment A
Construction Management		3%			$15,376,232	Percentage modified as documented in Attachment A
TOTAL					$548,418,932	
TOTAL CAPITAL COST					**$548,419,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	
Site-Wide Monitoring	CW-D23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-D24	1	LS	$20,031,523	$20,031,523	
SUBTOTAL					$28,328,659	
Contingency (Scope and Bid)		20%			$5,665,732	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$33,994,391	
Project Management		2%			$679,888	Percentage modified as documented in Attachment A
Technical Support		5%			$1,699,720	Percentage modified as documented in Attachment A
TOTAL					$36,373,999	
TOTAL PERIODIC COST					**$36,374,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-D25	1	LS	$3,391,669	$3,391,669	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,391,669	
Contingency (Scope and Bid)		20%			$678,334	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,070,003	
Project Management		5%			$203,500	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$407,000	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$4,680,503	
TOTAL PERIODIC COST					**$4,681,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-D3	1	LS	$441,761	$441,761	
SUBTOTAL					$441,761	
Contingency (Scope and Bid)		10%			$44,176	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$485,937	
Project Management		5%			$24,297	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$48,594	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$558,828	
TOTAL PERIODIC COST					**$559,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-D26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-E

PRESENT VALUE ANALYSIS

Alternative **E Sensitivity Analysis - Subtitle C Volume (15% Less Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$524,714	$9,991,000	$115,400,286	$0	$0	$0	$0	$125,916,000	1.0000	$125,916,000
1	$524,714	$0	$115,400,286	$0	$0	$0	$0	$115,925,000	0.9346	$108,343,505
2	$524,714	$0	$115,400,286	$0	$37,467,000	$0	$0	$153,392,000	0.8734	$133,972,573
3	$524,714	$0	$115,400,286	$0	$0	$0	$0	$115,925,000	0.8163	$94,629,578
4	$524,714	$0	$115,400,286	$0	$37,467,000	$0	$0	$153,392,000	0.7629	$117,022,757
5	$524,714	$0	$115,400,286	$0	$0	$5,969,000	$308,000	$122,202,000	0.7130	$87,130,026
6	$524,714	$0	$115,400,286	$0	$37,467,000	$0	$0	$153,392,000	0.6663	$102,205,090
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.5820	$21,805,794
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.5083	$22,235,075
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.3878	$14,529,703
15	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.3624	$2,274,785
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2959	$11,086,485
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.2584	$1,621,977
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2257	$8,456,302
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.1842	$1,156,223
26	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.1722	$6,451,817
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.1314	$5,747,962
TOTALS:	$3,673,000	$9,991,000	$807,802,000	$0	$374,670,000	$35,814,000	$1,848,000	$1,233,798,000		$864,585,652
TOTAL PRESENT VALUE OF ALTERNATIVE E[5]										**$864,590,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-E.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-E

PRESENT VALUE ANALYSIS

Alternative **E Sensitivity Analysis - Subtitle C Volume (15% More Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$524,714	$9,991,000	$117,114,571	$0	$0	$0	$0	$127,630,285	1.0000	$127,630,285
1	$524,714	$0	$117,114,571	$0	$0	$0	$0	$117,639,285	0.9346	$109,945,676
2	$524,714	$0	$117,114,571	$0	$37,467,000	$0	$0	$155,106,285	0.8734	$135,469,829
3	$524,714	$0	$117,114,571	$0	$0	$0	$0	$117,639,285	0.8163	$96,028,948
4	$524,714	$0	$117,114,571	$0	$37,467,000	$0	$0	$155,106,285	0.7629	$118,330,585
5	$524,714	$0	$117,114,571	$0	$0	$5,969,000	$308,000	$123,916,285	0.7130	$88,352,311
6	$524,714	$0	$117,114,571	$0	$37,467,000	$0	$0	$155,106,285	0.6663	$103,347,318
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.5820	$21,805,794
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.5083	$22,235,075
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.3878	$14,529,703
15	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.3624	$2,274,785
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2959	$11,086,485
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.2584	$1,621,977
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2257	$8,456,302
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.1842	$1,156,223
26	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.1722	$6,451,817
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.1314	$5,747,962
TOTALS:	$3,673,000	$9,991,000	$819,802,000	$0	$374,670,000	$35,814,000	$1,848,000	$1,245,798,000		$874,471,075
TOTAL PRESENT VALUE OF ALTERNATIVE E[5]										**$874,470,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-E.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-E

Alternative E Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-E2	1	LS	$2,985,246	$2,985,246	
SUBTOTAL					$2,985,246	
Contingency (Scope and Bid)		15%			$447,787	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$3,433,033	
Project Management		2%			$68,661	Percentage modified as documented in Attachment A
Remedial Design		2%			$68,661	Percentage modified as documented in Attachment A
Construction Management		3%			$102,991	Percentage modified as documented in Attachment A
TOTAL					$3,673,346	
TOTAL CAPITAL COST					**$3,673,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,996,648	
Contingency (Scope and Bid)		20%			$1,399,330	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,395,978	
Project Management		5%			$419,799	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$671,678	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$503,759	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$9,991,214	
TOTAL CAPITAL COST					**$9,991,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative **E Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6) - 15% Less Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-E1	1	LS	$9,982,000	$9,982,000	
Transload Facility Development	CW-E21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-E5	330	AC	$13,107	$4,325,313	
Obstruction Removal and Relocation	CW-E6	1	LS	$15,701,434	$15,701,434	
Erosion/Residual Control Measures	CW-E7	1	LS	$24,743,285	$24,743,285	
Dredging of Contaminated Sediments (Open Water)	CW-E8	1,835,521	CY	$24.53	$45,025,330	
Dredging of Contaminated Sediments (Confined)	CW-E9	92,616	CY	$31.10	$2,880,358	
Excavation of Riverbanks	CW-E10	96,086	CY	$5.19	$498,687	
Dewatering and Water Treatment for Dredging Operations	CW-E11	378	DY	$22,332	$8,443,577	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C	CW-E12A	305,057	TON	$191	$58,256,201	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C	CW-E13A	3,026,247	TON	$111	$335,175,254	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-E14	35	AC	$1,070,827	$37,478,945	
Sand Placement for Technology Assignments	CW-E15	665,248	CY	$33.73	$22,437,471	
Beach Mix Placement for Technology Assignments	CW-E16	48,189	CY	$73.34	$3,534,049	
Armor Placement for Technology Assignments	CW-E17	79,256	CY	$72.14	$5,717,178	
Reactive/GAC Placement for Technology Assignments	CW-E18	164,440	CY	$261.15	$42,943,721	
Geofabric for Riverbanks	CW-E19	20	AC	$14,240	$284,794	
Organoclay Mat Placement for Technology Assignments	CW-E20	4	AC	$293,260	$1,173,039	
SUBTOTAL					$629,129,634	
Contingency (Scope and Bid)		20%			$125,825,927	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$754,955,561	
Project Management		2%			$15,099,111	Percentage modified as documented in Attachment A
Remedial Design		2%			$15,099,111	Percentage modified as documented in Attachment A
Construction Management		3%			$22,648,667	Percentage modified as documented in Attachment A
TOTAL					$807,802,450	
TOTAL CAPITAL COST					**$807,802,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6) - 15% More Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-E1	1	LS	$9,982,000	$9,982,000	
Transload Facility Development	CW-E21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-E5	330	AC	$13,107	$4,325,313	
Obstruction Removal and Relocation	CW-E6	1	LS	$15,701,434	$15,701,434	
Erosion/Residual Control Measures	CW-E7	1	LS	$24,743,285	$24,743,285	
Dredging of Contaminated Sediments (Open Water)	CW-E8	1,835,521	CY	$24.53	$45,025,330	
Dredging of Contaminated Sediments (Confined)	CW-E9	92,616	CY	$31.10	$2,880,358	
Excavation of Riverbanks	CW-E10	96,086	CY	$5.19	$498,687	
Dewatering and Water Treatment for Dredging Operations	CW-E11	378	DY	$22,332	$8,443,577	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C	CW-E12B	412,725	TON	$191	$78,817,704	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C	CW-E13B	2,924,975	TON	$111	$323,958,871	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-E14	35	AC	$1,070,827	$37,478,945	
Sand Placement for Technology Assignments	CW-E15	665,248	CY	$33.73	$22,437,471	
Beach Mix Placement for Technology Assignments	CW-E16	48,189	CY	$73.34	$3,534,049	
Armor Placement for Technology Assignments	CW-E17	79,256	CY	$72.14	$5,717,178	
Reactive/GAC Placement for Technology Assignments	CW-E18	164,440	CY	$261.15	$42,943,721	
Geofabric for Riverbanks	CW-E19	20	AC	$14,240	$284,794	
Organoclay Mat Placement for Technology Assignments	CW-E20	4	AC	$293,260	$1,173,039	
SUBTOTAL					$638,474,754	
Contingency (Scope and Bid)		20%			$127,694,951	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$766,169,705	
Project Management		2%			$15,323,394	Percentage modified as documented in Attachment A
Remedial Design		2%			$15,323,394	Percentage modified as documented in Attachment A
Construction Management		3%			$22,985,091	Percentage modified as documented in Attachment A
TOTAL					$819,801,584	
TOTAL CAPITAL COST					**$819,802,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	
Site-Wide Monitoring	CW-E23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-E24	1	LS	$21,225,951	$21,225,951	
SUBTOTAL					$29,180,258	
Contingency (Scope and Bid)		20%			$5,836,052	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,016,310	
Project Management		2%			$700,326	Percentage modified as documented in Attachment A
Technical Support		5%			$1,750,816	Percentage modified as documented in Attachment A
TOTAL					$37,467,452	
TOTAL PERIODIC COST					**$37,467,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-E25	1	LS	$3,865,618	$3,865,618	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,865,618	
Contingency (Scope and Bid)		20%			$773,124	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,638,742	
Project Management		5%			$231,937	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,874	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,334,553	
TOTAL PERIODIC COST					**$5,335,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-E3	1	LS	$501,289	$501,289	
SUBTOTAL					$501,289	
Contingency (Scope and Bid)		10%			$50,129	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$551,418	
Project Management		5%			$27,571	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,142	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$634,131	
TOTAL PERIODIC COST					**$634,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-E26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-F

PRESENT VALUE ANALYSIS

Alternative **F Sensitivity Analysis - Subtitle C Volume (15% Less Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$353,000	$8,749,000	$123,851,615	$0	$0	$0	$0	$132,953,615	1.0000	$132,953,615
1	$353,000	$0	$123,851,615	$0	$0	$0	$0	$124,204,615	0.9346	$116,081,633
2	$353,000	$0	$123,851,615	$0	$49,499,000	$0	$0	$173,703,615	0.8734	$151,712,737
3	$353,000	$0	$123,851,615	$0	$0	$0	$0	$124,204,615	0.8163	$101,388,227
4	$353,000	$0	$123,851,615	$0	$49,499,000	$0	$0	$173,703,615	0.7629	$132,518,488
5	$353,000	$0	$123,851,615	$0	$0	$8,779,000	$308,000	$133,291,615	0.7130	$95,036,921
6	$353,000	$0	$123,851,615	$0	$49,499,000	$0	$0	$173,703,615	0.6663	$115,738,719
7	$353,000	$0	$123,851,615	$0	$0	$0	$0	$124,204,615	0.6227	$77,342,214
8	$353,000	$0	$123,851,615	$0	$49,499,000	$0	$0	$173,703,615	0.5820	$101,095,504
9	$353,000	$0	$123,851,615	$0	$0	$0	$0	$124,204,615	0.5439	$67,554,890
10	$353,000	$0	$123,851,615	$0	$49,499,000	$8,779,000	$308,000	$182,790,615	0.5083	$92,912,470
11	$353,000	$0	$123,851,615	$0	$0	$0	$0	$124,204,615	0.4751	$59,009,613
12	$353,000	$0	$123,851,615	$0	$0	$0	$0	$124,204,615	0.4440	$55,146,849
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.3878	$19,195,712
15	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.3624	$3,293,129
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2959	$14,646,754
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.2584	$2,348,081
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2257	$11,171,924
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.1842	$1,673,825
26	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.1722	$8,523,728
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.1314	$7,698,200
TOTALS:	$4,589,000	$8,749,000	$1,610,071,000	$0	$494,990,000	$52,674,000	$1,848,000	$2,172,921,000		$1,367,043,233
TOTAL PRESENT VALUE OF ALTERNATIVE F[5]										**$1,367,040,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-F.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-F

PRESENT VALUE ANALYSIS

Alternative **F Sensitivity Analysis - Subtitle C Volume (15% More Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$353,000	$8,749,000	$124,774,615	$0	$0	$0	$0	$133,876,615	1.0000	$133,876,615
1	$353,000	$0	$124,774,615	$0	$0	$0	$0	$125,127,615	0.9346	$116,944,269
2	$353,000	$0	$124,774,615	$0	$49,499,000	$0	$0	$174,626,615	0.8734	$152,518,886
3	$353,000	$0	$124,774,615	$0	$0	$0	$0	$125,127,615	0.8163	$102,141,672
4	$353,000	$0	$124,774,615	$0	$49,499,000	$0	$0	$174,626,615	0.7629	$133,222,645
5	$353,000	$0	$124,774,615	$0	$0	$8,779,000	$308,000	$134,214,615	0.7130	$95,695,020
6	$353,000	$0	$124,774,615	$0	$49,499,000	$0	$0	$174,626,615	0.6663	$116,353,714
7	$353,000	$0	$124,774,615	$0	$0	$0	$0	$125,127,615	0.6227	$77,916,966
8	$353,000	$0	$124,774,615	$0	$49,499,000	$0	$0	$174,626,615	0.5820	$101,632,690
9	$353,000	$0	$124,774,615	$0	$0	$0	$0	$125,127,615	0.5439	$68,056,910
10	$353,000	$0	$124,774,615	$0	$49,499,000	$8,779,000	$308,000	$183,713,615	0.5083	$93,381,631
11	$353,000	$0	$124,774,615	$0	$0	$0	$0	$125,127,615	0.4751	$59,448,130
12	$353,000	$0	$124,774,615	$0	$0	$0	$0	$125,127,615	0.4440	$55,556,661
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.3878	$19,195,712
15	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.3624	$3,293,129
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2959	$14,646,754
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.2584	$2,348,081
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2257	$11,171,924
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.1842	$1,673,825
26	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.1722	$8,523,728
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.1314	$7,698,200
TOTALS:	$4,589,000	$8,749,000	$1,622,070,000	$0	$494,990,000	$52,674,000	$1,848,000	$2,184,920,000		$1,375,297,162
TOTAL PRESENT VALUE OF ALTERNATIVE F[5]										**$1,375,300,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-F.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-F

Alternative **F Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW-F2	1	LS	$3,728,996	$3,728,996	
SUBTOTAL					$3,728,996	
Contingency (Scope and Bid)		15%			$559,349	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$4,288,345	
Project Management		2%			$85,767	Percentage modified as documented in Attachment A
Remedial Design		2%			$85,767	Percentage modified as documented in Attachment A
Construction Management		3%			$128,650	Percentage modified as documented in Attachment A
TOTAL					$4,588,529	
TOTAL CAPITAL COST					**$4,589,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,126,675	
Contingency (Scope and Bid)		20%			$1,225,335	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$7,352,010	
Project Management		5%			$367,601	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$588,161	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$441,121	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$8,748,893	
TOTAL CAPITAL COST					**$8,749,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 12) - 15% Less Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-F1	1	LS	$19,821,000	$19,821,000	
Transload Facility Development	CW-F21	1	LS	$15,651,213	$15,651,213	
Debris Removal and Disposal	CW-F5	534	AC	$13,107	$6,999,143	
Obstruction Removal and Relocation	CW-F6	1	LS	$20,718,583	$20,718,583	
Erosion/Residual Control Measures	CW-F7	1	LS	$27,166,335	$27,166,335	
Dredging of Contaminated Sediments (Open Water)	CW-F8	4,339,288	CY	$24.53	$106,442,735	
Dredging of Contaminated Sediments (Confined)	CW-F9	123,286	CY	$31.10	$3,834,195	
Excavation of Riverbanks	CW-F10	122,827	CY	$5.19	$637,472	
Dewatering and Water Treatment for Dredging Operations	CW-F11	1	LS	$19,423,050	$19,423,050	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C	CW-F12A	305,057	TON	$191	$58,256,201	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C	CW-F13A	7,199,787	TON	$111	$797,420,184	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-F14	60	AC	$1,070,827	$64,249,620	
Sand Placement for Technology Assignments	CW-F15	1,119,996	CY	$33.48	$37,494,727	
Beach Mix Placement for Technology Assignments	CW-F16	69,510	CY	$72.97	$5,071,863	
Armor Placement for Technology Assignments	CW-F17	151,909	CY	$71.97	$10,932,677	
Reactive/GAC Placement for Technology Assignments	CW-F18	1	LS	$58,294,110	$58,294,110	
Geofabric for Riverbanks	CW-F19	25.4	AC	$14,311	$363,505	
Organoclay Mat Placement for Technology Assignments	CW-F20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,253,949,652	
Contingency (Scope and Bid)		20%			$250,789,930	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$1,504,739,582	
Project Management		2%			$30,094,792	Percentage modified as documented in Attachment A
Remedial Design		2%			$30,094,792	Percentage modified as documented in Attachment A
Construction Management		3%			$45,142,187	Percentage modified as documented in Attachment A
TOTAL					$1,610,071,353	
TOTAL CAPITAL COST					**$1,610,071,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 12) - 15% More Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-F1	1	LS	$19,821,000	$19,821,000	
Transload Facility Development	CW-F21	1	LS	$15,651,213	$15,651,213	
Debris Removal and Disposal	CW-F5	534	AC	$13,107	$6,999,143	
Obstruction Removal and Relocation	CW-F6	1	LS	$20,718,583	$20,718,583	
Erosion/Residual Control Measures	CW-F7	1	LS	$27,166,335	$27,166,335	
Dredging of Contaminated Sediments (Open Water)	CW-F8	4,339,288	CY	$24.53	$106,442,735	
Dredging of Contaminated Sediments (Confined)	CW-F9	123,286	CY	$31.10	$3,834,195	
Excavation of Riverbanks	CW-F10	122,827	CY	$5.19	$637,472	
Dewatering and Water Treatment for Dredging Operations	CW-F11	1	LS	$19,423,050	$19,423,050	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C	CW-F12B	412,725	TON	$191	$78,817,704	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C	CW-F13B	7,098,515	TON	$111	$786,203,802	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-F14	60	AC	$1,070,827	$64,249,620	
Sand Placement for Technology Assignments	CW-F15	1,119,996	CY	$33.48	$37,494,727	
Beach Mix Placement for Technology Assignments	CW-F16	69,510	CY	$72.97	$5,071,863	
Armor Placement for Technology Assignments	CW-F17	151,909	CY	$71.97	$10,932,677	
Reactive/GAC Placement for Technology Assignments	CW-F18	1	LS	$58,294,110	$58,294,110	
Geofabric for Riverbanks	CW-F19	25.4	AC	$14,311	$363,505	
Organoclay Mat Placement for Technology Assignments	CW-F20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,263,294,773	
Contingency (Scope and Bid)		20%			$252,658,955	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$1,515,953,728	
Project Management		2%			$30,319,075	Percentage modified as documented in Attachment A
Remedial Design		2%			$30,319,075	Percentage modified as documented in Attachment A
Construction Management		3%			$45,478,612	Percentage modified as documented in Attachment A
TOTAL					$1,622,070,490	
TOTAL CAPITAL COST					**$1,622,070,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	
Site-Wide Monitoring	CW-F23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-F24	1	LS	$31,466,392	$31,466,392	
SUBTOTAL					$38,550,726	
Contingency (Scope and Bid)		20%			$7,710,145	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$46,260,871	
Project Management		2%			$925,217	Percentage modified as documented in Attachment A
Technical Support		5%			$2,313,044	Percentage modified as documented in Attachment A
TOTAL					$49,499,132	
TOTAL PERIODIC COST					**$49,499,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-F25	1	LS	$5,757,416	$5,757,416	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs
SUBTOTAL					$5,757,416	
Contingency (Scope and Bid)		20%			$1,151,483	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,908,899	
Project Management		5%			$345,445	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$690,890	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$7,945,234	
TOTAL PERIODIC COST					**$7,945,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Subtitle C Volume**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-F3	1	LS	$659,296	$659,296	
SUBTOTAL					$659,296	
Contingency (Scope and Bid)		10%			$65,930	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$725,226	
Project Management		5%			$36,261	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$72,523	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$834,010	
TOTAL PERIODIC COST					**$834,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-F26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-G

PRESENT VALUE ANALYSIS

Alternative **G Sensitivity Analysis - Subtitle C Volume (15% Less Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$264,579	$7,428,000	$130,636,421	$0	$0	$0	$0	$138,329,000	1.0000	$138,329,000
1	$264,579	$0	$130,636,421	$0	$0	$0	$0	$130,901,000	0.9346	$122,340,075
2	$264,579	$0	$130,636,421	$0	$63,513,000	$0	$0	$194,414,000	0.8734	$169,801,188
3	$264,579	$0	$130,636,421	$0	$0	$0	$0	$130,901,000	0.8163	$106,854,486
4	$264,579	$0	$130,636,421	$0	$63,513,000	$0	$0	$194,414,000	0.7629	$148,318,441
5	$264,579	$0	$130,636,421	$0	$0	$11,856,000	$308,000	$143,065,000	0.7130	$102,005,345
6	$264,579	$0	$130,636,421	$0	$63,513,000	$0	$0	$194,414,000	0.6663	$129,538,048
7	$264,579	$0	$130,636,421	$0	$0	$0	$0	$130,901,000	0.6227	$81,512,053
8	$264,579	$0	$130,636,421	$0	$63,513,000	$0	$0	$194,414,000	0.5820	$113,148,948
9	$264,579	$0	$130,636,421	$0	$0	$0	$0	$130,901,000	0.5439	$71,197,054
10	$264,579	$0	$130,636,421	$0	$63,513,000	$11,856,000	$308,000	$206,578,000	0.5083	$105,003,597
11	$264,579	$0	$130,636,421	$0	$0	$0	$0	$130,901,000	0.4751	$62,191,065
12	$264,579	$0	$130,636,421	$0	$0	$0	$0	$130,901,000	0.4440	$58,120,044
13	$264,579	$0	$130,636,421	$0	$0	$0	$0	$130,901,000	0.4150	$54,323,915
14	$264,579	$0	$130,636,421	$0	$63,513,000	$0	$0	$194,414,000	0.3878	$75,393,749
15	$264,579	$0	$130,636,421	$0	$0	$11,856,000	$308,000	$143,065,000	0.3624	$51,846,756
16	$264,579	$0	$130,636,421	$0	$0	$0	$0	$130,901,000	0.3387	$44,336,169
17	$264,579	$0	$130,636,421	$0	$0	$0	$0	$130,901,000	0.3166	$41,443,257
18	$264,579	$0	$130,636,421	$0	$63,513,000	$0	$0	$194,414,000	0.2959	$57,527,103
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.2584	$3,143,178
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.2257	$14,334,884
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.1842	$2,240,609
26	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.1722	$10,936,939
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.1314	$9,943,958
TOTALS:	$5,027,000	$7,428,000	$2,482,092,000	$0	$635,130,000	$71,136,000	$1,848,000	$3,202,661,000		$1,773,829,861
TOTAL PRESENT VALUE OF ALTERNATIVE G[5]										**$1,773,830,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-G.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-G

PRESENT VALUE ANALYSIS

Alternative G Sensitivity Analysis - Subtitle C Volume (15% More Volume to Subtitle C)

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$264,579	$7,428,000	$131,267,947	$0	$0	$0	$0	$138,960,526	1.0000	$138,960,526
1	$264,579	$0	$131,267,947	$0	$0	$0	$0	$131,532,526	0.9346	$122,930,299
2	$264,579	$0	$131,267,947	$0	$63,513,000	$0	$0	$195,045,526	0.8734	$170,352,762
3	$264,579	$0	$131,267,947	$0	$0	$0	$0	$131,532,526	0.8163	$107,370,001
4	$264,579	$0	$131,267,947	$0	$63,513,000	$0	$0	$195,045,526	0.7629	$148,800,232
5	$264,579	$0	$131,267,947	$0	$0	$11,856,000	$308,000	$143,696,526	0.7130	$102,455,623
6	$264,579	$0	$131,267,947	$0	$63,513,000	$0	$0	$195,045,526	0.6663	$129,958,834
7	$264,579	$0	$131,267,947	$0	$0	$0	$0	$131,532,526	0.6227	$81,905,304
8	$264,579	$0	$131,267,947	$0	$63,513,000	$0	$0	$195,045,526	0.5820	$113,516,496
9	$264,579	$0	$131,267,947	$0	$0	$0	$0	$131,532,526	0.5439	$71,540,541
10	$264,579	$0	$131,267,947	$0	$63,513,000	$11,856,000	$308,000	$207,209,526	0.5083	$105,324,602
11	$264,579	$0	$131,267,947	$0	$0	$0	$0	$131,532,526	0.4751	$62,491,103
12	$264,579	$0	$131,267,947	$0	$0	$0	$0	$131,532,526	0.4440	$58,400,442
13	$264,579	$0	$131,267,947	$0	$0	$0	$0	$131,532,526	0.4150	$54,585,998
14	$264,579	$0	$131,267,947	$0	$63,513,000	$0	$0	$195,045,526	0.3878	$75,638,655
15	$264,579	$0	$131,267,947	$0	$0	$11,856,000	$308,000	$143,696,526	0.3624	$52,075,621
16	$264,579	$0	$131,267,947	$0	$0	$0	$0	$131,532,526	0.3387	$44,550,067
17	$264,579	$0	$131,267,947	$0	$0	$0	$0	$131,532,526	0.3166	$41,643,198
18	$264,579	$0	$131,267,947	$0	$63,513,000	$0	$0	$195,045,526	0.2959	$57,713,971
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.2584	$3,143,178
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.2257	$14,334,884
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.1842	$2,240,609
26	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.1722	$10,936,939
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.1314	$9,943,958
TOTALS:	$5,027,000	$7,428,000	$2,494,091,000	$0	$635,130,000	$71,136,000	$1,848,000	$3,214,660,000		$1,780,813,843
TOTAL PRESENT VALUE OF ALTERNATIVE G[5]										**$1,780,810,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-G.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-G

Alternative G Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 18)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-G2	1	LS	$4,084,988	$4,084,988	
SUBTOTAL					$4,084,988	
Contingency (Scope and Bid)		15%			$612,748	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$4,697,736	
Project Management		2%			$93,955	Percentage modified as documented in Attachment A
Remedial Design		2%			$93,955	Percentage modified as documented in Attachment A
Construction Management		3%			$140,932	Percentage modified as documented in Attachment A
TOTAL					$5,026,578	
TOTAL CAPITAL COST					**$5,027,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$5,201,407	
Contingency (Scope and Bid)		20%			$1,040,281	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,241,688	
Project Management		5%			$312,084	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$499,335	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$374,501	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$7,427,608	
TOTAL CAPITAL COST					**$7,428,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 18) - 15% Less Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-G1	1	LS	$30,516,000	$30,516,000	
Transload Facility Development	CW-G21	1	LS	$20,773,428	$20,773,428	
Debris Removal and Disposal	CW-G5	776	AC	$13,107	$10,171,040	
Obstruction Removal and Relocation	CW-G6	1	LS	$22,638,241	$22,638,241	
Erosion/Residual Control Measures	CW-G7	1	LS	$28,135,555	$28,135,555	
Dredging of Contaminated Sediments (Open Water)	CW-G8	7,110,364	CY	$24.53	$174,417,229	
Dredging of Contaminated Sediments (Confined)	CW-G9	147,293	CY	$31.10	$4,580,812	
Excavation of Riverbanks	CW-G10	138,942	CY	$5.19	$721,107	
Dewatering and Water Treatment for Dredging Operations	CW-G11	1	LS	$31,511,207	$31,511,207	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C	CW-G12A	305,057	TON	$191	$58,256,201	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C	CW-G13A	11,778,158	TON	$111	$1,304,502,683	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-G14	86	AC	$1,070,827	$92,091,122	
Sand Placement for Technology Assignments	CW-G15	1,634,210	CY	$33.23	$54,304,680	
Beach Mix Placement for Technology Assignments	CW-G16	90,647	CY	$72.65	$6,585,212	
Armor Placement for Technology Assignments	CW-G17	245,586	CY	$71.57	$17,577,027	
Reactive/GAC Placement for Technology Assignments	CW-G18	1	LS	$74,728,183	$74,728,183	
Geofabric for Riverbanks	CW-G19	28.7	AC	$14,311	$410,732	
Organoclay Mat Placement for Technology Assignments	CW-G20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,933,093,498	
Contingency (Scope and Bid)		20%			$386,618,700	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,319,712,198	
Project Management		2%			$46,394,244	Percentage modified as documented in Attachment A
Remedial Design		2%			$46,394,244	Percentage modified as documented in Attachment A
Construction Management		3%			$69,591,366	Percentage modified as documented in Attachment A
TOTAL					$2,482,092,052	
TOTAL CAPITAL COST					**$2,482,092,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 18) - 15% More Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-G1	1	LS	$30,516,000	$30,516,000	
Transload Facility Development	CW-G21	1	LS	$20,773,428	$20,773,428	
Debris Removal and Disposal	CW-G5	776	AC	$13,107	$10,171,040	
Obstruction Removal and Relocation	CW-G6	1	LS	$22,638,241	$22,638,241	
Erosion/Residual Control Measures	CW-G7	1	LS	$28,135,555	$28,135,555	
Dredging of Contaminated Sediments (Open Water)	CW-G8	7,110,364	CY	$24.53	$174,417,229	
Dredging of Contaminated Sediments (Confined)	CW-G9	147,293	CY	$31.10	$4,580,812	
Excavation of Riverbanks	CW-G10	138,942	CY	$5.19	$721,107	
Dewatering and Water Treatment for Dredging Operations	CW-G11	1	LS	$31,511,207	$31,511,207	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C	CW-G12B	412,725	TON	$191	$78,817,704	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C	CW-G13B	11,676,885	TON	$111	$1,293,285,966	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-G14	86	AC	$1,070,827	$92,091,122	
Sand Placement for Technology Assignments	CW-G15	1,634,210	CY	$33.23	$54,304,680	
Beach Mix Placement for Technology Assignments	CW-G16	90,647	CY	$72.65	$6,585,212	
Armor Placement for Technology Assignments	CW-G17	245,586	CY	$71.57	$17,577,027	
Reactive/GAC Placement for Technology Assignments	CW-G18	1	LS	$74,728,183	$74,728,183	
Geofabric for Riverbanks	CW-G19	28.7	AC	$14,311	$410,732	
Organoclay Mat Placement for Technology Assignments	CW-G20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,942,438,284	
Contingency (Scope and Bid)		20%			$388,487,657	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,330,925,941	
Project Management		2%			$46,618,519	Percentage modified as documented in Attachment A
Remedial Design		2%			$46,618,519	Percentage modified as documented in Attachment A
Construction Management		3%			$69,927,778	Percentage modified as documented in Attachment A
TOTAL					$2,494,090,757	
TOTAL CAPITAL COST					**$2,494,091,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-G23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-G24	1	LS	$43,306,076	$43,306,076	
SUBTOTAL					$49,465,142	
Contingency (Scope and Bid)		20%			$9,893,028	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$59,358,170	
Project Management		2%			$1,187,163	Percentage modified as documented in Attachment A
Technical Support		5%			$2,967,909	Percentage modified as documented in Attachment A
TOTAL					$63,513,242	
TOTAL PERIODIC COST					**$63,513,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-G25	1	LS	$7,862,382	$7,862,382	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$7,862,382	
Contingency (Scope and Bid)		20%			$1,572,476	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,434,858	
Project Management		5%			$471,743	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$943,486	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$10,850,087	
TOTAL PERIODIC COST					**$10,850,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-G3	1	LS	$795,634	$795,634	
SUBTOTAL					$795,634	
Contingency (Scope and Bid)		10%			$79,563	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$875,197	
Project Management		5%			$43,760	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$87,520	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$1,006,477	
TOTAL PERIODIC COST					**$1,006,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-G26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-I

PRESENT VALUE ANALYSIS

Alternative **I Sensitivity Analysis - Subtitle C Volume (15% Less Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$532,286	$10,197,000	$104,547,143	$0	$0	$0	$0	$115,276,429	1.0000	$115,276,429
1	$532,286	$0	$104,547,143	$0	$0	$0	$0	$105,079,429	0.9346	$98,207,234
2	$532,286	$0	$104,547,143	$0	$38,426,000	$0	$0	$143,505,429	0.8734	$125,337,642
3	$532,286	$0	$104,547,143	$0	$0	$0	$0	$105,079,429	0.8163	$85,776,338
4	$532,286	$0	$104,547,143	$0	$38,426,000	$0	$0	$143,505,429	0.7629	$109,480,292
5	$532,286	$0	$104,547,143	$0	$0	$5,972,000	$308,000	$111,359,429	0.7130	$79,399,273
6	$532,286	$0	$104,547,143	$0	$38,426,000	$0	$0	$143,505,429	0.6663	$95,617,667
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.5820	$22,363,932
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.5083	$22,724,060
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.3878	$14,901,603
15	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.3624	$2,275,872
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2959	$11,370,253
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.2584	$1,622,752
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2257	$8,672,748
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.1842	$1,156,776
26	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.1722	$6,616,957
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.1314	$5,874,368
TOTALS:	$3,726,000	$10,197,000	$731,830,000	$0	$384,260,000	$35,832,000	$1,848,000	$1,167,693,000		$806,674,196
TOTAL PRESENT VALUE OF ALTERNATIVE I[5]										**$806,670,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-I.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-I

PRESENT VALUE ANALYSIS

Alternative **I Sensitivity Analysis - Subtitle C Volume (15% More Volume to Subtitle C)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$532,286	$10,197,000	$106,149,143	$0	$0	$0	$0	$116,878,429	1.0000	$116,878,429
1	$532,286	$0	$106,149,143	$0	$0	$0	$0	$106,681,429	0.9346	$99,704,464
2	$532,286	$0	$106,149,143	$0	$38,426,000	$0	$0	$145,107,429	0.8734	$126,736,828
3	$532,286	$0	$106,149,143	$0	$0	$0	$0	$106,681,429	0.8163	$87,084,050
4	$532,286	$0	$106,149,143	$0	$38,426,000	$0	$0	$145,107,429	0.7629	$110,702,458
5	$532,286	$0	$106,149,143	$0	$0	$5,972,000	$308,000	$112,961,429	0.7130	$80,541,499
6	$532,286	$0	$106,149,143	$0	$38,426,000	$0	$0	$145,107,429	0.6663	$96,685,080
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.5820	$22,363,932
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.5083	$22,724,060
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.3878	$14,901,603
15	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.3624	$2,275,872
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2959	$11,370,253
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.2584	$1,622,752
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2257	$8,672,748
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.1842	$1,156,776
26	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.1722	$6,616,957
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.1314	$5,874,368
TOTALS:	$3,726,000	$10,197,000	$743,044,000	$0	$384,260,000	$35,832,000	$1,848,000	$1,178,907,000		$815,912,129
TOTAL PRESENT VALUE OF ALTERNATIVE I[5]										**$815,910,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-I.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-I

Alternative I Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-I2	1	LS	$3,028,033	$3,028,033	
SUBTOTAL					$3,028,033	
Contingency (Scope and Bid)		15%			$454,205	10% Scope, 5% Bid as documented in Attachment A.
SUBTOTAL					$3,482,238	
Project Management		2%			$69,645	Percentage modified as documented in Attachment A.
Remedial Design		2%			$69,645	Percentage modified as documented in Attachment A.
Construction Management		3%			$104,467	Percentage modified as documented in Attachment A.
TOTAL					$3,725,995	
TOTAL CAPITAL COST					**$3,726,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,140,415	
Contingency (Scope and Bid)		20%			$1,428,083	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,568,498	
Project Management		5%			$428,425	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$685,480	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$514,110	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,196,513	
TOTAL CAPITAL COST					**$10,197,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6) - 15% Less Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-I1	1	LS	$9,045,000	$9,045,000	
Transload Facility Development	CW-I21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-I5	292	AC	$13,107	$3,827,247	
Obstruction Removal and Relocation	CW-I6	1	LS	$15,146,379	$15,146,379	
Erosion/Residual Control Measures	CW-I7	1	LS	$25,227,895	$25,227,895	
Dredging of Contaminated Sediments (Open Water)	CW-I8	1,556,599	CY	$24.53	$38,183,373	
Dredging of Contaminated Sediments (Confined)	CW-I9	93,151	CY	$31.10	$2,896,996	
Excavation of Riverbanks	CW-I10	102,624	CY	$5.19	$532,618	
Dewatering and Water Treatment for Dredging Operations	CW-I11	1	LS	$7,261,269	$7,261,269	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C	CW-I12A	305,057	TON	$191	$58,256,201	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C	CW-I13A	2,585,088	TON	$111	$286,314,121	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-I14	34	AC	$1,070,827	$36,408,118	
Sand Placement for Technology Assignments	CW-I15	598,578	CY	$34.00	$20,353,254	
Beach Mix Placement for Technology Assignments	CW-I16	49,511	CY	$73.43	$3,635,422	
Armor Placement for Technology Assignments	CW-I17	80,297	CY	$72.27	$5,802,915	
Reactive/GAC Placement for Technology Assignments	CW-I18	1	LS	$44,759,377	$44,759,377	
Geofabric for Riverbanks	CW-I19	21.2	AC	$14,311	$303,398	
Organoclay Mat Placement for Technology Assignments	CW-I20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$569,655,620	
Contingency (Scope and Bid)		20%			$113,931,124	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$683,586,744	
Project Management		2%			$13,783,852	Percentage modified as documented in Attachment A.
Remedial Design		2%			$13,783,852	Percentage modified as documented in Attachment A.
Construction Management		3%			$20,675,777	Percentage modified as documented in Attachment A.
TOTAL					$731,830,225	
TOTAL CAPITAL COST					**$731,830,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6) - 15% More Volume to Subtitle C

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-I1	1	LS	$9,045,000	$9,045,000	
Transload Facility Development	CW-I21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-I5	292	AC	$13,107	$3,827,247	
Obstruction Removal and Relocation	CW-I6	1	LS	$15,146,379	$15,146,379	
Erosion/Residual Control Measures	CW-I7	1	LS	$25,227,895	$25,227,895	
Dredging of Contaminated Sediments (Open Water)	CW-I8	1,556,599	CY	$24.53	$38,183,373	
Dredging of Contaminated Sediments (Confined)	CW-I9	93,151	CY	$31.10	$2,896,996	
Excavation of Riverbanks	CW-I10	102,624	CY	$5.19	$532,618	
Dewatering and Water Treatment for Dredging Operations	CW-I11	1	LS	$7,261,269	$7,261,269	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C	CW-I12B	412,725	TON	$191	$78,817,704	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C	CW-I13B	2,483,816	TON	$111	$275,097,739	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-I14	34	AC	$1,070,827	$36,408,118	
Sand Placement for Technology Assignments	CW-I15	598,578	CY	$34.00	$20,353,254	
Beach Mix Placement for Technology Assignments	CW-I16	49,511	CY	$73.43	$3,635,422	
Armor Placement for Technology Assignments	CW-I17	80,297	CY	$72.27	$5,802,915	
Reactive/GAC Placement for Technology Assignments	CW-I18	1	LS	$44,759,377	$44,759,377	
Geofabric for Riverbanks	CW-I19	21.2	AC	$14,311	$303,398	
Organoclay Mat Placement for Technology Assignments	CW-I20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$579,000,741	
Contingency (Scope and Bid)		20%			$115,800,148	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$694,800,889	
Project Management		2%			$13,783,852	Percentage modified as documented in Attachment A.
Remedial Design		2%			$13,783,852	Percentage modified as documented in Attachment A.
Construction Management		3%			$20,675,777	Percentage modified as documented in Attachment A.
TOTAL					$743,044,370	
TOTAL CAPITAL COST					**$743,044,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-I23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-I24	1	LS	$21,828,717	$21,828,717	
SUBTOTAL					$29,926,791	
Contingency (Scope and Bid)		20%			$5,985,358	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,912,149	
Project Management		2%			$718,243	Percentage modified as documented in Attachment A.
Technical Support		5%			$1,795,607	Percentage modified as documented in Attachment A.
TOTAL					$38,425,999	
TOTAL PERIODIC COST					**$38,426,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-I25	1	LS	$3,862,654	$3,862,654	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,862,654	
Contingency (Scope and Bid)		20%			$772,531	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,635,185	
Project Management		5%			$231,759	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,519	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,330,463	
TOTAL PERIODIC COST					**$5,330,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Subtitle C Volume

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-I3	1	LS	$507,467	$507,467	
SUBTOTAL					$507,467	
Contingency (Scope and Bid)		10%			$50,747	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$558,214	
Project Management		5%			$27,911	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,821	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$641,946	
TOTAL PERIODIC COST					**$642,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-I26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

Sensitivity Analysis

Cost Worksheets
Subtitle C Disposal Volume Scenarios

Note: Cost Worksheets presented herein are specific to the Subtitle C Disposal Volume Sensitivity Analysis Scenarios. All other Cost Worksheets are the same as the Cost Worksheets created for the base estimate, and can be found in Appendix G.

TABLE CW-B12A

Alternative B **Cost Worksheet: CW-B12A**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,535,063.78	0%	0%	$2,535,064	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,099,236.10	0%	0%	$3,099,236	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,800,155.10	0%	0%	$1,800,155	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$497,362.44	0%	0%	$497,362	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,546,783.50	0%	0%	$4,546,784	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,757	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,139,596.58	0%	0%	$1,139,597	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,547,716.00	5%	0%	$3,725,102	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$84,759.24	0%	0%	$84,759	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**240,729**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$20,748,432.51	1%	0%	$20,955,917	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$773,688.74	0%	0%	$773,689	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$945,871.30	0%	0%	$945,871	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$549,398.30	0%	0%	$549,398	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$151,792.52	0%	0%	$151,793	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,387,655.50	0%	0%	$1,387,656	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,845	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$513,279.30	0%	0%	$513,279	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$319,782.00	5%	0%	$335,771	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,639.98	0%	0%	$7,640	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,404,910.60	1%	0%	$3,438,960	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,107,220.60	1%	0%	$6,168,293	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,328**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,544,430.32	1%	0%	$5,599,875	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$58,256,201		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	305,057	TON	$58,256,201	$191

TABLE CW-B12A

Alternative B **Cost Worksheet: CW-B12A**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B13A

Alternative B **Cost Worksheet: CW-B13A**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	593,786	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$14,547,757.00	0%	0%	$14,547,757	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	35,451	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$3,755,678.94	0%	0%	$3,755,679	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	593,786	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$8,111,116.76	0%	0%	$8,111,117	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**744,477**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$55,485,870.81	1%	0%	$56,040,730	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
												TOTAL COST:			$82,455,283		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	744,477	TON	$82,455,283	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B12B

Alternative B **Cost Worksheet: CW-B12B**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:

This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:

Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,429,807.44	0%	0%	$3,429,807	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,193,102.80	0%	0%	$4,193,103	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,435,514.80	0%	0%	$2,435,515	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$672,905.12	0%	0%	$672,905	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,151,558.00	0%	0%	$6,151,558	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,554	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,541,850.76	0%	0%	$1,541,851	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,799,837.00	5%	0%	$5,039,829	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$114,673.93	0%	0%	$114,674	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**325,692**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$28,071,393.48	1%	0%	$28,352,107	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,046,765.80	0%	0%	$1,046,766	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,279,721.00	0%	0%	$1,279,721	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$743,311.00	0%	0%	$743,311	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$205,368.40	0%	0%	$205,368	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,877,435.00	0%	0%	$1,877,435	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,555	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$694,436.70	0%	0%	$694,437	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$432,351.00	5%	0%	$453,969	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,329.39	0%	0%	$10,329	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,606,850.43	1%	0%	$4,652,919	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,263,080.93	1%	0%	$8,345,712	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**87,033**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,501,374.27	1%	0%	$7,576,388	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
													TOTAL COST:		$78,817,704		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	412,725	TON	$78,817,704	$191

TABLE CW-B12B

Alternative B **Cost Worksheet: CW-B12B**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B13B

Alternative B **Cost Worksheet: CW-B13B**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	513,014	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$12,568,843.00	0%	0%	$12,568,843	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	30,629	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$3,244,836.26	0%	0%	$3,244,836	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	513,014	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$7,007,771.24	0%	0%	$7,007,771	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**643,205**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$47,938,068.65	1%	0%	$48,417,449	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
												TOTAL COST:			$71,238,899		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	643,205	TON	$71,238,899	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D12A

Alternative D **Cost Worksheet: CW-D12A**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,535,063.78	0%	0%	$2,535,064	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,099,236.10	0%	0%	$3,099,236	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,800,155.10	0%	0%	$1,800,155	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$497,362.44	0%	0%	$497,362	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,546,783.50	0%	0%	$4,546,784	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,757	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,139,596.58	0%	0%	$1,139,597	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,547,716.00	5%	0%	$3,725,102	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$84,759.24	0%	0%	$84,759	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**240,729**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$20,748,432.51	1%	0%	$20,955,917	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$773,688.74	0%	0%	$773,689	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$945,871.30	0%	0%	$945,871	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$549,398.30	0%	0%	$549,398	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$151,792.52	0%	0%	$151,793	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,387,655.50	0%	0%	$1,387,656	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,845	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$513,279.30	0%	0%	$513,279	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$319,782.00	5%	0%	$335,771	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,639.98	0%	0%	$7,640	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,404,910.60	1%	0%	$3,438,960	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,107,220.60	1%	0%	$6,168,293	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,328**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,544,430.32	1%	0%	$5,599,875	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$58,256,201		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	305,057	TON	$58,256,201	$191

TABLE CW-D12A

Alternative D **Cost Worksheet: CW-D12A**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D13A

Alternative D **Cost Worksheet: CW-D13A**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	1,315,878	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$32,239,011.00	0%	0%	$32,239,011	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	78,563	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$8,322,964.22	0%	0%	$8,322,964	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	1,315,878	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$17,974,893.48	0%	0%	$17,974,893	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**1,649,817**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$122,960,861.01	1%	0%	$124,190,470	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$182,727,338		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1,649,817	TON	$182,727,338	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D12B

Alternative D **Cost Worksheet: CW-D12B**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,429,807.44	0%	0%	$3,429,807	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,193,102.80	0%	0%	$4,193,103	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,435,514.80	0%	0%	$2,435,515	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$672,905.12	0%	0%	$672,905	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,151,558.00	0%	0%	$6,151,558	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,554	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,541,850.76	0%	0%	$1,541,851	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,799,837.00	5%	0%	$5,039,829	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$114,673.93	0%	0%	$114,674	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**325,692**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$28,071,393.48	1%	0%	$28,352,107	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,046,765.80	0%	0%	$1,046,766	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,279,721.00	0%	0%	$1,279,721	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$743,311.00	0%	0%	$743,311	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$205,368.40	0%	0%	$205,368	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,877,435.00	0%	0%	$1,877,435	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,555	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$694,436.70	0%	0%	$694,437	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$432,351.00	5%	0%	$453,969	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,329.39	0%	0%	$10,329	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,606,850.43	1%	0%	$4,652,919	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,263,080.93	1%	0%	$8,345,712	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**87,033**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,501,374.27	1%	0%	$7,576,388	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$78,817,704		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	412,725	TON	$78,817,704	$191

TABLE CW-D12B

Alternative D **Cost Worksheet: CW-D12B**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D13B

Alternative D **Cost Worksheet: CW-D13B**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	1,235,102	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$30,259,999.00	0%	0%	$30,259,999	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	73,740	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$7,812,015.60	0%	0%	$7,812,016	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	1,235,102	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$16,871,493.32	0%	0%	$16,871,493	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**1,548,544**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$115,412,984.32	1%	0%	$116,567,114	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$171,510,622		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1,548,544	TON	$171,510,622	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E12A

Alternative E **Cost Worksheet: CW-E12A**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,535,063.78	0%	0%	$2,535,064	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,099,236.10	0%	0%	$3,099,236	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,800,155.10	0%	0%	$1,800,155	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$497,362.44	0%	0%	$497,362	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,546,783.50	0%	0%	$4,546,784	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,757	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,139,596.58	0%	0%	$1,139,597	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,547,716.00	5%	0%	$3,725,102	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$84,759.24	0%	0%	$84,759	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**240,729**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$20,748,432.51	1%	0%	$20,955,917	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$773,688.74	0%	0%	$773,689	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$945,871.30	0%	0%	$945,871	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$549,398.30	0%	0%	$549,398	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$151,792.52	0%	0%	$151,793	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,387,655.50	0%	0%	$1,387,656	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,845	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$513,279.30	0%	0%	$513,279	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$319,782.00	5%	0%	$335,771	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,639.98	0%	0%	$7,640	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,404,910.60	1%	0%	$3,438,960	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,107,220.60	1%	0%	$6,168,293	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,328**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,544,430.32	1%	0%	$5,599,875	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$58,256,201		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	305,057	TON	$58,256,201	$191

TABLE CW-E12A

Alternative E **Cost Worksheet: CW-E12A**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E13A

Alternative E **Cost Worksheet: CW-E13A**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	2,413,703	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$59,135,723.50	0%	0%	$59,135,724	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	144,107	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$15,266,695.58	0%	0%	$15,266,696	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	2,413,703	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$32,971,182.98	0%	0%	$32,971,183	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**3,026,247**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$225,546,188.91	1%	0%	$227,801,651	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
														TOTAL COST:	$335,175,254		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	3,026,247	TON	$335,175,254	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E12B

Alternative E **Cost Worksheet: CW-E12B**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,429,807.44	0%	0%	$3,429,807	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,193,102.80	0%	0%	$4,193,103	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,435,514.80	0%	0%	$2,435,515	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$672,905.12	0%	0%	$672,905	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,151,558.00	0%	0%	$6,151,558	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,554	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,541,850.76	0%	0%	$1,541,851	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,799,837.00	5%	0%	$5,039,829	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$114,673.93	0%	0%	$114,674	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**325,692**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$28,071,393.48	1%	0%	$28,352,107	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,046,765.80	0%	0%	$1,046,766	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,279,721.00	0%	0%	$1,279,721	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$743,311.00	0%	0%	$743,311	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$205,368.40	0%	0%	$205,368	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,877,435.00	0%	0%	$1,877,435	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,555	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$694,436.70	0%	0%	$694,437	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$432,351.00	5%	0%	$453,969	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,329.39	0%	0%	$10,329	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,606,850.43	1%	0%	$4,652,919	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,263,080.93	1%	0%	$8,345,712	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**87,033**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,501,374.27	1%	0%	$7,576,388	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$78,817,704		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	412,725	TON	$78,817,704	$191

TABLE CW-E12B

Alternative E **Cost Worksheet: CW-E12B**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E13B

Alternative E **Cost Worksheet: CW-E13B**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	2,332,931	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$57,156,809.50	0%	0%	$57,156,810	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	139,285	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$14,755,852.90	0%	0%	$14,755,853	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	2,332,931	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$31,867,837.46	0%	0%	$31,867,837	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**2,924,975**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$217,998,386.75	1%	0%	$220,178,371	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$323,958,871		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	2,924,975	TON	$323,958,871	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F12A

Alternative F **Cost Worksheet: CW-F12A**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,535,063.78	0%	0%	$2,535,064	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,099,236.10	0%	0%	$3,099,236	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,800,155.10	0%	0%	$1,800,155	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$497,362.44	0%	0%	$497,362	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,546,783.50	0%	0%	$4,546,784	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,757	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,139,596.58	0%	0%	$1,139,597	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,547,716.00	5%	0%	$3,725,102	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$84,759.24	0%	0%	$84,759	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**240,729**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$20,748,432.51	1%	0%	$20,955,917	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$773,688.74	0%	0%	$773,689	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$945,871.30	0%	0%	$945,871	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$549,398.30	0%	0%	$549,398	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$151,792.52	0%	0%	$151,793	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,387,655.50	0%	0%	$1,387,656	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,845	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$513,279.30	0%	0%	$513,279	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$319,782.00	5%	0%	$335,771	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,639.98	0%	0%	$7,640	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,404,910.60	1%	0%	$3,438,960	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,107,220.60	1%	0%	$6,168,293	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,328**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,544,430.32	1%	0%	$5,599,875	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$58,256,201		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	305,057	TON	$58,256,201	$191

TABLE CW-F12A

Alternative F **Cost Worksheet: CW-F12A**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F13A

Alternative F **Cost Worksheet: CW-F13A**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	5,742,475	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$140,690,637.50	0%	0%	$140,690,638	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	342,847	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$36,321,211.18	0%	0%	$36,321,211	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	5,742,475	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$78,442,208.50	0%	0%	$78,442,209	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**7,199,787**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$536,600,125.11	1%	0%	$541,966,126	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$797,420,184		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	7,199,787	TON	$797,420,184	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F12B

Alternative F **Cost Worksheet: CW-F12B**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,429,807.44	0%	0%	$3,429,807	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,193,102.80	0%	0%	$4,193,103	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,435,514.80	0%	0%	$2,435,515	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$672,905.12	0%	0%	$672,905	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,151,558.00	0%	0%	$6,151,558	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,554	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,541,850.76	0%	0%	$1,541,851	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,799,837.00	5%	0%	$5,039,829	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$114,673.93	0%	0%	$114,674	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**325,692**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$28,071,393.48	1%	0%	$28,352,107	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,046,765.80	0%	0%	$1,046,766	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,279,721.00	0%	0%	$1,279,721	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$743,311.00	0%	0%	$743,311	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$205,368.40	0%	0%	$205,368	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,877,435.00	0%	0%	$1,877,435	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,555	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$694,436.70	0%	0%	$694,437	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$432,351.00	5%	0%	$453,969	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,329.39	0%	0%	$10,329	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,606,850.43	1%	0%	$4,652,919	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,263,080.93	1%	0%	$8,345,712	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**87,033**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,501,374.27	1%	0%	$7,576,388	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$78,817,704		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	412,725	TON	$78,817,704	$191

TABLE CW-F12B

Alternative F **Cost Worksheet: CW-F12B**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F13B

Alternative F **Cost Worksheet: CW-F13B**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	5,661,703	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$138,711,723.50	0%	0%	$138,711,724	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	338,025	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$35,810,368.50	0%	0%	$35,810,369	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	5,661,703	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$77,338,862.98	0%	0%	$77,338,863	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**7,098,515**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$529,052,322.95	1%	0%	$534,342,846	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
														TOTAL COST:	$786,203,802		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	7,098,515	TON	$786,203,802	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G12A

Alternative G **Cost Worksheet: CW-G12A**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,535,063.78	0%	0%	$2,535,064	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,099,236.10	0%	0%	$3,099,236	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,800,155.10	0%	0%	$1,800,155	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$497,362.44	0%	0%	$497,362	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,546,783.50	0%	0%	$4,546,784	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,757	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,139,596.58	0%	0%	$1,139,597	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,547,716.00	5%	0%	$3,725,102	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$84,759.24	0%	0%	$84,759	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**240,729**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$20,748,432.51	1%	0%	$20,955,917	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$773,688.74	0%	0%	$773,689	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$945,871.30	0%	0%	$945,871	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$549,398.30	0%	0%	$549,398	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$151,792.52	0%	0%	$151,793	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,387,655.50	0%	0%	$1,387,656	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,845	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$513,279.30	0%	0%	$513,279	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$319,782.00	5%	0%	$335,771	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,639.98	0%	0%	$7,640	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,404,910.60	1%	0%	$3,438,960	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,107,220.60	1%	0%	$6,168,293	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,328**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,544,430.32	1%	0%	$5,599,875	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$58,256,201		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	305,057	TON	$58,256,201	$191

TABLE CW-G12A

Alternative G **Cost Worksheet: CW-G12A**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G13A

Alternative G **Cost Worksheet:** **CW-G13A**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	9,394,137	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$230,156,356.50	0%	0%	$230,156,357	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	560,865	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$59,418,038.10	0%	0%	$59,418,038	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	9,394,137	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$128,323,911.42	0%	0%	$128,323,911	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**11,778,158**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$877,826,115.74	1%	0%	$886,604,377	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$1,304,502,683		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	11,778,158	TON	$1,304,502,683	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G12B

Alternative G **Cost Worksheet: CW-G12B**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,429,807.44	0%	0%	$3,429,807	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,193,102.80	0%	0%	$4,193,103	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,435,514.80	0%	0%	$2,435,515	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$672,905.12	0%	0%	$672,905	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,151,558.00	0%	0%	$6,151,558	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,554	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,541,850.76	0%	0%	$1,541,851	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,799,837.00	5%	0%	$5,039,829	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$114,673.93	0%	0%	$114,674	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**325,692**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$28,071,393.48	1%	0%	$28,352,107	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,046,765.80	0%	0%	$1,046,766	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,279,721.00	0%	0%	$1,279,721	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$743,311.00	0%	0%	$743,311	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$205,368.40	0%	0%	$205,368	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,877,435.00	0%	0%	$1,877,435	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,555	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$694,436.70	0%	0%	$694,437	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$432,351.00	5%	0%	$453,969	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,329.39	0%	0%	$10,329	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,606,850.43	1%	0%	$4,652,919	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,263,080.93	1%	0%	$8,345,712	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**87,033**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,501,374.27	1%	0%	$7,576,388	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$78,817,704		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	412,725	TON	$78,817,704	$191

TABLE CW-G12B

Alternative G **Cost Worksheet: CW-G12B**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G13B

Alternative G **Cost Worksheet:** **CW-G13B**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	9,313,361	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$228,177,344.50	0%	0%	$228,177,345	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	556,042	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$58,907,089.48	0%	0%	$58,907,089	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	9,313,361	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$127,220,511.26	0%	0%	$127,220,511	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**11,676,885**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$870,278,239.05	1%	0%	$878,981,021	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
														TOTAL COST:	$1,293,285,966		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	11,676,885	TON	$1,293,285,966	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I12A

Alternative I **Cost Worksheet:** **CW-I12A**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,535,063.78	0%	0%	$2,535,064	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,099,236.10	0%	0%	$3,099,236	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,800,155.10	0%	0%	$1,800,155	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$497,362.44	0%	0%	$497,362	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	185,583	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,546,783.50	0%	0%	$4,546,784	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,757	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,139,596.58	0%	0%	$1,139,597	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,547,716.00	5%	0%	$3,725,102	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	14,844	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$84,759.24	0%	0%	$84,759	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**240,729**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$20,748,432.51	1%	0%	$20,955,917	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$773,688.74	0%	0%	$773,689	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$945,871.30	0%	0%	$945,871	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$549,398.30	0%	0%	$549,398	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$151,792.52	0%	0%	$151,793	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	56,639	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,387,655.50	0%	0%	$1,387,656	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,845	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$513,279.30	0%	0%	$513,279	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$319,782.00	5%	0%	$335,771	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,338	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,639.98	0%	0%	$7,640	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,404,910.60	1%	0%	$3,438,960	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,660	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,107,220.60	1%	0%	$6,168,293	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,328**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,544,430.32	1%	0%	$5,599,875	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$58,256,201		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	305,057	TON	$58,256,201	$191

TABLE CW-I12A

Alternative I **Cost Worksheet:** **CW-I12A**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I13A

Alternative I **Cost Worksheet: CW-I13A**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% Less Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	2,061,838	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$50,515,031.00	0%	0%	$50,515,031	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	123,099	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$13,041,108.06	0%	0%	$13,041,108	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	2,061,838	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$28,164,707.08	0%	0%	$28,164,707	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**2,585,088**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$192,666,608.64	1%	0%	$194,593,275	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$286,314,121		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	2,585,088	TON	$286,314,121	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I12B

Alternative I **Cost Worksheet:** **CW-I12B**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,429,807.44	0%	0%	$3,429,807	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,193,102.80	0%	0%	$4,193,103	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,435,514.80	0%	0%	$2,435,515	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$672,905.12	0%	0%	$672,905	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	251,084	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,151,558.00	0%	0%	$6,151,558	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,554	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,541,850.76	0%	0%	$1,541,851	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,799,837.00	5%	0%	$5,039,829	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	20,083	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$114,673.93	0%	0%	$114,674	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**325,692**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$28,071,393.48	1%	0%	$28,352,107	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,046,765.80	0%	0%	$1,046,766	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,279,721.00	0%	0%	$1,279,721	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$743,311.00	0%	0%	$743,311	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$205,368.40	0%	0%	$205,368	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,630	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,877,435.00	0%	0%	$1,877,435	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,555	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$694,436.70	0%	0%	$694,437	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$432,351.00	5%	0%	$453,969	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,809	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,329.39	0%	0%	$10,329	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,606,850.43	1%	0%	$4,652,919	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,423	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,263,080.93	1%	0%	$8,345,712	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**87,033**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,501,374.27	1%	0%	$7,576,388	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$78,817,704		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	412,725	TON	$78,817,704	$191

TABLE CW-I12B

Alternative I **Cost Worksheet:** **CW-I12B**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I13B

Alternative I **Cost Worksheet: CW-I13B**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - 15% More Volume to Subtitle C

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-VOLC-01 through SEN-AN-VOLC-05.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	1,981,066	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$48,536,117.00	0%	0%	$48,536,117	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	118,277	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$12,530,265.38	0%	0%	$12,530,265	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	1,981,066	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$27,061,361.56	0%	0%	$27,061,362	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**2,483,816**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$185,118,806.48	1%	0%	$186,969,995	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
														TOTAL COST:	$275,097,739		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	2,483,816	TON	$275,097,739	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
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Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
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ADJ LABOR	Adjusted Labor for HFP	EA	Each
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UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

Sensitivity Analysis

Calculation Worksheets
Subtitle C Disposal Volume Scenarios

Note: Quantities and calculations presented herein are specific to the Subtitle C Disposal Volume Sensitivity Analysis Scenarios. All other quantities are the same as the quantities for the base estimate, and can be found in Appendix D.

PROJECT:	Portland Harbor FS	COMPUTED BY :	JN
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		WRKSHT NO. :	SEN-AN-VOLC-01

Sensitivity Analysis - Subtitle C Disposal Volume

In this comparison, the current volume assumption for Subtitle C/TSCA disposal was reduced by 15% in one scenario and increased by 15% in the other scenario. Under each scenario, the overall disposal volume was held constant, while the Subtitle C/TSCA volume was adjusted (i.e. when Subtitle C/TSCA volume was reduced by 15% of its total volume, the volume assumed for Subtitle D was increased by that corresponding volume and thus overall volume remained constant).

Percent Increase and Decrease of the Subtitle C Disposal Volume for Sensitivity Analysis: 15%

Quantity Estimate - 15% More Volume to Subtitle C

Quantities presented below represent disposal volume quantities for the 15% More Volume to Subtitle C Scenario for the Sensitivity Analysis. All other quantities for this Scenario will be the same as for the base estimate and can be found in Appendix D.

Quantities for Area 6W NRC/NAPL PTW

Subtitle C Disposal Quantities for Area 6W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Total Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (CY)	187,777	187,777	187,777	187,777	187,777	187,777	187,777	187,777
Total Weight of Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (TON)	291,055	291,055	291,055	291,055	291,055	291,055	291,055	291,055

Ex Situ Treatment Quantities for Area 6W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Weight of Diatomaceous Earth for Stabilization/Solidifcation Sediments (TON)	14,554	14,554	14,554	14,554	14,554	14,554	14,554	14,554
Volume of Diatomaceous Earth for Stabilization/Solidification Sediments (CY)	55,976	55,976	55,976	55,976	55,976	55,976	55,976	55,976
Weight of Quicklime for Amendment (TON)	20,083	20,083	20,083	20,083	20,083	20,083	20,083	20,083
Volume of Quicklime for Amendment (CY)	7,331	7,331	7,331	7,331	7,331	7,331	7,331	7,331
Total Weight of Amended Area 6W NRC/NAPL PTW for Subtitle C Disposal (TON)	325,692	325,692	325,692	325,692	325,692	325,692	325,692	325,692
Total Volume of Amended Area 6W NRC/NAPL PTW for Subtitle C Disposal (CY)	251,084	251,084	251,084	251,084	251,084	251,084	251,084	251,084

Quantities for Area 7W NRC/NAPL PTW

Subtitle C Disposal Quantities for Area 7W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Total Area 7W NRC/NAPL PTW Dredged for Subtitle C Disposal (CY)	50,758	50,758	50,758	50,758	50,758	50,758	50,758	50,758
Total Weight of Area 7W NRC/NAPL PTW Dredged for Subtitle C Disposal (TON)	78,675	78,675	78,675	78,675	78,675	78,675	78,675	78,675

Area 7W NRC/NAPL PTW - 1/3 of Volume - No Treatment Required

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for No Treatment (CY)	16,918	16,918	16,918	16,918	16,918	16,918	16,918	16,918
Weight of Sediments for No Treatment (TON)	26,223	26,223	26,223	26,223	26,223	26,223	26,223	26,223
Weight of Diatomaceous Earth for No Treatment Sediments (TON)	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622
Volume of Diatomaceous Earth for No Treatment Sediments (CY)	10,086	10,086	10,086	10,086	10,086	10,086	10,086	10,086
Total Weight of No Treatment Sediments (with Diatomaceous Earth) (TON)	28,845	28,845	28,845	28,845	28,845	28,845	28,845	28,845
Total Volume of No Treatment Sediments (with Diatomaceous Earth) (CY)	27,004	27,004	27,004	27,004	27,004	27,004	27,004	27,004

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JOB NO.:	79171.3383.345.FSZ
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Quantity Estimate - 15% More Volume to Subtitle C (Continued)

Area 7W NRC/NAPL PTW - 1/3 of Volume - Thermal Treatment at Subtitle C Facility

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for Thermal Treatment (CY)	16,918	16,918	16,918	16,918	16,918	16,918	16,918	16,918
Weight of Sediments for Thermal Treatment (TON)	26,223	26,223	26,223	26,223	26,223	26,223	26,223	26,223
Weight of Diatomaceous Earth for Thermal Treatment Sediments (TON)	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622
Volume of Diatomaceous Earth for Thermal Treatment Sediments (CY)	10,086	10,086	10,086	10,086	10,086	10,086	10,086	10,086
Total Weight of Thermal Treatment Sediments (with Diatomaceous Earth) (TON)	28,845	28,845	28,845	28,845	28,845	28,845	28,845	28,845
Total Volume of Thermal Treatment Sediments (with Diatomaceous Earth) (CY)	27,004	27,004	27,004	27,004	27,004	27,004	27,004	27,004
Weight of Thermal Treatment Sediments for Low End of Thermal Cost Range (TON)	14,423	14,423	14,423	14,423	14,423	14,423	14,423	14,423
Volume of Thermal Treatment Sediments for Low End of Thermal Cost Range (CY)	13,501	13,501	13,501	13,501	13,501	13,501	13,501	13,501
Weight of Thermal Treatment Sediments for High End of Thermal Cost Range (TON)	14,423	14,423	14,423	14,423	14,423	14,423	14,423	14,423
Volume of Thermal Treatment Sediments for High End of Thermal Cost Range (CY)	13,503	13,503	13,503	13,503	13,503	13,503	13,503	13,503

Area 7W NRC/NAPL PTW - 1/3 of Volume - Stabilization/Solidification

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for Stabilization/Solidification Treatment (CY)	16,918	16,918	16,918	16,918	16,918	16,918	16,918	16,918
Weight of Sediments for Stabilization/Solidification Treatment (TON)	26,223	26,223	26,223	26,223	26,223	26,223	26,223	26,223
Weight of Diatomaceous Earth for Stabilization/Solidifcation Sediments (TON)	1,311	1,311	1,311	1,311	1,311	1,311	1,311	1,311
Volume of Diatomaceous Earth for Stabilization/Solidification Sediments (CY)	5,043	5,043	5,043	5,043	5,043	5,043	5,043	5,043
Weight of Quicklime for Stabilization/Solidification Sediments (TON)	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
Volume of Quicklime for Stabilization/Solidification Sediments (CY)	662	662	662	662	662	662	662	662
Total Weight of Quicklime/Diatomaceous Earth Amended Sediments (TON)	29,343	29,343	29,343	29,343	29,343	29,343	29,343	29,343
Total Volume of Quicklime/Diatomaceous Earth Amended Sediments (CY)	22,622	22,622	22,622	22,622	22,622	22,622	22,622	22,622

Summary of Subtitle C Disposal and Ex Situ Treatment Volumes for Area 7W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Weight of Thermal Treatment Sediments for Low End of Thermal Cost Range (TON)	14,423	14,423	14,423	14,423	14,423	14,423	14,423	14,423
Weight of Thermal Treatment Sediments for High End of Thermal Cost Range (TON)	14,423	14,423	14,423	14,423	14,423	14,423	14,423	14,423
Weight of Quicklime for Stabilization/Solidification Sediments (TON)	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
Total Weight of Diatomaceous Earth for 7W PTW Sediments (TON)	6,555	6,555	6,555	6,555	6,555	6,555	6,555	6,555
Total Volume of Diatomaceous Earth for 7W PTW Sediments (CY)	25,215	25,215	25,215	25,215	25,215	25,215	25,215	25,215
Total Weight of Amended Area 7W NRC/NAPL PTW for Subtitle C Disposal (TON)	87,033	87,033	87,033	87,033	87,033	87,033	87,033	87,033
Total Volume of Amended Area 7W NRC/NAPL PTW for Subtitle C Disposal (CY)	76,630	76,630	76,630	76,630	76,630	76,630	76,630	76,630

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Quantity Estimate - 15% More Volume to Subtitle C (Continued)

Subtitle D Disposal

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Dredge Sediments for Subtitle D Disposal (including Riverbanks) (CY)	395,210	517,582	951,486	1,797,219	4,361,606	7,174,737	29,240,154	1,526,154
Weight of Dredge Sediments for Subtitle D Disposal (including Riverbanks) (TON)	612,576	802,253	1,474,804	2,785,690	6,760,490	11,120,843	45,322,239	2,365,539
Diatomaceous Earth Rate for dewatering and material handling (% by weight)	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Weight of Diatomaceous Earth for Subtitle D Materials (TON)	30,629	40,113	73,740	139,285	338,025	556,042	2,266,112	118,277
Volume of Diatomaceous Earth for Subtitle D Materials (CY)	117,804	154,281	283,616	535,712	1,300,097	2,138,624	8,715,816	454,912
Total Weight of Subtitle D Materials (with Diatomaceous Earth) (TON)	643,205	842,366	1,548,544	2,924,975	7,098,515	11,676,885	47,588,351	2,483,816
Total Volume of Subtitle D Materials (with Diatomaceous Earth) (CY)	513,014	671,863	1,235,102	2,332,931	5,661,703	9,313,361	37,955,970	1,981,066

Quantity Estimate - 15% Less Volume to Subtitle C

Quantities presented below represent disposal volume quantities for the 15% Less Volume to Subtitle C Scenario for the Sensitivity Analysis. All other quantities for this Scenario will be the same as for the base estimate and can be found in Appendix D.

Subtitle C Disposal Quantities for Area 6W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Total Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (CY)	138,792	138,792	138,792	138,792	138,792	138,792	138,792	138,792
Total Weight of Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (TON)	215,128	215,128	215,128	215,128	215,128	215,128	215,128	215,128

Ex Situ Treatment Quantities for Area 6W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Weight of Diatomaceous Earth for Stabilization/Solidifcation Sediments (TON)	10,757	10,757	10,757	10,757	10,757	10,757	10,757	10,757
Volume of Diatomaceous Earth for Stabilization/Solidification Sediments (CY)	41,373	41,373	41,373	41,373	41,373	41,373	41,373	41,373
Weight of Quicklime for Amendment (TON)	14,844	14,844	14,844	14,844	14,844	14,844	14,844	14,844
Volume of Quicklime for Amendment (CY)	5,418	5,418	5,418	5,418	5,418	5,418	5,418	5,418
Total Weight of Amended Area 6W NRC/NAPL PTW for Subtitle C Disposal (TON)	240,729	240,729	240,729	240,729	240,729	240,729	240,729	240,729
Total Volume of Amended Area 6W NRC/NAPL PTW for Subtitle C Disposal (CY)	185,583	185,583	185,583	185,583	185,583	185,583	185,583	185,583

Quantities for Area 7W NRC/NAPL PTW

Subtitle C Disposal Quantities for Area 7W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Total Area 7W NRC/NAPL PTW Dredged for Subtitle C Disposal (CY)	37,517	37,517	37,517	37,517	37,517	37,517	37,517	37,517
Total Weight of Area 7W NRC/NAPL PTW Dredged for Subtitle C Disposal (TON)	58,152	58,152	58,152	58,152	58,152	58,152	58,152	58,152

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JOB NO.:	79171.3383.345.FSZ
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Quantity Estimate - 15% Less Volume to Subtitle C (Continued)

Area 7W NRC/NAPL PTW - 1/3 of Volume - No Treatment Required

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for No Treatment (CY)	12,505	12,505	12,505	12,505	12,505	12,505	12,505	12,505
Weight of Sediments for No Treatment (TON)	19,382	19,382	19,382	19,382	19,382	19,382	19,382	19,382
Weight of Diatomaceous Earth for No Treatment Sediments (TON)	1,938	1,938	1,938	1,938	1,938	1,938	1,938	1,938
Volume of Diatomaceous Earth for No Treatment Sediments (CY)	7,455	7,455	7,455	7,455	7,455	7,455	7,455	7,455
Total Weight of No Treatment Sediments (with Diatomaceous Earth) (TON)	21,320	21,320	21,320	21,320	21,320	21,320	21,320	21,320
Total Volume of No Treatment Sediments (with Diatomaceous Earth) (CY)	19,959	19,959	19,959	19,959	19,959	19,959	19,959	19,959

Area 7W NRC/NAPL PTW - 1/3 of Volume - Thermal Treatment at Subtitle C Facility

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for Thermal Treatment (CY)	12,505	12,505	12,505	12,505	12,505	12,505	12,505	12,505
Weight of Sediments for Thermal Treatment (TON)	19,382	19,382	19,382	19,382	19,382	19,382	19,382	19,382
Weight of Diatomaceous Earth for Thermal Treatment Sediments (TON)	1,938	1,938	1,938	1,938	1,938	1,938	1,938	1,938
Volume of Diatomaceous Earth for Thermal Treatment Sediments (CY)	7,455	7,455	7,455	7,455	7,455	7,455	7,455	7,455
Total Weight of Thermal Treatment Sediments (with Diatomaceous Earth) (TON)	21,320	21,320	21,320	21,320	21,320	21,320	21,320	21,320
Total Volume of Thermal Treatment Sediments (with Diatomaceous Earth) (CY)	19,959	19,959	19,959	19,959	19,959	19,959	19,959	19,959
Weight of Thermal Treatment Sediments for Low End of Thermal Cost Range (TON)	10,660	10,660	10,660	10,660	10,660	10,660	10,660	10,660
Volume of Thermal Treatment Sediments for Low End of Thermal Cost Range (CY)	9,979	9,979	9,979	9,979	9,979	9,979	9,979	9,979
Weight of Thermal Treatment Sediments for High End of Thermal Cost Range (TON)	10,660	10,660	10,660	10,660	10,660	10,660	10,660	10,660
Volume of Thermal Treatment Sediments for High End of Thermal Cost Range (CY)	9,980	9,980	9,980	9,980	9,980	9,980	9,980	9,980

Area 7W NRC/NAPL PTW - 1/3 of Volume - Stabilization/Solidification

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for Stabilization/Solidification Treatment (CY)	12,505	12,505	12,505	12,505	12,505	12,505	12,505	12,505
Weight of Sediments for Stabilization/Solidification Treatment (TON)	19,382	19,382	19,382	19,382	19,382	19,382	19,382	19,382
Weight of Diatomaceous Earth for Stabilization/Solidifcation Sediments (TON)	969	969	969	969	969	969	969	969
Volume of Diatomaceous Earth for Stabilization/Solidification Sediments (CY)	3,728	3,728	3,728	3,728	3,728	3,728	3,728	3,728
Weight of Quicklime for Stabilization/Solidification Sediments (TON)	1,338	1,338	1,338	1,338	1,338	1,338	1,338	1,338
Volume of Quicklime for Stabilization/Solidification Sediments (CY)	489	489	489	489	489	489	489	489
Total Weight of Quicklime/Diatomaceous Earth Amended Sediments (TON)	21,688	21,688	21,688	21,688	21,688	21,688	21,688	21,688
Total Volume of Quicklime/Diatomaceous Earth Amended Sediments (CY)	16,721	16,721	16,721	16,721	16,721	16,721	16,721	16,721

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PROJECT:	Portland Harbor FS
JOB NO.:	79171.3383.345.FSZ
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Quantity Estimate - 15% Less Volume to Subtitle C (Continued)

Summary of Subtitle C Disposal and Ex Situ Treatment Volumes for Area 7W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Weight of Thermal Treatment Sediments for Low End of Thermal Cost Range (TON)	10,660	10,660	10,660	10,660	10,660	10,660	10,660	10,660
Weight of Thermal Treatment Sediments for High End of Thermal Cost Range (TON)	9,980	9,980	9,980	9,980	9,980	9,980	9,980	9,980
Weight of Quicklime for Stabilization/Solidification Sediments (TON)	1,338	1,338	1,338	1,338	1,338	1,338	1,338	1,338
Total Weight of Diatomaceous Earth for 7W PTW Sediments (TON)	4,845	4,845	4,845	4,845	4,845	4,845	4,845	4,845
Total Volume of Diatomaceous Earth for 7W PTW Sediments (CY)	18,638	18,638	18,638	18,638	18,638	18,638	18,638	18,638
Total Weight of Amended Area 7W NRC/NAPL PTW for Subtitle C Disposal (TON)	64,328	64,328	64,328	64,328	64,328	64,328	64,328	64,328
Total Volume of Amended Area 7W NRC/NAPL PTW for Subtitle C Disposal (CY)	56,639	56,639	56,639	56,639	56,639	56,639	56,639	56,639

Subtitle D Disposal

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Dredge Sediments for Subtitle D Disposal (including Riverbanks):	457,436	579,808	1,013,712	1,859,445	4,423,832	7,236,963	29,302,380	1,588,380
Weight of Dredge Sediments for Subtitle D Disposal (including Riverbanks) (TON)	709,026	898,703	1,571,254	2,882,140	6,856,940	11,217,293	45,418,689	2,461,989
Diatomaceous Earth Rate for dewatering and material handling (% by weight)	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Weight of Diatomaceous Earth for Subtitle D Materials (TON)	35,451	44,935	78,563	144,107	342,847	560,865	2,270,934	123,099
Volume of Diatomaceous Earth for Subtitle D Materials (CY)	136,350	172,827	302,166	554,258	1,318,643	2,157,174	8,734,362	473,458
Total Weight of Subtitle D Materials (with Diatomaceous Earth) (TON)	744,477	943,638	1,649,817	3,026,247	7,199,787	11,778,158	47,689,623	2,585,088
Total Volume of Subtitle D Materials (with Diatomaceous Earth) (CY)	593,786	752,635	1,315,878	2,413,703	5,742,475	9,394,137	38,036,742	2,061,838

Sensitivity Analysis

Construction Duration Scenarios
(± 50% Construction Duration)

Note: Costs presented herein are specific to DMM Scenario 2. All Cost Worksheets for the Construction Duration Sensitivity Analysis Scenarios are the same as the Cost Worksheets created for the base estimate, and can be found in Appendix G.

TABLE PV-B

PRESENT VALUE ANALYSIS

Alternative **B Sensitivity Analysis - Construction Duration (50% Shorter Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$1,240,500	$10,912,000	$169,352,000	$0	$0	$0	$0	$181,504,500	1.0000	$181,504,500
1	$1,240,500	$0	$169,352,000	$0	$0	$0	$0	$170,592,500	0.9346	$159,435,751
2	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.8734	$23,358,210
3	$0	$0	$0	$0	$0	$0	$0	$0	0.8163	$0
4	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.7629	$20,402,998
5	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.7130	$2,719,382
6	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.6663	$17,819,527
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.5820	$15,565,008
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.5083	$15,532,631
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.3878	$10,371,323
15	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.3624	$1,382,194
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2959	$7,913,550
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.2584	$985,538
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2257	$6,036,121
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.1842	$702,539
26	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.1722	$4,605,317
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.1314	$4,015,321
TOTALS:	$2,481,000	$10,912,000	$338,704,000	$0	$267,440,000	$21,036,000	$1,848,000	$642,421,000		$472,349,910
TOTAL PRESENT VALUE OF ALTERNATIVE B[5]										**$472,350,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-B.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-B

PRESENT VALUE ANALYSIS

Alternative **B Sensitivity Analysis - Construction Duration (50% Longer Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$413,500	$10,912,000	$56,450,667	$0	$0	$0	$0	$67,776,167	1.0000	$67,776,167
1	$413,500	$0	$56,450,667	$0	$0	$0	$0	$56,864,167	0.9346	$53,145,250
2	$413,500	$0	$56,450,667	$0	$26,744,000	$0	$0	$83,608,167	0.8734	$73,023,373
3	$413,500	$0	$56,450,667	$0	$0	$0	$0	$56,864,167	0.8163	$46,418,220
4	$413,500	$0	$56,450,667	$0	$26,744,000	$0	$0	$83,608,167	0.7629	$63,784,671
5	$413,500	$0	$56,450,667	$0	$0	$3,506,000	$308,000	$60,678,167	0.7130	$43,263,533
6	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.6663	$17,819,527
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.5820	$15,565,008
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.5083	$15,532,631
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.3878	$10,371,323
15	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.3624	$1,382,194
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2959	$7,913,550
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.2584	$985,538
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2257	$6,036,121
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.1842	$702,539
26	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.1722	$4,605,317
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.1314	$4,015,321
TOTALS:	$2,481,000	$10,912,000	$338,704,000	$0	$267,440,000	$21,036,000	$1,848,000	$642,421,000		$432,340,283
TOTAL PRESENT VALUE OF ALTERNATIVE B[5]										**$432,340,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-B.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-B

Alternative **B Sensitivity Analysis - Construction Duration**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-B2	1	LS	$2,016,443	$2,016,443	
SUBTOTAL					$2,016,443	
Contingency (Scope and Bid)		15%			$302,466	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$2,318,909	
Project Management		2%			$46,378	Percentage modified as documented in Attachment A
Remedial Design		2%			$46,378	Percentage modified as documented in Attachment A
Construction Management		3%			$69,567	Percentage modified as documented in Attachment A
TOTAL					$2,481,232	
TOTAL CAPITAL COST					**$2,481,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,641,756	
Contingency (Scope and Bid)		20%			$1,528,351	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,170,107	
Project Management		5%			$458,505	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$733,609	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$550,206	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,912,427	
TOTAL CAPITAL COST					**$10,912,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Construction Duration**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-B1	1	LS	$4,155,000	$4,155,000	
Transload Facility Development	CW-B21	1	LS	$7,967,890	$7,967,890	
Debris Removal and Disposal	CW-B5	202	AC	$13,107	$2,647,616	
Obstruction Removal and Relocation	CW-B6	1	LS	$3,907,503	$3,907,503	
Erosion/Residual Control Measures	CW-B7	1	LS	$22,320,235	$22,320,235	
Dredging of Contaminated Sediments (Open Water)	CW-B8	513,841	CY	$24.53	$12,604,520	
Dredging of Contaminated Sediments (Confined)	CW-B9	63,042	CY	$31.10	$1,960,606	
Excavation of Riverbanks	CW-B10	50,769	CY	$5.19	$263,490	
Dewatering and Water Treatment for Dredging Operations	CW-B11	1	LS	$2,595,467	$2,595,467	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-B12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-B13	693,843	TON	$111	$76,847,281	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-B14	15	AC	$1,070,827	$16,062,405	
Sand Placement for Technology Assignments	CW-B15	342,033	CY	$33.89	$11,591,596	
Beach Mix Placement for Technology Assignments	CW-B16	18,563	CY	$74.24	$1,378,163	
Armor Placement for Technology Assignments	CW-B17	29,533	CY	$72.42	$2,138,814	
Reactive/GAC Placement for Technology Assignments	CW-B18	1	LS	$27,488,372	$27,488,372	
Geofabric for Riverbanks	CW-B19	10.5	AC	$14,311	$150,268	
Organoclay Mat Placement for Technology Assignments	CW-B20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$263,787,994	
Contingency (Scope and Bid)		20%			$52,757,599	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$316,545,593	
Project Management		2%			$6,330,912	Percentage modified as documented in Attachment A
Remedial Design		2%			$6,330,912	Percentage modified as documented in Attachment A
Construction Management		3%			$9,496,368	Percentage modified as documented in Attachment A
TOTAL					$338,703,785	
TOTAL CAPITAL COST					**$338,704,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative B Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	
Site-Wide Monitoring	CW-B23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-B24	1	LS	$12,228,875	$12,228,875	
SUBTOTAL					$20,828,290	
Contingency (Scope and Bid)		20%			$4,165,658	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$24,993,948	
Project Management		2%			$499,879	Percentage modified as documented in Attachment A
Technical Support		5%			$1,249,697	Percentage modified as documented in Attachment A
TOTAL					$26,743,524	
TOTAL PERIODIC COST					**$26,744,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-B25	1	LS	$2,230,955	$2,230,955	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$2,230,955	
Contingency (Scope and Bid)		20%			$446,191	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,677,146	
Project Management		5%			$133,857	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$267,715	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$3,078,718	
TOTAL PERIODIC COST					**$3,079,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative B Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-B3	1	LS	$337,883	$337,883	
SUBTOTAL					$337,883	
Contingency (Scope and Bid)		10%			$33,788	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$371,671	
Project Management		5%			$18,584	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$37,167	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$427,422	
TOTAL PERIODIC COST					**$427,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-B26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-D

PRESENT VALUE ANALYSIS

Alternative **D Sensitivity Analysis - Construction Duration (50% Shorter Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$1,035,000	$10,481,000	$180,806,000	$0	$0	$0	$0	$192,322,000	1.0000	$192,322,000
1	$1,035,000	$0	$180,806,000	$0	$0	$0	$0	$181,841,000	0.9346	$169,948,599
2	$1,035,000	$0	$180,806,000	$0	$36,374,000	$0	$0	$218,215,000	0.8734	$190,588,981
3	$0	$0	$0	$0	$0	$0	$0	$0	0.8163	$0
4	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.7629	$27,749,725
5	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.7130	$3,955,724
6	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.6663	$24,235,996
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.5820	$21,169,668
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.5083	$21,308,953
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.3878	$14,105,837
15	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.3624	$2,010,595
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2959	$10,763,067
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.2584	$1,433,603
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2257	$8,209,612
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.1842	$1,021,942
26	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.1722	$6,263,603
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.1314	$5,508,551
TOTALS:	$3,105,000	$10,481,000	$542,418,000	$0	$363,740,000	$31,440,000	$1,848,000	$953,032,000		$700,596,456
TOTAL PRESENT VALUE OF ALTERNATIVE D[5]										**$700,600,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-D.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-D

PRESENT VALUE ANALYSIS

Alternative **D Sensitivity Analysis - Construction Duration (50% Longer Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$345,000	$10,481,000	$60,268,667	$0	$0	$0	$0	$71,094,667	1.0000	$71,094,667
1	$345,000	$0	$60,268,667	$0	$0	$0	$0	$60,613,667	0.9346	$56,649,533
2	$345,000	$0	$60,268,667	$0	$36,374,000	$0	$0	$96,987,667	0.8734	$84,709,028
3	$345,000	$0	$60,268,667	$0	$0	$0	$0	$60,613,667	0.8163	$49,478,936
4	$345,000	$0	$60,268,667	$0	$36,374,000	$0	$0	$96,987,667	0.7629	$73,991,891
5	$345,000	$0	$60,268,667	$0	$0	$5,240,000	$308,000	$66,161,667	0.7130	$47,173,269
6	$345,000	$0	$60,268,667	$0	$36,374,000	$0	$0	$96,987,667	0.6663	$64,622,883
7	$345,000	$0	$60,268,667	$0	$0	$0	$0	$60,613,667	0.6227	$37,744,130
8	$345,000	$0	$60,268,667	$0	$36,374,000	$0	$0	$96,987,667	0.5820	$56,446,822
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.5083	$21,308,953
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.3878	$14,105,837
15	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.3624	$2,010,595
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2959	$10,763,067
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.2584	$1,433,603
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2257	$8,209,612
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.1842	$1,021,942
26	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.1722	$6,263,603
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.1314	$5,508,551
TOTALS:	$3,105,000	$10,481,000	$542,418,000	$0	$363,740,000	$31,440,000	$1,848,000	$953,032,000		$612,536,922
TOTAL PRESENT VALUE OF ALTERNATIVE D[5]										**$612,540,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-D.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-D

Alternative D Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-D2	1	LS	$2,523,020	$2,523,020	
SUBTOTAL					$2,523,020	
Contingency (Scope and Bid)		15%			$378,453	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$2,901,473	
Project Management		2%			$58,029	Percentage modified as documented in Attachment A
Remedial Design		2%			$58,029	Percentage modified as documented in Attachment A
Construction Management		3%			$87,044	Percentage modified as documented in Attachment A
TOTAL					$3,104,575	
TOTAL CAPITAL COST					**$3,105,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,339,477	
Contingency (Scope and Bid)		20%			$1,467,895	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,807,372	
Project Management		5%			$440,369	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$704,590	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$528,442	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,480,773	
TOTAL CAPITAL COST					**$10,481,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-D1	1	LS	$6,653,000	$6,653,000	
Transload Facility Development	CW-D21	1	LS	$9,675,295	$9,675,295	
Debris Removal and Disposal	CW-D5	268	AC	$13,107	$3,512,679	
Obstruction Removal and Relocation	CW-D6	1	LS	$6,933,407	$6,933,407	
Erosion/Residual Control Measures	CW-D7	1	LS	$23,531,760	$23,531,760	
Dredging of Contaminated Sediments (Open Water)	CW-D8	1,035,580	CY	$24.53	$25,402,777	
Dredging of Contaminated Sediments (Confined)	CW-D9	72,466	CY	$31.10	$2,253,693	
Excavation of Riverbanks	CW-D10	73,192	CY	$5.19	$379,864	
Dewatering and Water Treatment for Dredging Operations	CW-D11	1	LS	$4,925,014	$4,925,014	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-D12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-D13	1,599,182	TON	$111	$177,119,261	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-D14	25	AC	$1,070,827	$26,770,675	
Sand Placement for Technology Assignments	CW-D15	475,860	CY	$33.82	$16,095,462	
Beach Mix Placement for Technology Assignments	CW-D16	32,441	CY	$73.59	$2,387,358	
Armor Placement for Technology Assignments	CW-D17	53,344	CY	$72.06	$3,844,036	
Reactive/GAC Placement for Technology Assignments	CW-D18	1	LS	$43,035,063	$43,035,063	
Geofabric for Riverbanks	CW-D19	15.1	AC	$14,311	$216,100	
Organoclay Mat Placement for Technology Assignments	CW-D20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$422,444,212	
Contingency (Scope and Bid)		20%			$84,488,842	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$506,933,054	
Project Management		2%			$10,138,661	Percentage modified as documented in Attachment A
Remedial Design		2%			$10,138,661	Percentage modified as documented in Attachment A
Construction Management		3%			$15,207,992	Percentage modified as documented in Attachment A
TOTAL					$542,418,368	
TOTAL CAPITAL COST					**$542,418,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	
Site-Wide Monitoring	CW-D23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-D24	1	LS	$20,031,523	$20,031,523	
SUBTOTAL					$28,328,659	
Contingency (Scope and Bid)		20%			$5,665,732	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$33,994,391	
Project Management		2%			$679,888	Percentage modified as documented in Attachment A
Technical Support		5%			$1,699,720	Percentage modified as documented in Attachment A
TOTAL					$36,373,999	
TOTAL PERIODIC COST					**$36,374,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-D25	1	LS	$3,391,669	$3,391,669	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,391,669	
Contingency (Scope and Bid)		20%			$678,334	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,070,003	
Project Management		5%			$203,500	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$407,000	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$4,680,503	
TOTAL PERIODIC COST					**$4,681,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-D3	1	LS	$441,761	$441,761	
SUBTOTAL					$441,761	
Contingency (Scope and Bid)		10%			$44,176	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$485,937	
Project Management		5%			$24,297	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$48,594	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$558,828	
TOTAL PERIODIC COST					**$559,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-D26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:

Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-E

PRESENT VALUE ANALYSIS

Alternative **E Sensitivity Analysis - Construction Duration (50% Shorter Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$1,224,333	$9,991,000	$271,267,000	$0	$0	$0	$0	$282,482,333	1.0000	$282,482,333
1	$1,224,333	$0	$271,267,000	$0	$0	$0	$0	$272,491,333	0.9346	$254,670,400
2	$1,224,333	$0	$271,267,000	$0	$37,467,000	$0	$0	$309,958,333	0.8734	$270,717,608
3	$0	$0	$0	$0	$0	$0	$0	$0	0.8163	$0
4	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.7629	$28,583,574
5	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.7130	$4,475,501
6	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.6663	$24,964,262
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.5820	$21,805,794
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.5083	$22,235,075
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.3878	$14,529,703
15	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.3624	$2,274,785
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2959	$11,086,485
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.2584	$1,621,977
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2257	$8,456,302
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.1842	$1,156,223
26	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.1722	$6,451,817
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.1314	$5,747,962
TOTALS:	$3,673,000	$9,991,000	$813,801,000	$0	$374,670,000	$35,814,000	$1,848,000	$1,239,797,000		$961,259,801
TOTAL PRESENT VALUE OF ALTERNATIVE E[5]										**$961,260,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-E.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-E

PRESENT VALUE ANALYSIS

Alternative **E Sensitivity Analysis - Construction Duration (50% Longer Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$333,909	$9,991,000	$73,981,909	$0	$0	$0	$0	$84,306,818	1.0000	$84,306,818
1	$333,909	$0	$73,981,909	$0	$0	$0	$0	$74,315,818	0.9346	$69,455,564
2	$333,909	$0	$73,981,909	$0	$37,467,000	$0	$0	$111,782,818	0.8734	$97,631,113
3	$333,909	$0	$73,981,909	$0	$0	$0	$0	$74,315,818	0.8163	$60,664,002
4	$333,909	$0	$73,981,909	$0	$37,467,000	$0	$0	$111,782,818	0.7629	$85,279,112
5	$333,909	$0	$73,981,909	$0	$0	$5,969,000	$308,000	$80,592,818	0.7130	$57,462,679
6	$333,909	$0	$73,981,909	$0	$37,467,000	$0	$0	$111,782,818	0.6663	$74,480,892
7	$333,909	$0	$73,981,909	$0	$0	$0	$0	$74,315,818	0.6227	$46,276,460
8	$333,909	$0	$73,981,909	$0	$37,467,000	$0	$0	$111,782,818	0.5820	$65,057,600
9	$333,909	$0	$73,981,909	$0	$0	$0	$0	$74,315,818	0.5439	$40,420,373
10	$333,909	$0	$73,981,909	$0	$37,467,000	$5,969,000	$308,000	$118,059,818	0.5083	$60,009,805
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.3878	$14,529,703
15	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.3624	$2,274,785
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2959	$11,086,485
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.2584	$1,621,977
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2257	$8,456,302
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.1842	$1,156,223
26	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.1722	$6,451,817
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.1314	$5,747,962
TOTALS:	$3,673,000	$9,991,000	$813,801,000	$0	$374,670,000	$35,814,000	$1,848,000	$1,239,797,000		$792,369,672
TOTAL PRESENT VALUE OF ALTERNATIVE E[5]										**$792,370,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-E.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-E

Alternative E Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-E2	1	LS	$2,985,246	$2,985,246	
SUBTOTAL					$2,985,246	
Contingency (Scope and Bid)		15%			$447,787	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$3,433,033	
Project Management		2%			$68,661	Percentage modified as documented in Attachment A
Remedial Design		2%			$68,661	Percentage modified as documented in Attachment A
Construction Management		3%			$102,991	Percentage modified as documented in Attachment A
TOTAL					$3,673,346	
TOTAL CAPITAL COST					**$3,673,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,996,648	
Contingency (Scope and Bid)		20%			$1,399,330	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,395,978	
Project Management		5%			$419,799	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$671,678	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$503,759	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$9,991,214	
TOTAL CAPITAL COST					**$9,991,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-E1	1	LS	$9,982,000	$9,982,000	
Transload Facility Development	CW-E21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-E5	330	AC	$13,107	$4,325,313	
Obstruction Removal and Relocation	CW-E6	1	LS	$15,701,434	$15,701,434	
Erosion/Residual Control Measures	CW-E7	1	LS	$24,743,285	$24,743,285	
Dredging of Contaminated Sediments (Open Water)	CW-E8	1,835,521	CY	$24.53	$45,025,330	
Dredging of Contaminated Sediments (Confined)	CW-E9	92,616	CY	$31.10	$2,880,358	
Excavation of Riverbanks	CW-E10	96,086	CY	$5.19	$498,687	
Dewatering and Water Treatment for Dredging Operations	CW-E11	1	LS	$8,443,577	$8,443,577	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-E12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-E13	2,975,613	TON	$111	$329,567,250	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-E14	35	AC	$1,070,827	$37,478,945	
Sand Placement for Technology Assignments	CW-E15	665,248	CY	$33.73	$22,437,471	
Beach Mix Placement for Technology Assignments	CW-E16	48,189	CY	$73.34	$3,534,049	
Armor Placement for Technology Assignments	CW-E17	79,256	CY	$72.14	$5,717,178	
Reactive/GAC Placement for Technology Assignments	CW-E18	1	LS	$42,943,721	$42,943,721	
Geofabric for Riverbanks	CW-E19	19.9	AC	$14,311	$284,794	
Organoclay Mat Placement for Technology Assignments	CW-E20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$633,801,158	
Contingency (Scope and Bid)		20%			$126,760,232	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$760,561,390	
Project Management		2%			$15,211,228	Percentage modified as documented in Attachment A
Remedial Design		2%			$15,211,228	Percentage modified as documented in Attachment A
Construction Management		3%			$22,816,842	Percentage modified as documented in Attachment A
TOTAL					$813,800,688	
TOTAL CAPITAL COST					**$813,801,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	
Site-Wide Monitoring	CW-E23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-E24	1	LS	$21,225,951	$21,225,951	
SUBTOTAL					$29,180,258	
Contingency (Scope and Bid)		20%			$5,836,052	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,016,310	
Project Management		2%			$700,326	Percentage modified as documented in Attachment A
Technical Support		5%			$1,750,816	Percentage modified as documented in Attachment A
TOTAL					$37,467,452	
TOTAL PERIODIC COST					**$37,467,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-E25	1	LS	$3,865,618	$3,865,618	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,865,618	
Contingency (Scope and Bid)		20%			$773,124	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,638,742	
Project Management		5%			$231,937	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,874	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,334,553	
TOTAL PERIODIC COST					**$5,335,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-E3	1	LS	$501,289	$501,289	
SUBTOTAL					$501,289	
Contingency (Scope and Bid)		10%			$50,129	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$551,418	
Project Management		5%			$27,571	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,142	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$634,131	
TOTAL PERIODIC COST					**$634,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-E26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:

Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-F

PRESENT VALUE ANALYSIS

Alternative **F Sensitivity Analysis - Construction Duration (50% Shorter Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$764,833	$8,749,000	$269,344,833	$0	$0	$0	$0	$278,858,666	1.0000	$278,858,666
1	$764,833	$0	$269,344,833	$0	$0	$0	$0	$270,109,666	0.9346	$252,444,494
2	$764,833	$0	$269,344,833	$0	$49,499,000	$0	$0	$319,608,666	0.8734	$279,146,209
3	$764,833	$0	$269,344,833	$0	$0	$0	$0	$270,109,666	0.8163	$220,490,520
4	$764,833	$0	$269,344,833	$0	$49,499,000	$0	$0	$319,608,666	0.7629	$243,829,451
5	$764,833	$0	$269,344,833	$0	$0	$8,779,000	$308,000	$279,196,666	0.7130	$199,067,223
6	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.6663	$32,981,184
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.5820	$28,808,418
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.5083	$29,779,264
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.3878	$19,195,712
15	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.3624	$3,293,129
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2959	$14,646,754
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.2584	$2,348,081
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2257	$11,171,924
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.1842	$1,673,825
26	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.1722	$8,523,728
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.1314	$7,698,200
TOTALS:	$4,589,000	$8,749,000	$1,616,069,000	$0	$494,990,000	$52,674,000	$1,848,000	$2,178,919,000		$1,633,956,782
TOTAL PRESENT VALUE OF ALTERNATIVE F[5]										**$1,633,960,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-F.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-F

PRESENT VALUE ANALYSIS

Alternative **F Sensitivity Analysis - Construction Duration (50% Longer Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$229,450	$8,749,000	$80,803,450	$0	$0	$0	$0	$89,781,900	1.0000	$89,781,900
1	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.9346	$75,733,348
2	$229,450	$0	$80,803,450	$0	$49,499,000	$0	$0	$130,531,900	0.8734	$114,006,561
3	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.8163	$66,147,156
4	$229,450	$0	$80,803,450	$0	$49,499,000	$0	$0	$130,531,900	0.7629	$99,582,787
5	$229,450	$0	$80,803,450	$0	$0	$8,779,000	$308,000	$90,119,900	0.7130	$64,255,489
6	$229,450	$0	$80,803,450	$0	$49,499,000	$0	$0	$130,531,900	0.6663	$86,973,405
7	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.6227	$50,459,187
8	$229,450	$0	$80,803,450	$0	$49,499,000	$0	$0	$130,531,900	0.5820	$75,969,566
9	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.5439	$44,073,794
10	$229,450	$0	$80,803,450	$0	$49,499,000	$8,779,000	$308,000	$139,618,900	0.5083	$70,968,287
11	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.4751	$38,498,731
12	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.4440	$35,978,608
13	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.4150	$33,628,654
14	$229,450	$0	$80,803,450	$0	$49,499,000	$0	$0	$130,531,900	0.3878	$50,620,271
15	$229,450	$0	$80,803,450	$0	$0	$8,779,000	$308,000	$90,119,900	0.3624	$32,659,452
16	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.3387	$27,445,843
17	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.3166	$25,655,016
18	$229,450	$0	$80,803,450	$0	$49,499,000	$0	$0	$130,531,900	0.2959	$38,624,389
19	$229,450	$0	$80,803,450	$0	$0	$0	$0	$81,032,900	0.2765	$22,405,597
20	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.2584	$2,348,081
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2257	$11,171,924
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.1842	$1,673,825
26	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.1722	$8,523,728
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.1314	$7,698,200
TOTALS:	$4,589,000	$8,749,000	$1,616,069,000	$0	$494,990,000	$52,674,000	$1,848,000	$2,178,919,000		$1,174,883,799
TOTAL PRESENT VALUE OF ALTERNATIVE F[5]										**$1,174,880,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-F.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-F

Alternative **F Sensitivity Analysis - Construction Duration**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW-F2	1	LS	$3,728,996	$3,728,996	
SUBTOTAL					$3,728,996	
Contingency (Scope and Bid)		15%			$559,349	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$4,288,345	
Project Management		2%			$85,767	Percentage modified as documented in Attachment A
Remedial Design		2%			$85,767	Percentage modified as documented in Attachment A
Construction Management		3%			$128,650	Percentage modified as documented in Attachment A
TOTAL					$4,588,529	
TOTAL CAPITAL COST					**$4,589,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,126,675	
Contingency (Scope and Bid)		20%			$1,225,335	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$7,352,010	
Project Management		5%			$367,601	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$588,161	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$441,121	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$8,748,893	
TOTAL CAPITAL COST					**$8,749,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Construction Duration**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-F1	1	LS	$19,821,000	$19,821,000	
Transload Facility Development	CW-F21	1	LS	$15,651,213	$15,651,213	
Debris Removal and Disposal	CW-F5	534	AC	$13,107	$6,999,143	
Obstruction Removal and Relocation	CW-F6	1	LS	$20,718,583	$20,718,583	
Erosion/Residual Control Measures	CW-F7	1	LS	$27,166,335	$27,166,335	
Dredging of Contaminated Sediments (Open Water)	CW-F8	4,339,288	CY	$24.53	$106,442,735	
Dredging of Contaminated Sediments (Confined)	CW-F9	123,286	CY	$31.10	$3,834,195	
Excavation of Riverbanks	CW-F10	122,827	CY	$5.19	$637,472	
Dewatering and Water Treatment for Dredging Operations	CW-F11	1	LS	$19,423,050	$19,423,050	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-F12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-F13	7,149,152	TON	$111	$791,812,106	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-F14	60	AC	$1,070,827	$64,249,620	
Sand Placement for Technology Assignments	CW-F15	1,119,996	CY	$33.48	$37,494,727	
Beach Mix Placement for Technology Assignments	CW-F16	69,510	CY	$72.97	$5,071,863	
Armor Placement for Technology Assignments	CW-F17	151,909	CY	$71.97	$10,932,677	
Reactive/GAC Placement for Technology Assignments	CW-F18	1	LS	$58,294,110	$58,294,110	
Geofabric for Riverbanks	CW-F19	25.4	AC	$14,311	$363,505	
Organoclay Mat Placement for Technology Assignments	CW-F20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,258,621,102	
Contingency (Scope and Bid)		20%			$251,724,220	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$1,510,345,322	
Project Management		2%			$30,206,906	Percentage modified as documented in Attachment A
Remedial Design		2%			$30,206,906	Percentage modified as documented in Attachment A
Construction Management		3%			$45,310,360	Percentage modified as documented in Attachment A
TOTAL					$1,616,069,494	
TOTAL CAPITAL COST					**$1,616,069,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Construction Duration**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	
Site-Wide Monitoring	CW-F23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-F24	1	LS	$31,466,392	$31,466,392	
SUBTOTAL					$38,550,726	
Contingency (Scope and Bid)		20%			$7,710,145	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$46,260,871	
Project Management		2%			$925,217	Percentage modified as documented in Attachment A
Technical Support		5%			$2,313,044	Percentage modified as documented in Attachment A
TOTAL					$49,499,132	
TOTAL PERIODIC COST					**$49,499,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-F25	1	LS	$5,757,416	$5,757,416	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs
SUBTOTAL					$5,757,416	
Contingency (Scope and Bid)		20%			$1,151,483	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,908,899	
Project Management		5%			$345,445	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$690,890	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$7,945,234	
TOTAL PERIODIC COST					**$7,945,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Construction Duration**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-F3	1	LS	$659,296	$659,296	
SUBTOTAL					$659,296	
Contingency (Scope and Bid)		10%			$65,930	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$725,226	
Project Management		5%			$36,261	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$72,523	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$834,010	
TOTAL PERIODIC COST					**$834,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-F26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:

Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-G

PRESENT VALUE ANALYSIS

Alternative **G Sensitivity Analysis - Construction Duration (50% Shorter Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$558,556	$7,428,000	$276,454,444	$0	$0	$0	$0	$284,441,000	1.0000	$284,441,000
1	$558,556	$0	$276,454,444	$0	$0	$0	$0	$277,013,000	0.9346	$258,896,350
2	$558,556	$0	$276,454,444	$0	$63,513,000	$0	$0	$340,526,000	0.8734	$297,415,408
3	$558,556	$0	$276,454,444	$0	$0	$0	$0	$277,013,000	0.8163	$226,125,712
4	$558,556	$0	$276,454,444	$0	$63,513,000	$0	$0	$340,526,000	0.7629	$259,787,285
5	$558,556	$0	$276,454,444	$0	$0	$11,856,000	$308,000	$289,177,000	0.7130	$206,183,201
6	$558,556	$0	$276,454,444	$0	$63,513,000	$0	$0	$340,526,000	0.6663	$226,892,474
7	$558,556	$0	$276,454,444	$0	$0	$0	$0	$277,013,000	0.6227	$172,495,995
8	$558,556	$0	$276,454,444	$0	$63,513,000	$0	$0	$340,526,000	0.5820	$198,186,132
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.5083	$38,466,619
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.3878	$24,630,341
15	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.3624	$4,408,234
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.2959	$18,793,497
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.2584	$3,143,178
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.2257	$14,334,884
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.1842	$2,240,609
26	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.1722	$10,936,939
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.1314	$9,943,958
TOTALS:	$5,027,000	$7,428,000	$2,488,090,000	$0	$635,130,000	$71,136,000	$1,848,000	$3,208,659,000		$2,257,321,816
TOTAL PRESENT VALUE OF ALTERNATIVE G[5]										**$2,257,320,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-G.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-G

PRESENT VALUE ANALYSIS

Alternative **G Sensitivity Analysis - Construction Duration (50% Longer Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$173,345	$7,428,000	$85,796,207	$0	$0	$0	$0	$93,397,552	1.0000	$93,397,552
1	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.9346	$80,347,143
2	$173,345	$0	$85,796,207	$0	$63,513,000	$0	$0	$149,482,552	0.8734	$130,558,061
3	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.8163	$70,176,945
4	$173,345	$0	$85,796,207	$0	$63,513,000	$0	$0	$149,482,552	0.7629	$114,040,239
5	$173,345	$0	$85,796,207	$0	$0	$11,856,000	$308,000	$98,133,552	0.7130	$69,969,223
6	$173,345	$0	$85,796,207	$0	$63,513,000	$0	$0	$149,482,552	0.6663	$99,600,224
7	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.6227	$53,533,240
8	$173,345	$0	$85,796,207	$0	$63,513,000	$0	$0	$149,482,552	0.5820	$86,998,845
9	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.5439	$46,758,839
10	$173,345	$0	$85,796,207	$0	$63,513,000	$11,856,000	$308,000	$161,646,552	0.5083	$82,164,942
11	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.4751	$40,844,134
12	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.4440	$38,170,481
13	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.4150	$35,677,364
14	$173,345	$0	$85,796,207	$0	$63,513,000	$0	$0	$149,482,552	0.3878	$57,969,334
15	$173,345	$0	$85,796,207	$0	$0	$11,856,000	$308,000	$98,133,552	0.3624	$35,563,599
16	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.3387	$29,117,887
17	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.3166	$27,217,960
18	$173,345	$0	$85,796,207	$0	$63,513,000	$0	$0	$149,482,552	0.2959	$44,231,887
19	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.2765	$23,770,581
20	$173,345	$0	$85,796,207	$0	$0	$11,856,000	$308,000	$98,133,552	0.2584	$25,357,710
21	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.2415	$20,761,647
22	$173,345	$0	$85,796,207	$0	$63,513,000	$0	$0	$149,482,552	0.2257	$33,738,212
23	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.2109	$18,130,979
24	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.1971	$16,944,599
25	$173,345	$0	$85,796,207	$0	$0	$11,856,000	$308,000	$98,133,552	0.1842	$18,076,200
26	$173,345	$0	$85,796,207	$0	$63,513,000	$0	$0	$149,482,552	0.1722	$25,740,895
27	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.1609	$13,832,501
28	$173,345	$0	$85,796,207	$0	$0	$0	$0	$85,969,552	0.1504	$12,929,821
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.1314	$9,943,958
TOTALS:	$5,027,000	$7,428,000	$2,488,090,000	$0	$635,130,000	$71,136,000	$1,848,000	$3,208,659,000		$1,455,565,002
TOTAL PRESENT VALUE OF ALTERNATIVE G[5]										**$1,455,570,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-G.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-G

Alternative G Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-G2	1	LS	$4,084,988	$4,084,988	
SUBTOTAL					$4,084,988	
Contingency (Scope and Bid)		15%			$612,748	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$4,697,736	
Project Management		2%			$93,955	Percentage modified as documented in Attachment A
Remedial Design		2%			$93,955	Percentage modified as documented in Attachment A
Construction Management		3%			$140,932	Percentage modified as documented in Attachment A
TOTAL					$5,026,578	
TOTAL CAPITAL COST					**$5,027,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$5,201,407	
Contingency (Scope and Bid)		20%			$1,040,281	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,241,688	
Project Management		5%			$312,084	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$499,335	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$374,501	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$7,427,608	
TOTAL CAPITAL COST					**$7,428,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-G1	1	LS	$30,516,000	$30,516,000	
Transload Facility Development	CW-G21	1	LS	$20,773,428	$20,773,428	
Debris Removal and Disposal	CW-G5	776	AC	$13,107	$10,171,040	
Obstruction Removal and Relocation	CW-G6	1	LS	$22,638,241	$22,638,241	
Erosion/Residual Control Measures	CW-G7	1	LS	$28,135,555	$28,135,555	
Dredging of Contaminated Sediments (Open Water)	CW-G8	7,110,364	CY	$24.53	$174,417,229	
Dredging of Contaminated Sediments (Confined)	CW-G9	147,293	CY	$31.10	$4,580,812	
Excavation of Riverbanks	CW-G10	138,942	CY	$5.19	$721,107	
Dewatering and Water Treatment for Dredging Operations	CW-G11	1	LS	$31,511,207	$31,511,207	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-G12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-G13	11,727,524	TON	$111	$1,298,894,643	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-G14	86	AC	$1,070,827	$92,091,122	
Sand Placement for Technology Assignments	CW-G15	1,634,210	CY	$33.23	$54,304,680	
Beach Mix Placement for Technology Assignments	CW-G16	90,647	CY	$72.65	$6,585,212	
Armor Placement for Technology Assignments	CW-G17	245,586	CY	$71.57	$17,577,027	
Reactive/GAC Placement for Technology Assignments	CW-G18	1	LS	$74,728,183	$74,728,183	
Geofabric for Riverbanks	CW-G19	28.7	AC	$14,311	$410,732	
Organoclay Mat Placement for Technology Assignments	CW-G20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,937,764,986	
Contingency (Scope and Bid)		20%			$387,552,997	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,325,317,983	
Project Management		2%			$46,506,360	Percentage modified as documented in Attachment A
Remedial Design		2%			$46,506,360	Percentage modified as documented in Attachment A
Construction Management		3%			$69,759,539	Percentage modified as documented in Attachment A
TOTAL					$2,488,090,242	
TOTAL CAPITAL COST					**$2,488,090,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-G23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-G24	1	LS	$43,306,076	$43,306,076	
SUBTOTAL					$49,465,142	
Contingency (Scope and Bid)		20%			$9,893,028	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$59,358,170	
Project Management		2%			$1,187,163	Percentage modified as documented in Attachment A
Technical Support		5%			$2,967,909	Percentage modified as documented in Attachment A
TOTAL					$63,513,242	
TOTAL PERIODIC COST					**$63,513,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-G25	1	LS	$7,862,382	$7,862,382	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$7,862,382	
Contingency (Scope and Bid)		20%			$1,572,476	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,434,858	
Project Management		5%			$471,743	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$943,486	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$10,850,087	
TOTAL PERIODIC COST					**$10,850,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-G3	1	LS	$795,634	$795,634	
SUBTOTAL					$795,634	
Contingency (Scope and Bid)		10%			$79,563	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$875,197	
Project Management		5%			$43,760	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$87,520	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$1,006,477	
TOTAL PERIODIC COST					**$1,006,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-G26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:

Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-I

PRESENT VALUE ANALYSIS

Alternative **I Sensitivity Analysis - Construction Duration (50% Shorter Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$1,242,000	$10,197,000	$245,812,000	$0	$0	$0	$0	$257,251,000	1.0000	$257,251,000
1	$1,242,000	$0	$245,812,000	$0	$0	$0	$0	$247,054,000	0.9346	$230,896,668
2	$1,242,000	$0	$245,812,000	$0	$38,426,000	$0	$0	$285,480,000	0.8734	$249,338,232
3	$0	$0	$0	$0	$0	$0	$0	$0	0.8163	$0
4	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.7629	$29,315,195
5	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.7130	$4,477,640
6	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.6663	$25,603,244
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.5820	$22,363,932
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.5083	$22,724,060
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.3878	$14,901,603
15	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.3624	$2,275,872
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2959	$11,370,253
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.2584	$1,622,752
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2257	$8,672,748
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.1842	$1,156,776
26	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.1722	$6,616,957
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.1314	$5,874,368
TOTALS:	$3,726,000	$10,197,000	$737,436,000	$0	$384,260,000	$35,832,000	$1,848,000	$1,173,299,000		$894,461,300
TOTAL PRESENT VALUE OF ALTERNATIVE I[5]										**$894,460,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-I.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-I

PRESENT VALUE ANALYSIS

Alternative **I Sensitivity Analysis - Construction Duration (50% Longer Construction Duration)**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$338,727	$10,197,000	$67,039,636	$0	$0	$0	$0	$77,575,363	1.0000	$77,575,363
1	$338,727	$0	$67,039,636	$0	$0	$0	$0	$67,378,363	0.9346	$62,971,818
2	$338,727	$0	$67,039,636	$0	$38,426,000	$0	$0	$105,804,363	0.8734	$92,409,531
3	$338,727	$0	$67,039,636	$0	$0	$0	$0	$67,378,363	0.8163	$55,000,958
4	$338,727	$0	$67,039,636	$0	$38,426,000	$0	$0	$105,804,363	0.7629	$80,718,149
5	$338,727	$0	$67,039,636	$0	$0	$5,972,000	$308,000	$73,658,363	0.7130	$52,518,413
6	$338,727	$0	$67,039,636	$0	$38,426,000	$0	$0	$105,804,363	0.6663	$70,497,447
7	$338,727	$0	$67,039,636	$0	$0	$0	$0	$67,378,363	0.6227	$41,956,507
8	$338,727	$0	$67,039,636	$0	$38,426,000	$0	$0	$105,804,363	0.5820	$61,578,139
9	$338,727	$0	$67,039,636	$0	$0	$0	$0	$67,378,363	0.5439	$36,647,092
10	$338,727	$0	$67,039,636	$0	$38,426,000	$5,972,000	$308,000	$112,084,363	0.5083	$56,972,482
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.3878	$14,901,603
15	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.3624	$2,275,872
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2959	$11,370,253
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.2584	$1,622,752
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2257	$8,672,748
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.1842	$1,156,776
26	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.1722	$6,616,957
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.1314	$5,874,368
TOTALS:	$3,726,000	$10,197,000	$737,436,000	$0	$384,260,000	$35,832,000	$1,848,000	$1,173,299,000		$741,337,228
TOTAL PRESENT VALUE OF ALTERNATIVE I[5]										**$741,340,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-I.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-I

Alternative I Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-I2	1	LS	$3,028,033	$3,028,033	
SUBTOTAL					$3,028,033	
Contingency (Scope and Bid)		15%			$454,205	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$3,482,238	
Project Management		2%			$69,645	Percentage modified as documented in Attachment A
Remedial Design		2%			$69,645	Percentage modified as documented in Attachment A
Construction Management		3%			$104,467	Percentage modified as documented in Attachment A
TOTAL					$3,725,995	
TOTAL CAPITAL COST					**$3,726,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,140,415	
Contingency (Scope and Bid)		20%			$1,428,083	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,568,498	
Project Management		5%			$428,425	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$685,480	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$514,110	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,196,513	
TOTAL CAPITAL COST					**$10,197,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-I1	1	LS	$9,045,000	$9,045,000	
Transload Facility Development	CW-I21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-I5	292	AC	$13,107	$3,827,247	
Obstruction Removal and Relocation	CW-I6	1	LS	$15,146,379	$15,146,379	
Erosion/Residual Control Measures	CW-I7	1	LS	$25,227,895	$25,227,895	
Dredging of Contaminated Sediments (Open Water)	CW-I8	1,556,599	CY	$24.53	$38,183,373	
Dredging of Contaminated Sediments (Confined)	CW-I9	93,151	CY	$31.10	$2,896,996	
Excavation of Riverbanks	CW-I10	102,624	CY	$5.19	$532,618	
Dewatering and Water Treatment for Dredging Operations	CW-I11	1	LS	$7,261,269	$7,261,269	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	CW-I12	358,888	TON	$191	$68,535,729	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal)	CW-I13	2,534,454	TON	$111	$280,706,119	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-I14	34	AC	$1,070,827	$36,408,118	
Sand Placement for Technology Assignments	CW-I15	598,578	CY	$34.00	$20,353,254	
Beach Mix Placement for Technology Assignments	CW-I16	49,511	CY	$73.43	$3,635,422	
Armor Placement for Technology Assignments	CW-I17	80,297	CY	$72.27	$5,802,915	
Reactive/GAC Placement for Technology Assignments	CW-I18	1	LS	$44,759,377	$44,759,377	
Geofabric for Riverbanks	CW-I19	21.2	AC	$14,311	$303,398	
Organoclay Mat Placement for Technology Assignments	CW-I20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$574,327,146	
Contingency (Scope and Bid)		20%			$114,865,429	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$689,192,575	
Project Management		2%			$13,783,852	Percentage modified as documented in Attachment A
Remedial Design		2%			$13,783,852	Percentage modified as documented in Attachment A
Construction Management		3%			$20,675,777	Percentage modified as documented in Attachment A
TOTAL					$737,436,056	
TOTAL CAPITAL COST					**$737,436,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-I23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-I24	1	LS	$21,828,717	$21,828,717	
SUBTOTAL					$29,926,791	
Contingency (Scope and Bid)		20%			$5,985,358	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,912,149	
Project Management		2%			$718,243	Percentage modified as documented in Attachment A
Technical Support		5%			$1,795,607	Percentage modified as documented in Attachment A
TOTAL					$38,425,999	
TOTAL PERIODIC COST					**$38,426,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-I25	1	LS	$3,862,654	$3,862,654	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,862,654	
Contingency (Scope and Bid)		20%			$772,531	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,635,185	
Project Management		5%			$231,759	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,519	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,330,463	
TOTAL PERIODIC COST					**$5,330,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Construction Duration

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-I3	1	LS	$507,467	$507,467	
SUBTOTAL					$507,467	
Contingency (Scope and Bid)		10%			$50,747	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$558,214	
Project Management		5%			$27,911	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,821	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$641,946	
TOTAL PERIODIC COST					**$642,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-I26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:

Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

All Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

Sensitivity Analysis

Overdredge Scenarios
(High/Low Overdredge Factors [1.5/2.0])

Note: Costs presented herein are specific to DMM Scenario 2. Cost Worksheets presented herein are specific to the Overdredge Sensitivity Analysis Scenarios. All other Cost Worksheets are the same as the Cost Worksheets created for the base estimate, and can be found in Appendix G.

TABLE PV-B

PRESENT VALUE ANALYSIS

Alternative **B Sensitivity Analysis - Overdredge (Low Overdredge Factor [1.5])**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$620,250	$10,912,000	$77,745,750	$0	$0	$0	$0	$89,278,000	1.0000	$89,278,000
1	$620,250	$0	$77,745,750	$0	$0	$0	$0	$78,366,000	0.9346	$73,240,864
2	$620,250	$0	$77,745,750	$0	$26,744,000	$0	$0	$105,110,000	0.8734	$91,803,074
3	$620,250	$0	$77,745,750	$0	$0	$0	$0	$78,366,000	0.8163	$63,970,166
4	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.7629	$20,402,998
5	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.7130	$2,719,382
6	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.6663	$17,819,527
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.5820	$15,565,008
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.5083	$15,532,631
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.3878	$10,371,323
15	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.3624	$1,382,194
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2959	$7,913,550
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.2584	$985,538
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2257	$6,036,121
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.1842	$702,539
26	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.1722	$4,605,317
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.1314	$4,015,321
TOTALS:	$2,481,000	$10,912,000	$310,983,000	$0	$267,440,000	$21,036,000	$1,848,000	$614,700,000		$426,343,553
TOTAL PRESENT VALUE OF ALTERNATIVE B[5]										**$426,340,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-B.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-B

PRESENT VALUE ANALYSIS

Alternative **B Sensitivity Analysis - Overdredge (High Overdredge Factor [2.0])**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$620,250	$10,912,000	$91,606,500	$0	$0	$0	$0	$103,138,750	1.0000	$103,138,750
1	$620,250	$0	$91,606,500	$0	$0	$0	$0	$92,226,750	0.9346	$86,195,121
2	$620,250	$0	$91,606,500	$0	$26,744,000	$0	$0	$118,970,750	0.8734	$103,909,053
3	$620,250	$0	$91,606,500	$0	$0	$0	$0	$92,226,750	0.8163	$75,284,696
4	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.7629	$20,402,998
5	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.7130	$2,719,382
6	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.6663	$17,819,527
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.5820	$15,565,008
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.5083	$15,532,631
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.3878	$10,371,323
15	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.3624	$1,382,194
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2959	$7,913,550
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.2584	$985,538
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.2257	$6,036,121
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$3,506,000	$308,000	$3,814,000	0.1842	$702,539
26	$0	$0	$0	$0	$26,744,000	$0	$0	$26,744,000	0.1722	$4,605,317
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$26,744,000	$3,506,000	$308,000	$30,558,000	0.1314	$4,015,321
TOTALS:	$2,481,000	$10,912,000	$366,426,000	$0	$267,440,000	$21,036,000	$1,848,000	$670,143,000		$476,579,069
TOTAL PRESENT VALUE OF ALTERNATIVE B[5]										**$476,580,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-B.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-B

Alternative **B Sensitivity Analysis - Overdredge**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 3)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-B2	1	LS	$2,016,443	$2,016,443	
SUBTOTAL					$2,016,443	
Contingency (Scope and Bid)		15%			$302,466	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,318,909	
Project Management		2%			$46,378	Percentage modified as documented in Attachment A
Remedial Design		2%			$46,378	Percentage modified as documented in Attachment A
Construction Management		3%			$69,567	Percentage modified as documented in Attachment A
TOTAL					$2,481,232	
TOTAL CAPITAL COST					**$2,481,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,641,756	
Contingency (Scope and Bid)		20%			$1,528,351	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,170,107	
Project Management		5%			$458,505	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$733,609	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$550,206	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,912,427	
TOTAL CAPITAL COST					**$10,912,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative B Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 3) - Low Overdredge Factor [1.5]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-B1	1	LS	$4,155,000	$4,155,000	
Transload Facility Development	CW-B21	1	LS	$7,967,890	$7,967,890	
Debris Removal and Disposal	CW-B5	202	AC	$13,107	$2,647,616	
Obstruction Removal and Relocation	CW-B6	1	LS	$3,907,503	$3,907,503	
Erosion/Residual Control Measures	CW-B7	1	LS	$22,320,235	$22,320,235	
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]	CW-B8E	440,435	CY	$24.53	$10,803,871	
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]	CW-B9E	54,036	CY	$31.10	$1,680,520	
Excavation of Riverbanks	CW-B10	50,769	CY	$5.19	$263,490	
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]	CW-B11E	1	LS	$2,246,838	$2,246,838	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]	CW-B12E	310,240	TON	$191	$59,162,359	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]	CW-B13E	605,481	TON	$111	$67,060,606	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-B14	15	AC	$1,070,827	$16,062,405	
Sand Placement for Technology Assignments	CW-B15	342,033	CY	$33.89	$11,591,596	
Beach Mix Placement for Technology Assignments	CW-B16	18,563	CY	$74.24	$1,378,163	
Armor Placement for Technology Assignments	CW-B17	29,533	CY	$72.42	$2,138,814	
Reactive/GAC Placement for Technology Assignments	CW-B18	1	LS	$27,488,372	$27,488,372	
Geofabric for Riverbanks	CW-B19	10.5	AC	$14,311	$150,268	
Organoclay Mat Placement for Technology Assignments	CW-B20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$242,198,585	
Contingency (Scope and Bid)		20%			$48,439,717	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$290,638,302	
Project Management		2%			$5,812,766	Percentage modified as documented in Attachment A
Remedial Design		2%			$5,812,766	Percentage modified as documented in Attachment A
Construction Management		3%			$8,719,149	Percentage modified as documented in Attachment A
TOTAL					$310,982,983	
TOTAL CAPITAL COST					**$310,983,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Overdredge**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 3) - High Overdredge Factor [2.0]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-B1	1	LS	$4,155,000	$4,155,000	
Transload Facility Development	CW-B21	1	LS	$7,967,890	$7,967,890	
Debris Removal and Disposal	CW-B5	202	AC	$13,107	$2,647,616	
Obstruction Removal and Relocation	CW-B6	1	LS	$3,907,503	$3,907,503	
Erosion/Residual Control Measures	CW-B7	1	LS	$22,320,235	$22,320,235	
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]	CW-B8F	587,246	CY	$24.53	$14,405,144	
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]	CW-B9F	72,048	CY	$31.10	$2,240,693	
Excavation of Riverbanks	CW-B10	50,769	CY	$5.19	$263,490	
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]	CW-B11F	1	LS	$2,946,262	$2,946,262	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]	CW-B12F	407,533	TON	$191	$77,908,134	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]	CW-B13F	782,205	TON	$111	$86,633,992	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-B14	15	AC	$1,070,827	$16,062,405	
Sand Placement for Technology Assignments	CW-B15	342,033	CY	$33.89	$11,591,596	
Beach Mix Placement for Technology Assignments	CW-B16	18,563	CY	$74.24	$1,378,163	
Armor Placement for Technology Assignments	CW-B17	29,533	CY	$72.42	$2,138,814	
Reactive/GAC Placement for Technology Assignments	CW-B18	1	LS	$27,488,372	$27,488,372	
Geofabric for Riverbanks	CW-B19	10.5	AC	$14,311	$150,268	
Organoclay Mat Placement for Technology Assignments	CW-B20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$285,378,616	
Contingency (Scope and Bid)		20%			$57,075,723	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$342,454,339	
Project Management		2%			$6,849,087	Percentage modified as documented in Attachment A
Remedial Design		2%			$6,849,087	Percentage modified as documented in Attachment A
Construction Management		3%			$10,273,630	Percentage modified as documented in Attachment A
TOTAL					$366,426,143	
TOTAL CAPITAL COST					**$366,426,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative B Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-B22	2,073	AC	$3,686	$7,641,756	
Site-Wide Monitoring	CW-B23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-B24	1	LS	$12,228,875	$12,228,875	
SUBTOTAL					$20,828,290	
Contingency (Scope and Bid)		20%			$4,165,658	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$24,993,948	
Project Management		2%			$499,879	Percentage modified as documented in Attachment A
Technical Support		5%			$1,249,697	Percentage modified as documented in Attachment A
TOTAL					$26,743,524	
TOTAL PERIODIC COST					**$26,744,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-B25	1	LS	$2,230,955	$2,230,955	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$2,230,955	
Contingency (Scope and Bid)		20%			$446,191	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,677,146	
Project Management		5%			$133,857	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$267,715	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$3,078,718	
TOTAL PERIODIC COST					**$3,079,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-B

Alternative **B Sensitivity Analysis - Overdredge**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR).Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-B3	1	LS	$337,883	$337,883	
SUBTOTAL					$337,883	
Contingency (Scope and Bid)		10%			$33,788	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$371,671	
Project Management		5%			$18,584	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$37,167	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$427,422	
TOTAL PERIODIC COST					**$427,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-B26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-D

PRESENT VALUE ANALYSIS

Alternative **D Sensitivity Analysis - Overdredge (Low Overdredge Factor [1.5])**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$517,500	$10,481,000	$82,386,167	$0	$0	$0	$0	$93,384,667	1.0000	$93,384,667
1	$517,500	$0	$82,386,167	$0	$0	$0	$0	$82,903,667	0.9346	$77,481,767
2	$517,500	$0	$82,386,167	$0	$36,374,000	$0	$0	$119,277,667	0.8734	$104,177,114
3	$517,500	$0	$82,386,167	$0	$0	$0	$0	$82,903,667	0.8163	$67,674,263
4	$517,500	$0	$82,386,167	$0	$36,374,000	$0	$0	$119,277,667	0.7629	$90,996,932
5	$517,500	$0	$82,386,167	$0	$0	$5,240,000	$308,000	$88,451,667	0.7130	$63,066,039
6	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.6663	$24,235,996
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.5820	$21,169,668
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.5083	$21,308,953
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.3878	$14,105,837
15	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.3624	$2,010,595
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2959	$10,763,067
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.2584	$1,433,603
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2257	$8,209,612
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.1842	$1,021,942
26	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.1722	$6,263,603
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.1314	$5,508,551
TOTALS:	$3,105,000	$10,481,000	$494,317,000	$0	$363,740,000	$31,440,000	$1,848,000	$904,931,000		$612,812,209
TOTAL PRESENT VALUE OF ALTERNATIVE D[5]										**$612,810,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-D.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-D

PRESENT VALUE ANALYSIS

Alternative **D Sensitivity Analysis - Overdredge (High Overdredge Factor [2.0])**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$517,500	$10,481,000	$98,419,333	$0	$0	$0	$0	$109,417,833	1.0000	$109,417,833
1	$517,500	$0	$98,419,333	$0	$0	$0	$0	$98,936,833	0.9346	$92,466,364
2	$517,500	$0	$98,419,333	$0	$36,374,000	$0	$0	$135,310,833	0.8734	$118,180,482
3	$517,500	$0	$98,419,333	$0	$0	$0	$0	$98,936,833	0.8163	$80,762,137
4	$517,500	$0	$98,419,333	$0	$36,374,000	$0	$0	$135,310,833	0.7629	$103,228,634
5	$517,500	$0	$98,419,333	$0	$0	$5,240,000	$308,000	$104,484,833	0.7130	$74,497,686
6	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.6663	$24,235,996
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.5820	$21,169,668
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.5083	$21,308,953
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.3878	$14,105,837
15	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.3624	$2,010,595
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2959	$10,763,067
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.2584	$1,433,603
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.2257	$8,209,612
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,240,000	$308,000	$5,548,000	0.1842	$1,021,942
26	$0	$0	$0	$0	$36,374,000	$0	$0	$36,374,000	0.1722	$6,263,603
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$36,374,000	$5,240,000	$308,000	$41,922,000	0.1314	$5,508,551
TOTALS:	$3,105,000	$10,481,000	$590,516,000	$0	$363,740,000	$31,440,000	$1,848,000	$1,001,130,000		$694,584,563
TOTAL PRESENT VALUE OF ALTERNATIVE D[5]										**$694,580,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-D.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-D

Alternative D Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 5)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-D2	1	LS	$2,523,020	$2,523,020	
SUBTOTAL					$2,523,020	
Contingency (Scope and Bid)		15%			$378,453	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$2,901,473	
Project Management		2%			$58,029	Percentage modified as documented in Attachment A
Remedial Design		2%			$58,029	Percentage modified as documented in Attachment A
Construction Management		3%			$87,044	Percentage modified as documented in Attachment A
TOTAL					$3,104,575	
TOTAL CAPITAL COST					**$3,105,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,339,477	
Contingency (Scope and Bid)		20%			$1,467,895	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,807,372	
Project Management		5%			$440,369	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$704,590	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$528,442	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,480,773	
TOTAL CAPITAL COST					**$10,481,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 5) - Low Overdredge Factor [1.5]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-D1	1	LS	$6,653,000	$6,653,000	
Transload Facility Development	CW-D21	1	LS	$9,675,295	$9,675,295	
Debris Removal and Disposal	CW-D5	268	AC	$13,107	$3,512,679	
Obstruction Removal and Relocation	CW-D6	1	LS	$6,933,407	$6,933,407	
Erosion/Residual Control Measures	CW-D7	1	LS	$23,531,760	$23,531,760	
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]	CW-D8E	887,640	CY	$24.53	$21,773,809	
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]	CW-D9E	62,114	CY	$31.10	$1,931,745	
Excavation of Riverbanks	CW-D10	73,192	CY	$5.19	$379,864	
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]	CW-D11E	1	LS	$4,251,575	$4,251,575	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]	CW-D12E	310,240	TON	$191	$59,162,359	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]	CW-D13E	1,387,325	TON	$111	$153,654,671	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-D14	25	AC	$1,070,827	$26,770,675	
Sand Placement for Technology Assignments	CW-D15	475,860	CY	$33.82	$16,095,462	
Beach Mix Placement for Technology Assignments	CW-D16	32,441	CY	$73.59	$2,387,358	
Armor Placement for Technology Assignments	CW-D17	53,344	CY	$72.06	$3,844,036	
Reactive/GAC Placement for Technology Assignments	CW-D18	1	LS	$43,035,063	$43,035,063	
Geofabric for Riverbanks	CW-D19	15.1	AC	$14,311	$216,100	
Organoclay Mat Placement for Technology Assignments	CW-D20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$384,981,897	
Contingency (Scope and Bid)		20%			$76,996,379	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$461,978,276	
Project Management		2%			$9,239,566	Percentage modified as documented in Attachment A
Remedial Design		2%			$9,239,566	Percentage modified as documented in Attachment A
Construction Management		3%			$13,859,348	Percentage modified as documented in Attachment A
TOTAL					$494,316,756	
TOTAL CAPITAL COST					**$494,317,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 5) - High Overdredge Factor [2.0]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-D1	1	LS	$6,653,000	$6,653,000	
Transload Facility Development	CW-D21	1	LS	$9,675,295	$9,675,295	
Debris Removal and Disposal	CW-D5	268	AC	$13,107	$3,512,679	
Obstruction Removal and Relocation	CW-D6	1	LS	$6,933,407	$6,933,407	
Erosion/Residual Control Measures	CW-D7	1	LS	$23,531,760	$23,531,760	
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]	CW-D8F	1,183,520	CY	$24.53	$29,031,746	
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]	CW-D9F	82,818	CY	$31.10	$2,575,640	
Excavation of Riverbanks	CW-D10	73,192	CY	$5.19	$379,864	
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]	CW-D11F	1	LS	$5,596,288	$5,596,288	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]	CW-D12F	407,533	TON	$191	$77,908,134	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]	CW-D13F	1,811,040	TON	$111	$200,583,706	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-D14	25	AC	$1,070,827	$26,770,675	
Sand Placement for Technology Assignments	CW-D15	475,860	CY	$33.82	$16,095,462	
Beach Mix Placement for Technology Assignments	CW-D16	32,441	CY	$73.59	$2,387,358	
Armor Placement for Technology Assignments	CW-D17	53,344	CY	$72.06	$3,844,036	
Reactive/GAC Placement for Technology Assignments	CW-D18	1	LS	$43,035,063	$43,035,063	
Geofabric for Riverbanks	CW-D19	15.1	AC	$14,311	$216,100	
Organoclay Mat Placement for Technology Assignments	CW-D20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$459,903,252	
Contingency (Scope and Bid)		20%			$91,980,650	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$551,883,902	
Project Management		2%			$11,037,678	Percentage modified as documented in Attachment A
Remedial Design		2%			$11,037,678	Percentage modified as documented in Attachment A
Construction Management		3%			$16,556,517	Percentage modified as documented in Attachment A
TOTAL					$590,515,775	
TOTAL CAPITAL COST					**$590,516,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-D22	1,991	AC	$3,686	$7,339,477	
Site-Wide Monitoring	CW-D23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-D24	1	LS	$20,031,523	$20,031,523	
SUBTOTAL					$28,328,659	
Contingency (Scope and Bid)		20%			$5,665,732	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$33,994,391	
Project Management		2%			$679,888	Percentage modified as documented in Attachment A
Technical Support		5%			$1,699,720	Percentage modified as documented in Attachment A
TOTAL					$36,373,999	
TOTAL PERIODIC COST					**$36,374,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-D25	1	LS	$3,391,669	$3,391,669	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,391,669	
Contingency (Scope and Bid)		20%			$678,334	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,070,003	
Project Management		5%			$203,500	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$407,000	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$4,680,503	
TOTAL PERIODIC COST					**$4,681,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-D

Alternative D Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-D3	1	LS	$441,761	$441,761	
SUBTOTAL					$441,761	
Contingency (Scope and Bid)		10%			$44,176	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$485,937	
Project Management		5%			$24,297	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$48,594	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$558,828	
TOTAL PERIODIC COST					**$559,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-D26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-E

PRESENT VALUE ANALYSIS

Alternative **E Sensitivity Analysis - Overdredge (Low Overdredge Factor [1.5])**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$524,714	$9,991,000	$104,890,429	$0	$0	$0	$0	$115,406,143	1.0000	$115,406,143
1	$524,714	$0	$104,890,429	$0	$0	$0	$0	$105,415,143	0.9346	$98,520,993
2	$524,714	$0	$104,890,429	$0	$37,467,000	$0	$0	$142,882,143	0.8734	$124,793,264
3	$524,714	$0	$104,890,429	$0	$0	$0	$0	$105,415,143	0.8163	$86,050,381
4	$524,714	$0	$104,890,429	$0	$37,467,000	$0	$0	$142,882,143	0.7629	$109,004,787
5	$524,714	$0	$104,890,429	$0	$0	$5,969,000	$308,000	$111,692,143	0.7130	$79,636,498
6	$524,714	$0	$104,890,429	$0	$37,467,000	$0	$0	$142,882,143	0.6663	$95,202,372
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.5820	$21,805,794
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.5083	$22,235,075
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.3878	$14,529,703
15	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.3624	$2,274,785
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2959	$11,086,485
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.2584	$1,621,977
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2257	$8,456,302
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.1842	$1,156,223
26	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.1722	$6,451,817
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.1314	$5,747,962
TOTALS:	$3,673,000	$9,991,000	$734,233,000	$0	$374,670,000	$35,814,000	$1,848,000	$1,160,229,000		$803,980,561
TOTAL PRESENT VALUE OF ALTERNATIVE E[5]										**$803,980,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-E.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-E

PRESENT VALUE ANALYSIS

Alternative **E Sensitivity Analysis - Overdredge (High Overdredge Factor [2.0])**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$524,714	$9,991,000	$127,623,857	$0	$0	$0	$0	$138,139,571	1.0000	$138,139,571
1	$524,714	$0	$127,623,857	$0	$0	$0	$0	$128,148,571	0.9346	$119,767,654
2	$524,714	$0	$127,623,857	$0	$37,467,000	$0	$0	$165,615,571	0.8734	$144,648,640
3	$524,714	$0	$127,623,857	$0	$0	$0	$0	$128,148,571	0.8163	$104,607,679
4	$524,714	$0	$127,623,857	$0	$37,467,000	$0	$0	$165,615,571	0.7629	$126,348,119
5	$524,714	$0	$127,623,857	$0	$0	$5,969,000	$308,000	$134,425,571	0.7130	$95,845,432
6	$524,714	$0	$127,623,857	$0	$37,467,000	$0	$0	$165,615,571	0.6663	$110,349,655
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.5820	$21,805,794
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.5083	$22,235,075
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.3878	$14,529,703
15	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.3624	$2,274,785
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2959	$11,086,485
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.2584	$1,621,977
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.2257	$8,456,302
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,969,000	$308,000	$6,277,000	0.1842	$1,156,223
26	$0	$0	$0	$0	$37,467,000	$0	$0	$37,467,000	0.1722	$6,451,817
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$37,467,000	$5,969,000	$308,000	$43,744,000	0.1314	$5,747,962
TOTALS:	$3,673,000	$9,991,000	$893,367,000	$0	$374,670,000	$35,814,000	$1,848,000	$1,319,363,000		$935,072,873
TOTAL PRESENT VALUE OF ALTERNATIVE E[5]										**$935,070,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-E.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-E

Alternative E Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-E2	1	LS	$2,985,246	$2,985,246	
SUBTOTAL					$2,985,246	
Contingency (Scope and Bid)		15%			$447,787	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$3,433,033	
Project Management		2%			$68,661	Percentage modified as documented in Attachment A
Remedial Design		2%			$68,661	Percentage modified as documented in Attachment A
Construction Management		3%			$102,991	Percentage modified as documented in Attachment A
TOTAL					$3,673,346	
TOTAL CAPITAL COST					**$3,673,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,996,648	
Contingency (Scope and Bid)		20%			$1,399,330	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,395,978	
Project Management		5%			$419,799	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$671,678	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$503,759	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$9,991,214	
TOTAL CAPITAL COST					**$9,991,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6) - Low Overdredge Factor [1.5]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-E1	1	LS	$9,982,000	$9,982,000	
Transload Facility Development	CW-E21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-E5	330	AC	$13,107	$4,325,313	
Obstruction Removal and Relocation	CW-E6	1	LS	$15,701,434	$15,701,434	
Erosion/Residual Control Measures	CW-E7	1	LS	$24,743,285	$24,743,285	
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]	CW-E8E	1,573,304	CY	$24.53	$38,593,147	
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]	CW-E9E	79,385	CY	$31.10	$2,468,874	
Excavation of Riverbanks	CW-E10	96,086	CY	$5.19	$498,687	
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]	CW-E11E	1	LS	$7,274,261	$7,274,261	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]	CW-E12E	310,240	TON	$191	$59,162,359	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]	CW-E13E	2,573,085	TON	$111	$284,984,832	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-E14	35	AC	$1,070,827	$37,478,945	
Sand Placement for Technology Assignments	CW-E15	665,248	CY	$33.73	$22,437,471	
Beach Mix Placement for Technology Assignments	CW-E16	48,189	CY	$73.34	$3,534,049	
Armor Placement for Technology Assignments	CW-E17	79,256	CY	$72.14	$5,717,178	
Reactive/GAC Placement for Technology Assignments	CW-E18	1	LS	$42,943,721	$42,943,721	
Geofabric for Riverbanks	CW-E19	19.9	AC	$14,311	$284,794	
Organoclay Mat Placement for Technology Assignments	CW-E20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$571,832,387	
Contingency (Scope and Bid)		20%			$114,366,477	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$686,198,864	
Project Management		2%			$13,723,977	Percentage modified as documented in Attachment A
Remedial Design		2%			$13,723,977	Percentage modified as documented in Attachment A
Construction Management		3%			$20,585,966	Percentage modified as documented in Attachment A
TOTAL					$734,232,784	
TOTAL CAPITAL COST					**$734,233,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 6) - High Overdredge Factor [2.0]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-E1	1	LS	$9,982,000	$9,982,000	
Transload Facility Development	CW-E21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-E5	330	AC	$13,107	$4,325,313	
Obstruction Removal and Relocation	CW-E6	1	LS	$15,701,434	$15,701,434	
Erosion/Residual Control Measures	CW-E7	1	LS	$24,743,285	$24,743,285	
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]	CW-E8F	2,097,738	CY	$24.53	$51,457,513	
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]	CW-E9F	105,846	CY	$31.10	$3,291,811	
Excavation of Riverbanks	CW-E10	96,086	CY	$5.19	$498,687	
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]	CW-E11F	1	LS	$9,612,893	$9,612,893	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]	CW-E12F	407,533	TON	$191	$77,908,134	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]	CW-E13F	3,378,141	TON	$111	$374,149,668	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-E14	35	AC	$1,070,827	$37,478,945	
Sand Placement for Technology Assignments	CW-E15	665,248	CY	$33.73	$22,437,471	
Beach Mix Placement for Technology Assignments	CW-E16	48,189	CY	$73.34	$3,534,049	
Armor Placement for Technology Assignments	CW-E17	79,256	CY	$72.14	$5,717,178	
Reactive/GAC Placement for Technology Assignments	CW-E18	1	LS	$42,943,721	$42,943,721	
Geofabric for Riverbanks	CW-E19	19.9	AC	$14,311	$284,794	
Organoclay Mat Placement for Technology Assignments	CW-E20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$695,768,933	
Contingency (Scope and Bid)		20%			$139,153,787	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$834,922,720	
Project Management		2%			$16,698,454	Percentage modified as documented in Attachment A
Remedial Design		2%			$16,698,454	Percentage modified as documented in Attachment A
Construction Management		3%			$25,047,682	Percentage modified as documented in Attachment A
TOTAL					$893,367,310	
TOTAL CAPITAL COST					**$893,367,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-E22	1,898	AC	$3,686	$6,996,648	
Site-Wide Monitoring	CW-E23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-E24	1	LS	$21,225,951	$21,225,951	
SUBTOTAL					$29,180,258	
Contingency (Scope and Bid)		20%			$5,836,052	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,016,310	
Project Management		2%			$700,326	Percentage modified as documented in Attachment A
Technical Support		5%			$1,750,816	Percentage modified as documented in Attachment A
TOTAL					$37,467,452	
TOTAL PERIODIC COST					**$37,467,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-E25	1	LS	$3,865,618	$3,865,618	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,865,618	
Contingency (Scope and Bid)		20%			$773,124	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,638,742	
Project Management		5%			$231,937	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,874	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,334,553	
TOTAL PERIODIC COST					**$5,335,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-E

Alternative E Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-E3	1	LS	$501,289	$501,289	
SUBTOTAL					$501,289	
Contingency (Scope and Bid)		10%			$50,129	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$551,418	
Project Management		5%			$27,571	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,142	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$634,131	
TOTAL PERIODIC COST					**$634,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-E26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-F

PRESENT VALUE ANALYSIS

Alternative **F Sensitivity Analysis - Overdredge (Low Overdredge Factor [1.5])**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$353,000	$8,749,000	$110,714,462	$0	$0	$0	$0	$119,816,462	1.0000	$119,816,462
1	$353,000	$0	$110,714,462	$0	$0	$0	$0	$111,067,462	0.9346	$103,803,650
2	$353,000	$0	$110,714,462	$0	$49,499,000	$0	$0	$160,566,462	0.8734	$140,238,748
3	$353,000	$0	$110,714,462	$0	$0	$0	$0	$111,067,462	0.8163	$90,664,369
4	$353,000	$0	$110,714,462	$0	$49,499,000	$0	$0	$160,566,462	0.7629	$122,496,154
5	$353,000	$0	$110,714,462	$0	$0	$8,779,000	$308,000	$120,154,462	0.7130	$85,670,131
6	$353,000	$0	$110,714,462	$0	$49,499,000	$0	$0	$160,566,462	0.6663	$106,985,434
7	$353,000	$0	$110,714,462	$0	$0	$0	$0	$111,067,462	0.6227	$69,161,709
8	$353,000	$0	$110,714,462	$0	$49,499,000	$0	$0	$160,566,462	0.5820	$93,449,681
9	$353,000	$0	$110,714,462	$0	$0	$0	$0	$111,067,462	0.5439	$60,409,593
10	$353,000	$0	$110,714,462	$0	$49,499,000	$8,779,000	$308,000	$169,653,462	0.5083	$86,234,855
11	$353,000	$0	$110,714,462	$0	$0	$0	$0	$111,067,462	0.4751	$52,768,151
12	$353,000	$0	$110,714,462	$0	$0	$0	$0	$111,067,462	0.4440	$49,313,953
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.3878	$19,195,712
15	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.3624	$3,293,129
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2959	$14,646,754
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.2584	$2,348,081
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2257	$11,171,924
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.1842	$1,673,825
26	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.1722	$8,523,728
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.1314	$7,698,200
TOTALS:	$4,589,000	$8,749,000	$1,439,288,000	$0	$494,990,000	$52,674,000	$1,848,000	$2,002,138,000		$1,249,564,243
TOTAL PRESENT VALUE OF ALTERNATIVE F[5]										**$1,249,560,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-F.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-F

PRESENT VALUE ANALYSIS

Alternative **F Sensitivity Analysis - Overdredge (High Overdredge Factor [2.0])**

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$353,000	$8,749,000	$137,911,538	$0	$0	$0	$0	$147,013,538	1.0000	$147,013,538
1	$353,000	$0	$137,911,538	$0	$0	$0	$0	$138,264,538	0.9346	$129,222,037
2	$353,000	$0	$137,911,538	$0	$49,499,000	$0	$0	$187,763,538	0.8734	$163,992,674
3	$353,000	$0	$137,911,538	$0	$0	$0	$0	$138,264,538	0.8163	$112,865,342
4	$353,000	$0	$137,911,538	$0	$49,499,000	$0	$0	$187,763,538	0.7629	$143,244,803
5	$353,000	$0	$137,911,538	$0	$0	$8,779,000	$308,000	$147,351,538	0.7130	$105,061,647
6	$353,000	$0	$137,911,538	$0	$49,499,000	$0	$0	$187,763,538	0.6663	$125,106,845
7	$353,000	$0	$137,911,538	$0	$0	$0	$0	$138,264,538	0.6227	$86,097,328
8	$353,000	$0	$137,911,538	$0	$49,499,000	$0	$0	$187,763,538	0.5820	$109,278,379
9	$353,000	$0	$137,911,538	$0	$0	$0	$0	$138,264,538	0.5439	$75,202,082
10	$353,000	$0	$137,911,538	$0	$49,499,000	$8,779,000	$308,000	$196,850,538	0.5083	$100,059,128
11	$353,000	$0	$137,911,538	$0	$0	$0	$0	$138,264,538	0.4751	$65,689,482
12	$353,000	$0	$137,911,538	$0	$0	$0	$0	$138,264,538	0.4440	$61,389,455
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.3878	$19,195,712
15	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.3624	$3,293,129
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2959	$14,646,754
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.2584	$2,348,081
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.2257	$11,171,924
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$8,779,000	$308,000	$9,087,000	0.1842	$1,673,825
26	$0	$0	$0	$0	$49,499,000	$0	$0	$49,499,000	0.1722	$8,523,728
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$49,499,000	$8,779,000	$308,000	$58,586,000	0.1314	$7,698,200
TOTALS:	$4,589,000	$8,749,000	$1,792,850,000	$0	$494,990,000	$52,674,000	$1,848,000	$2,355,700,000		$1,492,774,093
TOTAL PRESENT VALUE OF ALTERNATIVE F[5]										**$1,492,770,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-F.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-F

Alternative **F Sensitivity Analysis - Overdredge**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW-F2	1	LS	$3,728,996	$3,728,996	
SUBTOTAL					$3,728,996	
Contingency (Scope and Bid)		15%			$559,349	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$4,288,345	
Project Management		2%			$85,767	Percentage modified as documented in Attachment A
Remedial Design		2%			$85,767	Percentage modified as documented in Attachment A
Construction Management		3%			$128,650	Percentage modified as documented in Attachment A
TOTAL					$4,588,529	
TOTAL CAPITAL COST					**$4,589,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$6,126,675	
Contingency (Scope and Bid)		20%			$1,225,335	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$7,352,010	
Project Management		5%			$367,601	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$588,161	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$441,121	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$8,748,893	
TOTAL CAPITAL COST					**$8,749,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Overdredge**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 12) - Low Overdredge Factor [1.5]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-F1	1	LS	$19,821,000	$19,821,000	
Transload Facility Development	CW-F21	1	LS	$15,651,213	$15,651,213	
Debris Removal and Disposal	CW-F5	534	AC	$13,107	$6,999,143	
Obstruction Removal and Relocation	CW-F6	1	LS	$20,718,583	$20,718,583	
Erosion/Residual Control Measures	CW-F7	1	LS	$27,166,335	$27,166,335	
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]	CW-F8E	3,719,390	CY	$24.53	$91,236,637	
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]	CW-F9E	105,674	CY	$31.10	$3,286,461	
Excavation of Riverbanks	CW-F10	122,827	CY	$5.19	$637,472	
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]	CW-F11E	1	LS	$16,716,300	$16,716,300	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]	CW-F12E	310,240	TON	$191	$59,162,359	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]	CW-F13E	6,157,368	TON	$111	$681,965,962	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-F14	60	AC	$1,070,827	$64,249,620	
Sand Placement for Technology Assignments	CW-F15	1,119,996	CY	$33.48	$37,494,727	
Beach Mix Placement for Technology Assignments	CW-F16	69,510	CY	$72.97	$5,071,863	
Armor Placement for Technology Assignments	CW-F17	151,909	CY	$71.97	$10,932,677	
Reactive/GAC Placement for Technology Assignments	CW-F18	1	LS	$58,294,110	$58,294,110	
Geofabric for Riverbanks	CW-F19	25.4	AC	$14,311	$363,505	
Organoclay Mat Placement for Technology Assignments	CW-F20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,120,941,006	
Contingency (Scope and Bid)		20%			$224,188,201	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$1,345,129,207	
Project Management		2%			$26,902,584	Percentage modified as documented in Attachment A
Remedial Design		2%			$26,902,584	Percentage modified as documented in Attachment A
Construction Management		3%			$40,353,876	Percentage modified as documented in Attachment A
TOTAL					$1,439,288,251	
TOTAL CAPITAL COST					**$1,439,288,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Overdredge**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 12) - High Overdredge Factor [2.0]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-F1	1	LS	$19,821,000	$19,821,000	
Transload Facility Development	CW-F21	1	LS	$15,651,213	$15,651,213	
Debris Removal and Disposal	CW-F5	534	AC	$13,107	$6,999,143	
Obstruction Removal and Relocation	CW-F6	1	LS	$20,718,583	$20,718,583	
Erosion/Residual Control Measures	CW-F7	1	LS	$27,166,335	$27,166,335	
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]	CW-F8F	4,959,186	CY	$24.53	$121,648,833	
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]	CW-F9F	140,898	CY	$31.10	$4,381,928	
Excavation of Riverbanks	CW-F10	122,827	CY	$5.19	$637,472	
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]	CW-F11F	1	LS	$22,129,800	$22,129,800	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]	CW-F12F	407,533	TON	$191	$77,908,134	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]	CW-F13F	8,140,938	TON	$111	$901,658,438	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-F14	60	AC	$1,070,827	$64,249,620	
Sand Placement for Technology Assignments	CW-F15	1,119,996	CY	$33.48	$37,494,727	
Beach Mix Placement for Technology Assignments	CW-F16	69,510	CY	$72.97	$5,071,863	
Armor Placement for Technology Assignments	CW-F17	151,909	CY	$71.97	$10,932,677	
Reactive/GAC Placement for Technology Assignments	CW-F18	1	LS	$58,294,110	$58,294,110	
Geofabric for Riverbanks	CW-F19	25.4	AC	$14,311	$363,505	
Organoclay Mat Placement for Technology Assignments	CW-F20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,396,300,420	
Contingency (Scope and Bid)		20%			$279,260,084	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$1,675,560,504	
Project Management		2%			$33,511,210	Percentage modified as documented in Attachment A
Remedial Design		2%			$33,511,210	Percentage modified as documented in Attachment A
Construction Management		3%			$50,266,815	Percentage modified as documented in Attachment A
TOTAL					$1,792,849,739	
TOTAL CAPITAL COST					**$1,792,850,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Overdredge**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-F22	1,662	AC	$3,686	$6,126,675	
Site-Wide Monitoring	CW-F23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-F24	1	LS	$31,466,392	$31,466,392	
SUBTOTAL					$38,550,726	
Contingency (Scope and Bid)		20%			$7,710,145	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$46,260,871	
Project Management		2%			$925,217	Percentage modified as documented in Attachment A
Technical Support		5%			$2,313,044	Percentage modified as documented in Attachment A
TOTAL					$49,499,132	
TOTAL PERIODIC COST					**$49,499,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-F25	1	LS	$5,757,416	$5,757,416	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs
SUBTOTAL					$5,757,416	
Contingency (Scope and Bid)		20%			$1,151,483	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,908,899	
Project Management		5%			$345,445	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$690,890	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$7,945,234	
TOTAL PERIODIC COST					**$7,945,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-F

Alternative **F Sensitivity Analysis - Overdredge**

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-F3	1	LS	$659,296	$659,296	
SUBTOTAL					$659,296	
Contingency (Scope and Bid)		10%			$65,930	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$725,226	
Project Management		5%			$36,261	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$72,523	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$834,010	
TOTAL PERIODIC COST					**$834,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-F26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-G

PRESENT VALUE ANALYSIS

Alternative G Sensitivity Analysis - Overdredge (Low Overdredge Factor [1.5])

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$264,579	$7,428,000	$116,005,789	$0	$0	$0	$0	$123,698,368	1.0000	$123,698,368
1	$264,579	$0	$116,005,789	$0	$0	$0	$0	$116,270,368	0.9346	$108,666,286
2	$264,579	$0	$116,005,789	$0	$63,513,000	$0	$0	$179,783,368	0.8734	$157,022,794
3	$264,579	$0	$116,005,789	$0	$0	$0	$0	$116,270,368	0.8163	$94,911,501
4	$264,579	$0	$116,005,789	$0	$63,513,000	$0	$0	$179,783,368	0.7629	$137,156,731
5	$264,579	$0	$116,005,789	$0	$0	$11,856,000	$308,000	$128,434,368	0.7130	$91,573,704
6	$264,579	$0	$116,005,789	$0	$63,513,000	$0	$0	$179,783,368	0.6663	$119,789,658
7	$264,579	$0	$116,005,789	$0	$0	$0	$0	$116,270,368	0.6227	$72,401,558
8	$264,579	$0	$116,005,789	$0	$63,513,000	$0	$0	$179,783,368	0.5820	$104,633,920
9	$264,579	$0	$116,005,789	$0	$0	$0	$0	$116,270,368	0.5439	$63,239,453
10	$264,579	$0	$116,005,789	$0	$63,513,000	$11,856,000	$308,000	$191,947,368	0.5083	$97,566,847
11	$264,579	$0	$116,005,789	$0	$0	$0	$0	$116,270,368	0.4751	$55,240,052
12	$264,579	$0	$116,005,789	$0	$0	$0	$0	$116,270,368	0.4440	$51,624,043
13	$264,579	$0	$116,005,789	$0	$0	$0	$0	$116,270,368	0.4150	$48,252,203
14	$264,579	$0	$116,005,789	$0	$63,513,000	$0	$0	$179,783,368	0.3878	$69,719,990
15	$264,579	$0	$116,005,789	$0	$0	$11,856,000	$308,000	$128,434,368	0.3624	$46,544,615
16	$264,579	$0	$116,005,789	$0	$0	$0	$0	$116,270,368	0.3387	$39,380,774
17	$264,579	$0	$116,005,789	$0	$0	$0	$0	$116,270,368	0.3166	$36,811,199
18	$264,579	$0	$116,005,789	$0	$63,513,000	$0	$0	$179,783,368	0.2959	$53,197,899
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.2584	$3,143,178
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.2257	$14,334,884
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.1842	$2,240,609
26	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.1722	$10,936,939
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.1314	$9,943,958
TOTALS:	$5,027,000	$7,428,000	$2,204,110,000	$0	$635,130,000	$71,136,000	$1,848,000	$2,924,679,000		$1,612,031,163
TOTAL PRESENT VALUE OF ALTERNATIVE G[5]										**$1,612,030,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-G.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-G

PRESENT VALUE ANALYSIS

Alternative G Sensitivity Analysis - Overdredge (High Overdredge Factor [2.0])

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (In-River Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$264,579	$7,428,000	$145,898,368	$0	$0	$0	$0	$153,590,947	1.0000	$153,590,947
1	$264,579	$0	$145,898,368	$0	$0	$0	$0	$146,162,947	0.9346	$136,603,890
2	$264,579	$0	$145,898,368	$0	$63,513,000	$0	$0	$209,675,947	0.8734	$183,130,972
3	$264,579	$0	$145,898,368	$0	$0	$0	$0	$146,162,947	0.8163	$119,312,814
4	$264,579	$0	$145,898,368	$0	$63,513,000	$0	$0	$209,675,947	0.7629	$159,961,780
5	$264,579	$0	$145,898,368	$0	$0	$11,856,000	$308,000	$158,326,947	0.7130	$112,887,113
6	$264,579	$0	$145,898,368	$0	$63,513,000	$0	$0	$209,675,947	0.6663	$139,707,083
7	$264,579	$0	$145,898,368	$0	$0	$0	$0	$146,162,947	0.6227	$91,015,667
8	$264,579	$0	$145,898,368	$0	$63,513,000	$0	$0	$209,675,947	0.5820	$122,031,401
9	$264,579	$0	$145,898,368	$0	$0	$0	$0	$146,162,947	0.5439	$79,498,027
10	$264,579	$0	$145,898,368	$0	$63,513,000	$11,856,000	$308,000	$221,839,947	0.5083	$112,761,245
11	$264,579	$0	$145,898,368	$0	$0	$0	$0	$146,162,947	0.4751	$69,442,016
12	$264,579	$0	$145,898,368	$0	$0	$0	$0	$146,162,947	0.4440	$64,896,348
13	$264,579	$0	$145,898,368	$0	$0	$0	$0	$146,162,947	0.4150	$60,657,623
14	$264,579	$0	$145,898,368	$0	$63,513,000	$0	$0	$209,675,947	0.3878	$81,312,332
15	$264,579	$0	$145,898,368	$0	$0	$11,856,000	$308,000	$158,326,947	0.3624	$57,377,686
16	$264,579	$0	$145,898,368	$0	$0	$0	$0	$146,162,947	0.3387	$49,505,390
17	$264,579	$0	$145,898,368	$0	$0	$0	$0	$146,162,947	0.3166	$46,275,189
18	$264,579	$0	$145,898,368	$0	$63,513,000	$0	$0	$209,675,947	0.2959	$62,043,113
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.2584	$3,143,178
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.2257	$14,334,884
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$11,856,000	$308,000	$12,164,000	0.1842	$2,240,609
26	$0	$0	$0	$0	$63,513,000	$0	$0	$63,513,000	0.1722	$10,936,939
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$63,513,000	$11,856,000	$308,000	$75,677,000	0.1314	$9,943,958
TOTALS:	$5,027,000	$7,428,000	$2,772,069,000	$0	$635,130,000	$71,136,000	$1,848,000	$3,492,638,000		$1,942,610,204
TOTAL PRESENT VALUE OF ALTERNATIVE G[5]										**$1,942,610,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-G.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-G

Alternative G Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 18)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-G2	1	LS	$4,084,988	$4,084,988	
SUBTOTAL					$4,084,988	
Contingency (Scope and Bid)		15%			$612,748	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$4,697,736	
Project Management		2%			$93,955	Percentage modified as documented in Attachment A
Remedial Design		2%			$93,955	Percentage modified as documented in Attachment A
Construction Management		3%			$140,932	Percentage modified as documented in Attachment A
TOTAL					$5,026,578	
TOTAL CAPITAL COST					**$5,027,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$5,201,407	
Contingency (Scope and Bid)		20%			$1,040,281	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,241,688	
Project Management		5%			$312,084	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$499,335	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$374,501	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$7,427,608	
TOTAL CAPITAL COST					**$7,428,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 18) - Low Overdredge Factor [1.5]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-G1	1	LS	$30,516,000	$30,516,000	
Transload Facility Development	CW-G21	1	LS	$20,773,428	$20,773,428	
Debris Removal and Disposal	CW-G5	776	AC	$13,107	$10,171,040	
Obstruction Removal and Relocation	CW-G6	1	LS	$22,638,241	$22,638,241	
Erosion/Residual Control Measures	CW-G7	1	LS	$28,135,555	$28,135,555	
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]	CW-G8E	6,094,598	CY	$24.53	$149,500,489	
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]	CW-G9E	126,251	CY	$31.10	$3,926,406	
Excavation of Riverbanks	CW-G10	138,942	CY	$5.19	$721,107	
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]	CW-G11E	1	LS	$27,108,949	$27,108,949	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]	CW-G12E	310,240	TON	$191	$59,162,359	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]	CW-G13E	10,085,882	TON	$111	$1,117,072,693	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-G14	86	AC	$1,070,827	$92,091,122	
Sand Placement for Technology Assignments	CW-G15	1,634,210	CY	$33.23	$54,304,680	
Beach Mix Placement for Technology Assignments	CW-G16	90,647	CY	$72.65	$6,585,212	
Armor Placement for Technology Assignments	CW-G17	245,586	CY	$71.57	$17,577,027	
Reactive/GAC Placement for Technology Assignments	CW-G18	1	LS	$74,728,183	$74,728,183	
Geofabric for Riverbanks	CW-G19	28.7	AC	$14,311	$410,732	
Organoclay Mat Placement for Technology Assignments	CW-G20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$1,716,596,262	
Contingency (Scope and Bid)		20%			$343,319,252	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,059,915,514	
Project Management		2%			$41,198,310	Percentage modified as documented in Attachment A
Remedial Design		2%			$41,198,310	Percentage modified as documented in Attachment A
Construction Management		3%			$61,797,465	Percentage modified as documented in Attachment A
TOTAL					$2,204,109,599	
TOTAL CAPITAL COST					**$2,204,110,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 18) - High Overdredge Factor [2.0]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-G1	1	LS	$30,516,000	$30,516,000	
Transload Facility Development	CW-G21	1	LS	$20,773,428	$20,773,428	
Debris Removal and Disposal	CW-G5	776	AC	$13,107	$10,171,040	
Obstruction Removal and Relocation	CW-G6	1	LS	$22,638,241	$22,638,241	
Erosion/Residual Control Measures	CW-G7	1	LS	$28,135,555	$28,135,555	
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]	CW-G8F	8,126,130	CY	$24.53	$199,333,969	
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]	CW-G9F	168,334	CY	$31.10	$5,235,187	
Excavation of Riverbanks	CW-G10	138,942	CY	$5.19	$721,107	
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]	CW-G11F	1	LS	$35,913,466	$35,913,466	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]	CW-G12F	407,533	TON	$191	$77,908,134	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]	CW-G13F	13,369,164	TON	$111	$1,480,716,220	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-G14	86	AC	$1,070,827	$92,091,122	
Sand Placement for Technology Assignments	CW-G15	1,634,210	CY	$33.23	$54,304,680	
Beach Mix Placement for Technology Assignments	CW-G16	90,647	CY	$72.65	$6,585,212	
Armor Placement for Technology Assignments	CW-G17	245,586	CY	$71.57	$17,577,027	
Reactive/GAC Placement for Technology Assignments	CW-G18	1	LS	$74,728,183	$74,728,183	
Geofabric for Riverbanks	CW-G19	28.7	AC	$14,311	$410,732	
Organoclay Mat Placement for Technology Assignments	CW-G20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$2,158,932,342	
Contingency (Scope and Bid)		20%			$431,786,468	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$2,590,718,810	
Project Management		2%			$51,814,376	Percentage modified as documented in Attachment A
Remedial Design		2%			$51,814,376	Percentage modified as documented in Attachment A
Construction Management		3%			$77,721,564	Percentage modified as documented in Attachment A
TOTAL					$2,772,069,126	
TOTAL CAPITAL COST					**$2,772,069,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-G22	1,411	AC	$3,686	$5,201,407	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-G23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-G24	1	LS	$43,306,076	$43,306,076	
SUBTOTAL					$49,465,142	
Contingency (Scope and Bid)		20%			$9,893,028	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$59,358,170	
Project Management		2%			$1,187,163	Percentage modified as documented in Attachment A
Technical Support		5%			$2,967,909	Percentage modified as documented in Attachment A
TOTAL					$63,513,242	
TOTAL PERIODIC COST					**$63,513,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-G25	1	LS	$7,862,382	$7,862,382	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$7,862,382	
Contingency (Scope and Bid)		20%			$1,572,476	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$9,434,858	
Project Management		5%			$471,743	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$943,486	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$10,850,087	
TOTAL PERIODIC COST					**$10,850,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-G

Alternative G Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, OR
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-G3	1	LS	$795,634	$795,634	
SUBTOTAL					$795,634	
Contingency (Scope and Bid)		10%			$79,563	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$875,197	
Project Management		5%			$43,760	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$87,520	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$1,006,477	
TOTAL PERIODIC COST					**$1,006,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-G26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

TABLE PV-I

PRESENT VALUE ANALYSIS

Alternative **I Sensitivity Analysis - Overdredge (Low Overdredge Factor [1.5])**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$532,286	$10,197,000	$96,149,857	$0	$0	$0	$0	$106,879,143	1.0000	$106,879,143
1	$532,286	$0	$96,149,857	$0	$0	$0	$0	$96,682,143	0.9346	$90,359,131
2	$532,286	$0	$96,149,857	$0	$38,426,000	$0	$0	$135,108,143	0.8734	$118,003,452
3	$532,286	$0	$96,149,857	$0	$0	$0	$0	$96,682,143	0.8163	$78,921,633
4	$532,286	$0	$96,149,857	$0	$38,426,000	$0	$0	$135,108,143	0.7629	$103,074,002
5	$532,286	$0	$96,149,857	$0	$0	$5,972,000	$308,000	$102,962,143	0.7130	$73,412,008
6	$532,286	$0	$96,149,857	$0	$38,426,000	$0	$0	$135,108,143	0.6663	$90,022,556
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.5820	$22,363,932
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.5083	$22,724,060
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.3878	$14,901,603
15	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.3624	$2,275,872
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2959	$11,370,253
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.2584	$1,622,752
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2257	$8,672,748
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.1842	$1,156,776
26	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.1722	$6,616,957
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.1314	$5,874,368
TOTALS:	$3,726,000	$10,197,000	$673,049,000	$0	$384,260,000	$35,832,000	$1,848,000	$1,108,912,000		$758,251,246
TOTAL PRESENT VALUE OF ALTERNATIVE I[5]										**$758,250,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-I.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-I

PRESENT VALUE ANALYSIS

Alternative **I Sensitivity Analysis - Overdredge (High Overdredge Factor [2.0])**

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Monitored Natural Recovery)[2]	Capital Costs (Technology Assignments)[2]	Annual O&M Costs	Periodic Costs (Long Term Monitoring and Monitored Natural Recovery)	Periodic Costs (Long Term Operations and Maintenance and Institutional Controls)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$532,286	$10,197,000	$114,546,000	$0	$0	$0	$0	$125,275,286	1.0000	$125,275,286
1	$532,286	$0	$114,546,000	$0	$0	$0	$0	$115,078,286	0.9346	$107,552,166
2	$532,286	$0	$114,546,000	$0	$38,426,000	$0	$0	$153,504,286	0.8734	$134,070,643
3	$532,286	$0	$114,546,000	$0	$0	$0	$0	$115,078,286	0.8163	$93,938,405
4	$532,286	$0	$114,546,000	$0	$38,426,000	$0	$0	$153,504,286	0.7629	$117,108,420
5	$532,286	$0	$114,546,000	$0	$0	$5,972,000	$308,000	$121,358,286	0.7130	$86,528,458
6	$532,286	$0	$114,546,000	$0	$38,426,000	$0	$0	$153,504,286	0.6663	$102,279,906
7	$0	$0	$0	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.5820	$22,363,932
9	$0	$0	$0	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.5083	$22,724,060
11	$0	$0	$0	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.3878	$14,901,603
15	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.3624	$2,275,872
16	$0	$0	$0	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2959	$11,370,253
19	$0	$0	$0	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.2584	$1,622,752
21	$0	$0	$0	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.2257	$8,672,748
23	$0	$0	$0	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	$5,972,000	$308,000	$6,280,000	0.1842	$1,156,776
26	$0	$0	$0	$0	$38,426,000	$0	$0	$38,426,000	0.1722	$6,616,957
27	$0	$0	$0	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$0	$0	$0	$38,426,000	$5,972,000	$308,000	$44,706,000	0.1314	$5,874,368
TOTALS:	$3,726,000	$10,197,000	$801,822,000	$0	$384,260,000	$35,832,000	$1,848,000	$1,237,685,000		$864,332,605
TOTAL PRESENT VALUE OF ALTERNATIVE I[5]										**$864,330,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since some contamination within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However the period of analysis was assumed to be 30 yrs beyond the construction in Year 0.

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-I.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-I

Alternative I Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 6)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Initial Establishment of Institutional Controls	CW-I2	1	LS	$3,028,033	$3,028,033	
SUBTOTAL					$3,028,033	
Contingency (Scope and Bid)		15%			$454,205	10% Scope, 5% Bid as documented in Attachment A.
SUBTOTAL					$3,482,238	
Project Management		2%			$69,645	Percentage modified as documented in Attachment A.
Remedial Design		2%			$69,645	Percentage modified as documented in Attachment A.
Construction Management		3%			$104,467	Percentage modified as documented in Attachment A.
TOTAL					$3,725,995	
TOTAL CAPITAL COST					**$3,726,000**	Total capital cost is rounded to the nearest $1,000.

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
SUBTOTAL					$7,140,415	
Contingency (Scope and Bid)		20%			$1,428,083	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,568,498	
Project Management		5%			$428,425	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Remedial Design		8%			$685,480	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		6%			$514,110	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
TOTAL					$10,196,513	
TOTAL CAPITAL COST					**$10,197,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL Construction COSTS: (Assumed to be Incurred During Years 0 through 6) - Low Overdredge Factor [1.5]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-I1	1	LS	$9,045,000	$9,045,000	
Transload Facility Development	CW-I21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-I5	292	AC	$13,107	$3,827,247	
Obstruction Removal and Relocation	CW-I6	1	LS	$15,146,379	$15,146,379	
Erosion/Residual Control Measures	CW-I7	1	LS	$25,227,895	$25,227,895	
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]	CW-I8E	1,334,228	CY	$24.53	$32,728,613	
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]	CW-I9E	79,844	CY	$31.10	$2,483,148	
Excavation of Riverbanks	CW-I10	102,624	CY	$5.19	$532,618	
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]	CW-I11E	1	LS	$6,260,854	$6,260,854	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]	CW-I12E	310,240	TON	$191	$59,162,359	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]	CW-I13E	2,196,651	TON	$111	$243,292,374	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-I14	34	AC	$1,070,827	$36,408,118	
Sand Placement for Technology Assignments	CW-I15	598,578	CY	$34.00	$20,353,254	
Beach Mix Placement for Technology Assignments	CW-I16	49,511	CY	$73.43	$3,635,422	
Armor Placement for Technology Assignments	CW-I17	80,297	CY	$72.27	$5,802,915	
Reactive/GAC Placement for Technology Assignments	CW-I18	1	LS	$44,759,377	$44,759,377	
Geofabric for Riverbanks	CW-I19	21.2	AC	$14,311	$303,398	
Organoclay Mat Placement for Technology Assignments	CW-I20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$520,671,008	
Contingency (Scope and Bid)		20%			$104,134,202	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$624,805,210	
Project Management		2%			$13,783,852	Percentage modified as documented in Attachment A.
Remedial Design		2%			$13,783,852	Percentage modified as documented in Attachment A.
Construction Management		3%			$20,675,777	Percentage modified as documented in Attachment A.
TOTAL					$673,048,691	
TOTAL CAPITAL COST					**$673,049,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL Construction COSTS: (Assumed to be Incurred During Years 0 through 6) - High Overdredge Factor [2.0]

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization / Demobilization	CW-I1	1	LS	$9,045,000	$9,045,000	
Transload Facility Development	CW-I21	1	LS	$10,528,998	$10,528,998	
Debris Removal and Disposal	CW-I5	292	AC	$13,107	$3,827,247	
Obstruction Removal and Relocation	CW-I6	1	LS	$15,146,379	$15,146,379	
Erosion/Residual Control Measures	CW-I7	1	LS	$25,227,895	$25,227,895	
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]	CW-I8F	1,778,970	CY	$24.53	$43,638,134	
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]	CW-I9F	106,458	CY	$31.10	$3,310,844	
Excavation of Riverbanks	CW-I10	102,624	CY	$5.19	$532,618	
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]	CW-I11F	1	LS	$8,261,684	$8,261,684	Includes collection and treatment of water from sediment dewatering during dredging operations
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]	CW-I12F	407,533	TON	$191	$77,908,134	Includes waste going to offsite Subtitle C/TSCA facility for disposal, including the volume of NRC/NAPL PTW that would require treatment
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]	CW-I13F	2,872,258	TON	$111	$318,119,978	Includes waste going to offsite Subtitle D facility for disposal without treatment, including the volume of non-PTW contaminated sediments/riverbank soils as well as the volume of highly toxic PTW
Mitigation	CW-I14	34	AC	$1,070,827	$36,408,118	
Sand Placement for Technology Assignments	CW-I15	598,578	CY	$34.00	$20,353,254	
Beach Mix Placement for Technology Assignments	CW-I16	49,511	CY	$73.43	$3,635,422	
Armor Placement for Technology Assignments	CW-I17	80,297	CY	$72.27	$5,802,915	
Reactive/GAC Placement for Technology Assignments	CW-I18	1	LS	$44,759,377	$44,759,377	
Geofabric for Riverbanks	CW-I19	21.2	AC	$14,311	$303,398	
Organoclay Mat Placement for Technology Assignments	CW-I20	174,300	SF	$6.73	$1,173,039	
SUBTOTAL					$627,982,434	
Contingency (Scope and Bid)		20%			$125,596,487	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$753,578,921	
Project Management		2%			$13,783,852	Percentage modified as documented in Attachment A.
Remedial Design		2%			$13,783,852	Percentage modified as documented in Attachment A.
Construction Management		3%			$20,675,777	Percentage modified as documented in Attachment A.
TOTAL					$801,822,402	
TOTAL CAPITAL COST					**$801,822,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10 and Every 4 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	CW-I22	1937	AC	$3,686	$7,140,415	Quantity represents dredge, MNR/ENR and in situ treatment areas.
Site-Wide Monitoring	CW-I23	1	LS	$957,659	$957,659	
Cap Area Monitoring and Reactive Layer Monitoring	CW-I24	1	LS	$21,828,717	$21,828,717	
SUBTOTAL					$29,926,791	
Contingency (Scope and Bid)		20%			$5,985,358	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$35,912,149	
Project Management		2%			$718,243	Percentage modified as documented in Attachment A.
Technical Support		5%			$1,795,607	Percentage modified as documented in Attachment A.
TOTAL					$38,425,999	
TOTAL PERIODIC COST					**$38,426,000**	Total periodic cost is rounded to the nearest $1,000.

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	CW-I25	1	LS	$3,862,654	$3,862,654	Assume 5% of placement of additional material for capping, ENR and In Situ Treatment. Includes mobilization and demobilization costs.
SUBTOTAL					$3,862,654	
Contingency (Scope and Bid)		20%			$772,531	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,635,185	
Project Management		5%			$231,759	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$463,519	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$5,330,463	
TOTAL PERIODIC COST					**$5,330,000**	Total periodic cost is rounded to the nearest $1,000.

TABLE CS-I

Alternative I Sensitivity Analysis - Overdredge

DETAILED COST ESTIMATE SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study (-30% to +50%)
Base Year: 2016
Date: 5/25/2016

Description: This alternative evaluates a remedy that would involve dredging of contaminated sediments, disposal of the remaining contaminated sediment at offsite facilities (Subtitle D and Subtitle C/TSCA), capping, enhanced natural recovery (ENR), in-situ treatment, and monitored natural recovery (MNR). Capital costs are based on Disposed Material Management (DMM) Scenario 2.

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CW-I3	1	LS	$507,467	$507,467	
SUBTOTAL					$507,467	
Contingency (Scope and Bid)		10%			$50,747	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$558,214	
Project Management		5%			$27,911	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$55,821	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$641,946	
TOTAL PERIODIC COST					**$642,000**	Total periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Year 5 and Every 5 Years through Period of Analysis)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review	CW-I26	1	LS	$243,687	$243,687	
SUBTOTAL					$243,687	
Contingency (Scope and Bid)		10%			$24,369	10% Scope, 0% Bid as documented in Attachment A.
SUBTOTAL					$268,056	
Project Management		5%			$13,403	Low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		10%			$26,806	Low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$308,265	
TOTAL PERIODIC COST					**$308,000**	Total periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Attachment A.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.
Red text indicates Cost Worksheets that are newly created for the Sensitivity Analysis. All other Cost Worksheets are the same as the Cost Worksheets from the base cost estimate and can be found in Appendix G.

Abbreviations:

AC	Acre
CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
SF	Square Foot
TON	Ton

Sensitivity Analysis

Cost Worksheets
Overdredge Scenarios

Note: Cost Worksheets presented herein are specific to the Overdredge Sensitivity Analysis Scenarios. All other Cost Worksheets are the same as the Cost Worksheets created for the base estimate, and can be found in Appendix G.

TABLE CW-B8E

Alternative B **Cost Worksheet:** **CW-B8E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - **Low Overdredge Factor [1.5]**

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**440,435**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$10,803,870.55	0%	0%	$10,803,871	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$10,803,871		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	440,435	CY	$10,803,871	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B9E

Alternative B **Cost Worksheet: CW-B9E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**54,036**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$1,680,519.60	0%	0%	$1,680,520	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$1,680,520		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	54,036	CY	$1,680,520	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B11E

Alternative B **Cost Worksheet: CW-B11E**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	4	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$146,400.00	0%	0%	$146,400	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	97	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$2,100,438.00	0%	0%	$2,100,438	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$2,246,838		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$2,246,838	$2,246,838

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B12E

Alternative B **Cost Worksheet: CW-B12E**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,583,961.16	0%	0%	$2,583,961	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,159,015.47	0%	0%	$3,159,015	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,834,877.25	0%	0%	$1,834,877	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$506,955.78	0%	0%	$506,956	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,634,483.78	0%	0%	$4,634,484	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,964	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,161,526.16	0%	0%	$1,161,526	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,616,070.00	5%	0%	$3,796,874	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$86,392.30	0%	0%	$86,392	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**245,374**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$21,148,785.06	1%	0%	$21,360,273	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$780,122.60	0%	0%	$780,123	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$953,737.00	0%	0%	$953,737	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$553,967.00	0%	0%	$553,967	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$153,054.80	0%	0%	$153,055	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,399,195.00	0%	0%	$1,399,195	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,885	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$517,516.90	0%	0%	$517,517	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$322,411.00	5%	0%	$338,532	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,702.79	0%	0%	$7,703	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,433,338.09	1%	0%	$3,467,671	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,158,209.59	1%	0%	$6,219,792	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,866**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,590,800.54	1%	0%	$5,646,709	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$59,162,359		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	310,240	TON	$59,162,359	$191

TABLE CW-B12E

Alternative B **Cost Worksheet: CW-B12E**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B13E

Alternative B **Cost Worksheet: CW-B13E**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	482,924	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$11,831,638.00	0%	0%	$11,831,638	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	28,832	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$3,054,462.08	0%	0%	$3,054,462	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	482,924	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$6,596,741.84	0%	0%	$6,596,742	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**605,481**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$45,126,498.93	1%	0%	$45,577,764	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
												TOTAL COST:			$67,060,606		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	605,481	TON	$67,060,606	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B8F

Alternative B **Cost Worksheet: CW-B8F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**587,246**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$14,405,144.38	0%	0%	$14,405,144	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$14,405,144		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	587,246	CY	$14,405,144	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B9F

Alternative B **Cost Worksheet:** **CW-B9F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**72,048**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$2,240,692.80	0%	0%	$2,240,693	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$2,240,693		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	72,048	CY	$2,240,693	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B11F

Alternative B **Cost Worksheet: CW-B11F**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	4	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$146,400.00	0%	0%	$146,400	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	129	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$2,799,862.20	0%	0%	$2,799,862	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$2,946,262		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$2,946,262	$2,946,262

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B12F

Alternative B **Cost Worksheet: CW-B12F**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,380,801.79	0%	0%	$3,380,802	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,133,191.06	0%	0%	$4,133,191	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,400,715.77	0%	0%	$2,400,716	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$663,290.54	0%	0%	$663,291	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,063,663.53	0%	0%	$6,063,664	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,345	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,519,709.30	0%	0%	$1,519,709	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,731,244.00	5%	0%	$4,967,806	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$113,035.16	0%	0%	$113,035	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**321,043**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$27,670,696.17	1%	0%	$27,947,403	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,040,249.98	0%	0%	$1,040,250	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,271,755.10	0%	0%	$1,271,755	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$738,684.10	0%	0%	$738,684	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$204,090.04	0%	0%	$204,090	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,865,748.50	0%	0%	$1,865,749	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,515	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$690,199.10	0%	0%	$690,199	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$429,722.00	5%	0%	$451,208	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,266.58	0%	0%	$10,267	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,332	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,577,784.12	1%	0%	$4,623,562	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,333	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,211,519.03	1%	0%	$8,293,634	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**86,490**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,454,573.10	1%	0%	$7,529,119	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
													TOTAL COST:		$77,908,134		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	407,533	TON	$77,908,134	$191

TABLE CW-B12F

Alternative B **Cost Worksheet: CW-B12F**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-B13F

Alternative B **Cost Worksheet: CW-B13F**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	623,879	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$15,285,035.50	0%	0%	$15,285,036	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	37,248	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$3,946,053.12	0%	0%	$3,946,053	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	623,879	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$8,522,187.14	0%	0%	$8,522,187	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**782,205**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$58,297,738.65	1%	0%	$58,880,716	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
												TOTAL COST:			$86,633,992		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	782,205	TON	$86,633,992	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity
EQUIP	Equipment
MATL	Material
HPF	HTRW Productivity Factor
ADJ LABOR	Adjusted Labor for HFP
ADJ EQUIP	Adjusted Equipment for HFP
UNMOD UC	Unmodified Unit Cost
UNMOD LIC	Unmodified Line Item Cost
UNBUR LIC	Unburdened Line Item Cost
PC OH	Prime Contractor Overhead
PC PF	Prime Contractor Profit
BUR LIC	Burdened Line Item Cost
AC	Acres
CLF	100 Linear Foot
CY	Cubic Yard
DY	Days
EA	Each
FTE	Full Time Equivalent
HR	Hours
LB	Pounds
LCY	Loose Cubic Yard
LF	Linear Foot
LS	Lump Sum
MO	Month
SF	Square Foot
SY	Square Yard
TON	Tons
YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D8E

Alternative D **Cost Worksheet:** **CW-D8E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**887,640**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$21,773,809.20	0%	0%	$21,773,809	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$21,773,809		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	887,640	CY	$21,773,809	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D9E

Alternative D **Cost Worksheet:** **CW-D9E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**62,114**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$1,931,745.40	0%	0%	$1,931,745	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$1,931,745		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	62,114	CY	$1,931,745	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D11E

Alternative D **Cost Worksheet: CW-D11E**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	6	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$219,600.00	0%	0%	$219,600	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	186	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$4,031,974.80	0%	0%	$4,031,975	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$4,251,575		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$4,251,575	$4,251,575

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D12E

Alternative D **Cost Worksheet: CW-D12E**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,583,961.16	0%	0%	$2,583,961	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,159,015.47	0%	0%	$3,159,015	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,834,877.25	0%	0%	$1,834,877	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$506,955.78	0%	0%	$506,956	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,634,483.78	0%	0%	$4,634,484	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,964	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,161,526.16	0%	0%	$1,161,526	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,616,070.00	5%	0%	$3,796,874	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$86,392.30	0%	0%	$86,392	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**245,374**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$21,148,785.06	1%	0%	$21,360,273	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$780,122.60	0%	0%	$780,123	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$953,737.00	0%	0%	$953,737	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$553,967.00	0%	0%	$553,967	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$153,054.80	0%	0%	$153,055	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,399,195.00	0%	0%	$1,399,195	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,885	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$517,516.90	0%	0%	$517,517	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$322,411.00	5%	0%	$338,532	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,702.79	0%	0%	$7,703	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,433,338.09	1%	0%	$3,467,671	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,158,209.59	1%	0%	$6,219,792	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,866**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,590,800.54	1%	0%	$5,646,709	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$59,162,359		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	310,240	TON	$59,162,359	$191

TABLE CW-D12E

Alternative D **Cost Worksheet: CW-D12E**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D13E

Alternative D **Cost Worksheet: CW-D13E**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	1,106,516	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$27,109,642.00	0%	0%	$27,109,642	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	66,063	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$6,998,714.22	0%	0%	$6,998,714	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	1,106,516	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$15,115,008.56	0%	0%	$15,115,009	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**1,387,325**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$103,397,332.25	1%	0%	$104,431,306	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$153,654,671		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1,387,325	TON	$153,654,671	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D8F

Alternative D **Cost Worksheet: CW-D8F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**1,183,520**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$29,031,745.60	0%	0%	$29,031,746	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$29,031,746		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1,183,520	CY	$29,031,746	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D9F

Alternative D **Cost Worksheet: CW-D9F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**82,818**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$2,575,639.80	0%	0%	$2,575,640	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$2,575,640		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	82,818	CY	$2,575,640	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D11F

Alternative D **Cost Worksheet: CW-D11F**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	6	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$219,600.00	0%	0%	$219,600	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	248	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$5,376,688.20	0%	0%	$5,376,688	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$5,596,288		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$5,596,288	$5,596,288

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D12F

Alternative D **Cost Worksheet: CW-D12F**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,380,801.79	0%	0%	$3,380,802	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,133,191.06	0%	0%	$4,133,191	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,400,715.77	0%	0%	$2,400,716	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$663,290.54	0%	0%	$663,291	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,063,663.53	0%	0%	$6,063,664	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,345	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,519,709.30	0%	0%	$1,519,709	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,731,244.00	5%	0%	$4,967,806	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$113,035.16	0%	0%	$113,035	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**321,043**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$27,670,696.17	1%	0%	$27,947,403	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,040,249.98	0%	0%	$1,040,250	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,271,755.10	0%	0%	$1,271,755	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$738,684.10	0%	0%	$738,684	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$204,090.04	0%	0%	$204,090	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,865,748.50	0%	0%	$1,865,749	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,515	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$690,199.10	0%	0%	$690,199	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$429,722.00	5%	0%	$451,208	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,266.58	0%	0%	$10,267	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,332	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,577,784.12	1%	0%	$4,623,562	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,333	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,211,519.03	1%	0%	$8,293,634	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**86,490**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,454,573.10	1%	0%	$7,529,119	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$77,908,134		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	407,533	TON	$77,908,134	$191

TABLE CW-D12F

Alternative D **Cost Worksheet: CW-D12F**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-D13F

Alternative D **Cost Worksheet: CW-D13F**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	1,444,467	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$35,389,441.50	0%	0%	$35,389,442	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	86,240	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$9,136,265.60	0%	0%	$9,136,266	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	1,444,467	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$19,731,419.22	0%	0%	$19,731,419	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**1,811,040**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$134,976,811.20	1%	0%	$136,326,579	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$200,583,706		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1,811,040	TON	$200,583,706	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E8E

Alternative E **Cost Worksheet:** **CW-E8E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**1,573,304**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$38,593,147.12	0%	0%	$38,593,147	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$38,593,147		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1,573,304	CY	$38,593,147	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E9E

Alternative E **Cost Worksheet:** **CW-E9E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**79,385**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$2,468,873.50	0%	0%	$2,468,874	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$2,468,874		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	79,385	CY	$2,468,874	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E11E

Alternative E **Cost Worksheet: CW-E11E**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	7	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$256,200.00	0%	0%	$256,200	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	324	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$7,018,061.40	0%	0%	$7,018,061	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$7,274,261		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$7,274,261	$7,274,261

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
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Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E12E

Alternative E **Cost Worksheet: CW-E12E**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,583,961.16	0%	0%	$2,583,961	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,159,015.47	0%	0%	$3,159,015	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,834,877.25	0%	0%	$1,834,877	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$506,955.78	0%	0%	$506,956	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,634,483.78	0%	0%	$4,634,484	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,964	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,161,526.16	0%	0%	$1,161,526	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,616,070.00	5%	0%	$3,796,874	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$86,392.30	0%	0%	$86,392	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**245,374**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$21,148,785.06	1%	0%	$21,360,273	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$780,122.60	0%	0%	$780,123	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$953,737.00	0%	0%	$953,737	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$553,967.00	0%	0%	$553,967	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$153,054.80	0%	0%	$153,055	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,399,195.00	0%	0%	$1,399,195	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,885	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$517,516.90	0%	0%	$517,517	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$322,411.00	5%	0%	$338,532	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,702.79	0%	0%	$7,703	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,433,338.09	1%	0%	$3,467,671	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,158,209.59	1%	0%	$6,219,792	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,866**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,590,800.54	1%	0%	$5,646,709	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$59,162,359		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	310,240	TON	$59,162,359	$191

TABLE CW-E12E

Alternative E **Cost Worksheet: CW-E12E**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E13E

Alternative E **Cost Worksheet: CW-E13E**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	2,052,266	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$50,280,517.00	0%	0%	$50,280,517	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	122,528	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$12,980,616.32	0%	0%	$12,980,616	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	2,052,266	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$28,033,953.56	0%	0%	$28,033,954	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**2,573,085**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$191,772,025.05	1%	0%	$193,689,745	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$284,984,832		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	2,573,085	TON	$284,984,832	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
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Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
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UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
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		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E8F

Alternative E **Cost Worksheet:** **CW-E8F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**2,097,738**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$51,457,513.14	0%	0%	$51,457,513	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$51,457,513		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	2,097,738	CY	$51,457,513	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E9F

Alternative E **Cost Worksheet:** **CW-E9F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**105,846**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$3,291,810.60	0%	0%	$3,291,811	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$3,291,811		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	105,846	CY	$3,291,811	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E11F

Alternative E **Cost Worksheet: CW-E11F**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	7	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$256,200.00	0%	0%	$256,200	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	432	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$9,356,693.40	0%	0%	$9,356,693	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$9,612,893		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$9,612,893	$9,612,893

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E12F

Alternative E **Cost Worksheet: CW-E12F**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,380,801.79	0%	0%	$3,380,802	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,133,191.06	0%	0%	$4,133,191	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,400,715.77	0%	0%	$2,400,716	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$663,290.54	0%	0%	$663,291	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,063,663.53	0%	0%	$6,063,664	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,345	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,519,709.30	0%	0%	$1,519,709	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,731,244.00	5%	0%	$4,967,806	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$113,035.16	0%	0%	$113,035	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**321,043**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$27,670,696.17	1%	0%	$27,947,403	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,040,249.98	0%	0%	$1,040,250	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,271,755.10	0%	0%	$1,271,755	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$738,684.10	0%	0%	$738,684	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$204,090.04	0%	0%	$204,090	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,865,748.50	0%	0%	$1,865,749	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,515	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$690,199.10	0%	0%	$690,199	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$429,722.00	5%	0%	$451,208	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,266.58	0%	0%	$10,267	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,332	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,577,784.12	1%	0%	$4,623,562	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,333	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,211,519.03	1%	0%	$8,293,634	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**86,490**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,454,573.10	1%	0%	$7,529,119	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$77,908,134		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	407,533	TON	$77,908,134	$191

TABLE CW-E12F

Alternative E **Cost Worksheet: CW-E12F**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-E13F

Alternative E **Cost Worksheet: CW-E13F**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	2,694,370	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$66,012,065.00	0%	0%	$66,012,065	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	160,864	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$17,041,932.16	0%	0%	$17,041,932	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	2,694,370	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$36,805,094.20	0%	0%	$36,805,094	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**3,378,141**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$251,772,848.73	1%	0%	$254,290,577	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
														TOTAL COST:	$374,149,668		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	3,378,141	TON	$374,149,668	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F8E

Alternative F **Cost Worksheet:** **CW-F8E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**3,719,390**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$91,236,636.70	0%	0%	$91,236,637	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$91,236,637		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	3,719,390	CY	$91,236,637	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F9E

Alternative F **Cost Worksheet:** **CW-F9E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**105,674**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$3,286,461.40	0%	0%	$3,286,461	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$3,286,461		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	105,674	CY	$3,286,461	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F11E

Alternative F **Cost Worksheet: CW-F11E**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	13	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$475,800.00	0%	0%	$475,800	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	750	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$16,240,500.00	0%	0%	$16,240,500	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$16,716,300		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$16,716,300	$16,716,300

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F12E

Alternative F **Cost Worksheet:** **CW-F12E**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - **Low Overdredge Factor [1.5]**

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,583,961.16	0%	0%	$2,583,961	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,159,015.47	0%	0%	$3,159,015	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,834,877.25	0%	0%	$1,834,877	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$506,955.78	0%	0%	$506,956	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,634,483.78	0%	0%	$4,634,484	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,964	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,161,526.16	0%	0%	$1,161,526	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,616,070.00	5%	0%	$3,796,874	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$86,392.30	0%	0%	$86,392	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**245,374**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$21,148,785.06	1%	0%	$21,360,273	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$780,122.60	0%	0%	$780,123	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$953,737.00	0%	0%	$953,737	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$553,967.00	0%	0%	$553,967	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$153,054.80	0%	0%	$153,055	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,399,195.00	0%	0%	$1,399,195	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,885	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$517,516.90	0%	0%	$517,517	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$322,411.00	5%	0%	$338,532	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,702.79	0%	0%	$7,703	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,433,338.09	1%	0%	$3,467,671	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,158,209.59	1%	0%	$6,219,792	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,866**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,590,800.54	1%	0%	$5,646,709	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$59,162,359		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	310,240	TON	$59,162,359	$191

TABLE CW-F12E

Alternative F **Cost Worksheet: CW-F12E**
Capital Cost Sub-Element
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F13E

Alternative F **Cost Worksheet: CW-F13E**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	4,911,053	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$120,320,798.50	0%	0%	$120,320,799	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	293,208	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$31,062,455.52	0%	0%	$31,062,456	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	4,911,053	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$67,084,983.98	0%	0%	$67,084,984	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**6,157,368**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$458,908,637.04	1%	0%	$463,497,723	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
														TOTAL COST:	$681,965,962		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	6,157,368	TON	$681,965,962	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F8F

Alternative F **Cost Worksheet:** **CW-F8F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**4,959,186**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$121,648,832.58	0%	0%	$121,648,833	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$121,648,833		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	4,959,186	CY	$121,648,833	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F9F

Alternative F **Cost Worksheet:** **CW-F9F**

Capital Cost Sub-Element

Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**140,898**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$4,381,927.80	0%	0%	$4,381,928	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$4,381,928		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	140,898	CY	$4,381,928	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F11F

Alternative F **Cost Worksheet: CW-F11F**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	13	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$475,800.00	0%	0%	$475,800	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	1,000	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$21,654,000.00	0%	0%	$21,654,000	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$22,129,800		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$22,129,800	$22,129,800

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F12F

Alternative F **Cost Worksheet:** **CW-F12F**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - **High Overdredge Factor [2.0]**

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,380,801.79	0%	0%	$3,380,802	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,133,191.06	0%	0%	$4,133,191	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,400,715.77	0%	0%	$2,400,716	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$663,290.54	0%	0%	$663,291	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,063,663.53	0%	0%	$6,063,664	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,345	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,519,709.30	0%	0%	$1,519,709	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,731,244.00	5%	0%	$4,967,806	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$113,035.16	0%	0%	$113,035	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**321,043**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$27,670,696.17	1%	0%	$27,947,403	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,040,249.98	0%	0%	$1,040,250	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,271,755.10	0%	0%	$1,271,755	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$738,684.10	0%	0%	$738,684	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$204,090.04	0%	0%	$204,090	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,865,748.50	0%	0%	$1,865,749	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,515	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$690,199.10	0%	0%	$690,199	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$429,722.00	5%	0%	$451,208	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,266.58	0%	0%	$10,267	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,332	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,577,784.12	1%	0%	$4,623,562	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,333	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,211,519.03	1%	0%	$8,293,634	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**86,490**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,454,573.10	1%	0%	$7,529,119	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$77,908,134		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	407,533	TON	$77,908,134	$191

TABLE CW-F12F

Alternative F **Cost Worksheet: CW-F12F**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-F13F

Alternative F **Cost Worksheet: CW-F13F**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	6,493,128	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$159,081,636.00	0%	0%	$159,081,636	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	387,664	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$41,069,124.16	0%	0%	$41,069,124	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	6,493,128	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$88,696,128.48	0%	0%	$88,696,128	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**8,140,938**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$606,744,109.14	1%	0%	$612,811,550	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$901,658,438		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	8,140,938	TON	$901,658,438	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G8E

Alternative G **Cost Worksheet:** **CW-G8E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**6,094,598**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$149,500,488.94	0%	0%	$149,500,489	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$149,500,489		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	6,094,598	CY	$149,500,489	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G9E

Alternative G **Cost Worksheet: CW-G9E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**126,251**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$3,926,406.10	0%	0%	$3,926,406	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$3,926,406		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	126,251	CY	$3,926,406	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G11E

Alternative G **Cost Worksheet: CW-G11E**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	19	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$695,400.00	0%	0%	$695,400	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	1,220	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$26,413,549.20	0%	0%	$26,413,549	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$27,108,949		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$27,108,949	$27,108,949

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G12E

Alternative G **Cost Worksheet:** **CW-G12E**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:

This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:

Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,583,961.16	0%	0%	$2,583,961	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,159,015.47	0%	0%	$3,159,015	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,834,877.25	0%	0%	$1,834,877	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$506,955.78	0%	0%	$506,956	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,634,483.78	0%	0%	$4,634,484	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,964	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,161,526.16	0%	0%	$1,161,526	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,616,070.00	5%	0%	$3,796,874	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$86,392.30	0%	0%	$86,392	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**245,374**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$21,148,785.06	1%	0%	$21,360,273	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$780,122.60	0%	0%	$780,123	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$953,737.00	0%	0%	$953,737	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$553,967.00	0%	0%	$553,967	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$153,054.80	0%	0%	$153,055	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,399,195.00	0%	0%	$1,399,195	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,885	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$517,516.90	0%	0%	$517,517	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$322,411.00	5%	0%	$338,532	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,702.79	0%	0%	$7,703	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,433,338.09	1%	0%	$3,467,671	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,158,209.59	1%	0%	$6,219,792	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,866**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,590,800.54	1%	0%	$5,646,709	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$59,162,359		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	310,240	TON	$59,162,359	$191

TABLE CW-G12E

Alternative G **Cost Worksheet:** **CW-G12E**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G13E

Alternative G **Cost Worksheet: CW-G13E**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	8,044,393	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$197,087,628.50	0%	0%	$197,087,629	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	480,280	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$50,880,863.20	0%	0%	$50,880,863	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	8,044,393	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$109,886,408.38	0%	0%	$109,886,408	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**10,085,882**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$751,700,785.46	1%	0%	$759,217,793	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
														TOTAL COST:	$1,117,072,693		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	10,085,882	TON	$1,117,072,693	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G8F

Alternative G **Cost Worksheet:** **CW-G8F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**8,126,130**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$199,333,968.90	0%	0%	$199,333,969	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$199,333,969		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	8,126,130	CY	$199,333,969	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G9F

Alternative G **Cost Worksheet: CW-G9F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**168,334**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$5,235,187.40	0%	0%	$5,235,187	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$5,235,187		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	168,334	CY	$5,235,187	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G11F

Alternative G **Cost Worksheet:** **CW-G11F**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	19	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$695,400.00	0%	0%	$695,400	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	1,626	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$35,218,065.60	0%	0%	$35,218,066	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$35,913,466		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$35,913,466	$35,913,466

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G12F

Alternative G **Cost Worksheet: CW-G12F**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,380,801.79	0%	0%	$3,380,802	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,133,191.06	0%	0%	$4,133,191	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,400,715.77	0%	0%	$2,400,716	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$663,290.54	0%	0%	$663,291	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,063,663.53	0%	0%	$6,063,664	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,345	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,519,709.30	0%	0%	$1,519,709	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,731,244.00	5%	0%	$4,967,806	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$113,035.16	0%	0%	$113,035	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**321,043**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$27,670,696.17	1%	0%	$27,947,403	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,040,249.98	0%	0%	$1,040,250	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,271,755.10	0%	0%	$1,271,755	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$738,684.10	0%	0%	$738,684	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$204,090.04	0%	0%	$204,090	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,865,748.50	0%	0%	$1,865,749	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,515	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$690,199.10	0%	0%	$690,199	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$429,722.00	5%	0%	$451,208	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,266.58	0%	0%	$10,267	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,332	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,577,784.12	1%	0%	$4,623,562	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,333	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,211,519.03	1%	0%	$8,293,634	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**86,490**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,454,573.10	1%	0%	$7,529,119	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$77,908,134		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	407,533	TON	$77,908,134	$191

TABLE CW-G12F

Alternative G **Cost Worksheet: CW-G12F**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-G13F

Alternative G **Cost Worksheet: CW-G13F**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	10,663,106	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$261,246,097.00	0%	0%	$261,246,097	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	636,627	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$67,444,264.38	0%	0%	$67,444,264	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	10,663,106	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$145,658,027.96	0%	0%	$145,658,028	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**13,369,164**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$996,403,792.92	1%	0%	$1,006,367,831	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$1,480,716,220		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	13,369,164	TON	$1,480,716,220	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I8E

Alternative I **Cost Worksheet:** **CW-I8E**

Capital Cost Sub-Element

Dredging of Contaminated Sediments (Open Water) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**1,334,228**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$32,728,612.84	0%	0%	$32,728,613	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$32,728,613		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1,334,228	CY	$32,728,613	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I9E

Alternative I **Cost Worksheet:** **CW-I9E**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**79,844**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$2,483,148.40	0%	0%	$2,483,148	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$2,483,148		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	79,844	CY	$2,483,148	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I11E

Alternative I **Cost Worksheet: CW-I11E**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	7	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$256,200.00	0%	0%	$256,200	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	277	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$6,004,654.20	0%	0%	$6,004,654	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$6,260,854		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$6,260,854	$6,260,854

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I12E

Alternative I **Cost Worksheet:** **CW-I12E**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$2,583,961.16	0%	0%	$2,583,961	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$3,159,015.47	0%	0%	$3,159,015	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$1,834,877.25	0%	0%	$1,834,877	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$506,955.78	0%	0%	$506,956	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	189,163	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$4,634,483.78	0%	0%	$4,634,484	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	10,964	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,161,526.16	0%	0%	$1,161,526	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$3,616,070.00	5%	0%	$3,796,874	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	15,130	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$86,392.30	0%	0%	$86,392	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**245,374**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$21,148,785.06	1%	0%	$21,360,273	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$780,122.60	0%	0%	$780,123	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$953,737.00	0%	0%	$953,737	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$553,967.00	0%	0%	$553,967	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$153,054.80	0%	0%	$153,055	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	57,110	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,399,195.00	0%	0%	$1,399,195	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	4,885	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$517,516.90	0%	0%	$517,517	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$322,411.00	5%	0%	$338,532	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,349	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$7,702.79	0%	0%	$7,703	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$3,433,338.09	1%	0%	$3,467,671	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	10,749	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$6,158,209.59	1%	0%	$6,219,792	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**64,866**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$5,590,800.54	1%	0%	$5,646,709	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$59,162,359		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	310,240	TON	$59,162,359	$191

TABLE CW-I12E

Alternative I **Cost Worksheet:** **CW-I12E**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I13E

Alternative I **Cost Worksheet: CW-I13E**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - Low Overdredge Factor [1.5]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	1,752,025	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$42,924,612.50	0%	0%	$42,924,613	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	104,602	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$11,081,535.88	0%	0%	$11,081,536	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	1,752,025	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$23,932,661.50	0%	0%	$23,932,662	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**2,196,651**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$163,716,399.03	1%	0%	$165,353,563	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$243,292,374		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	2,196,651	TON	$243,292,374	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I8F

Alternative I **Cost Worksheet:** **CW-I8F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Open Water) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in open water areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for open water dredging, assuming a 10 CY barge mounted crane and clamshell.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Open Water Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A6	Open Water Dredging	**1,778,970**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.53	$24.53	$43,638,134.10	0%	0%	$43,638,134	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$43,638,134		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1,778,970	CY	$43,638,134	$24.53

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I9F

Alternative I **Cost Worksheet:** **CW-I9F**
Capital Cost Sub-Element
Dredging of Contaminated Sediments (Confined) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves mechanical dredging of contaminated sediments in confined areas and transport to dewatering/stabilization area. It includes costs for on-site labor, equipment, and materials for confined dredging, assuming a 4 CY barge mounted excavator.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Confined Dredging (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A7	Confined Dredging	**106,458**	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.10	$31.10	$3,310,843.80	0%	0%	$3,310,844	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$3,310,844		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	106,458	CY	$3,310,844	$31.10

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I11F

Alternative I **Cost Worksheet:** **CW-I11F**
Capital Cost Sub-Element
Dewatering and Water Treatment for Dredging Operations - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the dewatering and water treatment for dredging operations. Assumes a temporary water treatment plant will be utilized for treatment of water generated from dewatering of sediments. It includes costs for labor, equipment, and materials for treatment of water generated from dredged sediments. Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Dewatering and Water Treatment for Dredging Operations (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9	Mobilization/Demobilization of Temporary Water Treatment System	7	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$36,600.00	$36,600.00	$256,200.00	0%	0%	$256,200	MII MII	mob/demob of treatment system will be required for each construction season
A10	Dewatering and Temporary Water Treatment System Operations	370	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,654.00	$21,654.00	$8,005,483.80	0%	0%	$8,005,484	MII MII	Project-specific unit cost developed in MII.
												TOTAL COST:			$8,261,684		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	1	LS	$8,261,684	$8,261,684

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I12F

Alternative I **Cost Worksheet:** **CW-I12F**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016
Checked By: AB **Date:** 5/23/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle C/TSCA landfill, including in-barge mixing of amendments, barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes. Costs for development of a transload facility are included in a separate cost worksheet.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle C/TSCA Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
Area 6W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$3,380,801.79	0%	0%	$3,380,802	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$4,133,191.06	0%	0%	$4,133,191	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$2,400,715.77	0%	0%	$2,400,716	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$663,290.54	0%	0%	$663,291	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	247,496	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$6,063,663.53	0%	0%	$6,063,664	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	14,345	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$1,519,709.30	0%	0%	$1,519,709	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$4,731,244.00	5%	0%	$4,967,806	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	19,796	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$113,035.16	0%	0%	$113,035	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**321,043**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$27,670,696.17	1%	0%	$27,947,403	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
Area 7W NRC/NAPL PTW																	
	Transportation																
A13	Barging to Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$1,040,249.98	0%	0%	$1,040,250	MII MII	Project-specific unit cost developed in MII.
A5	Hauling Waste from Transload Facility to Landfill	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.70	$16.70	$1,271,755.10	0%	0%	$1,271,755	MII MII	Project-specific unit cost developed in MII.
	Materials Handling at Transload Facility																
A14	Offloading of Sediments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.70	$9.70	$738,684.10	0%	0%	$738,684	MII MII	Project-specific unit cost developed in MII. Assumes mechanical offloading of sediments at the transload facility.
A4	Loading Trucks at Transload Facility	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.68	$2.68	$204,090.04	0%	0%	$204,090	MII MII	Project-specific unit cost developed in MII.
	Treatment																
A11	In-Barge Stabilization / Mixing of Amendments	76,153	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$1,865,748.50	0%	0%	$1,865,749	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	6,515	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$690,199.10	0%	0%	$690,199	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
M25	Quicklime	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$239.00	$0.00	$239.00	$429,722.00	5%	0%	$451,208	V Vendor Quote	Project-specific vendor quote - Graymont, 2016.
A2	Hauling - Quicklime to Site	1,798	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.71	$5.71	$10,266.58	0%	0%	$10,267	MII MII	Project-specific unit cost developed in MII. Assumes 10 mile one-way haul.
M20	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (Low End of Treatment Cost Range)	14,332	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$319.41	$319.41	$4,577,784.12	1%	0%	$4,623,562	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
M9	Thermal Desorption Treatment at Subtitle C/TSCA Landfill (High End of Treatment Cost Range)	14,333	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$572.91	$572.91	$8,211,519.03	1%	0%	$8,293,634	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
	Disposal at Subtitle C/TSCA Landfill																
M10	Tipping Fee at Subtitle C/TSCA Landfill	**86,490**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.19	$86.19	$7,454,573.10	1%	0%	$7,529,119	V Vendor Quote	Project-specific vendor quote - CWM of the Northwest, 2015.
												TOTAL COST:			$77,908,134		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	407,533	TON	$77,908,134	$191

TABLE CW-I12F

Alternative I **Cost Worksheet:** **CW-I12F**

Capital Cost Sub-Element

Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select Materials, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 5/20/2016

Checked By: AB **Date:** 5/23/2016

Notes:

Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:

The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:

L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:

For citation references, the following sources apply:

ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

TABLE CW-I13F

Alternative I **Cost Worksheet:** **CW-I13F**
Capital Cost Sub-Element
Subtitle D Disposal (Handling, Transportation, and Disposal) - High Overdredge Factor [2.0]

COST WORKSHEET

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Feasibility Study
Base Year: 2016

Prepared By: JN **Date:** 3/4/2016
Checked By: AB **Date:** 3/7/2016

Work Statement:
This sub-element involves the disposal of contaminated sediments at a Subtitle D landfill, including barge transportation of materials to a transload facility, materials handling from the barge to truck, transportation of the sediments to the Subtitle C/TSCA landfill, and disposal of contaminated sediments (including thermal treatment at the landfill facility for a portion of the volume). It includes costs for labor, equipment, and materials as well as recent vendor quotes.
Quantity development presented in calculation worksheets SEN-AN-OVER-01 through SEN-AN-OVER-06.

Cost Analysis:
Cost for Subtitle D Disposal (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Diatomaceous Earth Amendment																
A11	In-Barge Stabilization / Mixing of Amendments	2,290,882	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$24.50	$24.50	$56,126,609.00	0%	0%	$56,126,609	MII MII	Project-specific unit cost developed in MII.
P5	Diatomaceous Earth	136,774	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.94	$105.94	$14,489,837.56	0%	0%	$14,489,838	P Anchor QEA	Project-specific cost developed by Anchor QEA (2010) - see Backup Table 24.
	Transportation to Transload Facility																
A13	Barging to Transload Facility	2,290,882	CY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13.66	$13.66	$31,293,448.12	0%	0%	$31,293,448	MII MII	Project-specific unit cost developed in MII.
	Transportation and Disposal at Subtitle D Landfill																
M11	Transportation and Disposal at Subtitle D Landfill	**2,872,258**	TON	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$74.53	$74.53	$214,069,388.74	1%	0%	$216,210,083	V Vendor Quote	Project-specific vendor quote - Republic Services (Roosevelt Landfill), 2015. Includes transloading of the sediments, truck transportation from the transload facility to the landfill, and disposal at the landfill.
													TOTAL COST:		$318,119,978		

	Representative Unit Quantity	Unit(s)	Total Cost	Unit Cost
COST WORKSHEET SUMMARY	2,872,258	TON	$318,119,978	$111

Notes:
Further information about the development of cost worksheets can be found in Attachment A - Methodology and Organization of Detailed Cost Estimates.
The quantity bolded in the QTY column is the quantity selected as the representative unit quantity for this cost worksheet. If multiple quantities are bolded, the representative unit quantity is the sum of those quantities. When the LS unit is utilized, the default representative unit quantity is 1.
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3

Cost Database Code:
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets. The following cost source database prefixes apply:
L (EPA-Derived Labor Unit Costs), M (Project-Specific Vendor Unit Costs), P (Previously Developed Unit Costs by Anchor QEA for Portland Harbor), A (EPA-Derived MII Unit Costs), O (Unit Costs from Other Projects/Sources)

Source of Cost Data:
For citation references, the following sources apply:
ALL (Allowance), FLC (www.flcdatacenter.com), LD (Costs Derived from Lower Duwamish Waterway Final Feasibility Study), MII (MII), O (Other), P (Previously Developed by Anchor QEA for Portland Harbor), and V (Vendor Quote)

Abbreviations:

QTY	Quantity	AC	Acres
EQUIP	Equipment	CLF	100 Linear Foot
MATL	Material	CY	Cubic Yard
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	FTE	Full Time Equivalent
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LF	Linear Foot
PC PF	Prime Contractor Profit	LS	Lump Sum
BUR LIC	Burdened Line Item Cost	MO	Month
		SF	Square Foot
		SY	Square Yard
		TON	Tons
		YR	Years

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2016 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sept 2015.
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%.
Prime Contractor Overhead and Profit	Allowances and items with mandated costs such as per diem do not have overhead and profit applied.
	Items previously developed by Anchor QEA already include contractor markups, therefore overhead and profit were not applied to those items.
	It is assumed that OH is 1% and profit is 0% for vendor quotes for treatment and disposal at offsite disposal facilities. It is assumed that OH is 5% and profit is 0% for quotes for all other material vendor quotes.
	Items developed using MII already include contractor markups such as overhead and profit, therefore additional overhead and profit were not applied in the PC OH and PC PF to those items.

Sensitivity Analysis

Calculation Worksheets
Overdredge Scenarios

Note: Quantities and calculations presented herein are specific to the Overdredge Sensitivity Analysis Scenarios. All other quantities are the same as the quantities for the base estimate, and can be found in Appendix D.

PROJECT:	Portland Harbor FS	COMPUTED BY :	JN
JOB NO.:	79171.3383.345.FSZ	DATE :	3/31/2016
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Sensitivity Analysis - Overdredge

In this comparison, overdredge factors of 1.50 [low] and 2.0 [high] are compared to the base assumption of 1.75. By increasing the overdredge factor, the overall dredging volumes as well as offsite disposal volumes (both Subtitle C/TSCA and Subtitle D) increase, while decreasing the overdredge factor will decrease those volumes.

High Overdredge Factor: 2
Low Overdredge Factor: 1.5

Quantity Estimate - High Overdredge Factor (2.0)

Quantities presented below represent dredge and disposal volume quantities for the High Overdredge Factor Scenario for the Sensitivity Analysis. All other quantities for this Scenario will be the same as for the base estimate and can be found in Appendix D.

Summary of Dredge Volumes

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
High Volume with Overdredge (Open Water)	587,246	713,572	1,183,520	2,097,738	4,959,186	8,126,130	33,270,672	1,778,970
High Volume with Overdredge (Confined)	72,048	76,036	82,818	105,846	140,898	168,334	216,546	106,458
Total Volume Dredged (CY)	**659,294**	**789,608**	**1,266,338**	**2,203,584**	**5,100,084**	**8,294,464**	**33,487,218**	**1,885,428**

Dredge and Dewatering Productivity Quantities

Assumed Dredging Productivity (CY/DY) 5,100 *See Appendix D3 for additional information regarding productivity calculations*

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Estimated Number of Dredging Days (DY)	**129**	**155**	**248**	**432**	**1,000**	**1,626**	**6,566**	**370**
Estimated Number of Days for Dewatering/Water Treatment Operations (DY)	**129**	**155**	**248**	**432**	**1,000**	**1,626**	**6,566**	**370**

Quantities for Area 6W NRC/NAPL PTW

Subtitle C Disposal Quantities for Area 6W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (Not Including Riverbanks) (CY)	**174,507**	**174,507**	**174,507**	**174,507**	**174,507**	**174,507**	**174,507**	**174,507**
Area 6W NRC/NAPL PTW from Riverbank Excavation for Subtitle C Disposal (CY)	**10,590**	**10,590**	**10,590**	**10,590**	**10,590**	**10,590**	**10,590**	**10,590**
Total Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (CY)	**185,097**	**185,097**	**185,097**	**185,097**	**185,097**	**185,097**	**185,097**	**185,097**
Total Weight of Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (TON)	**286,902**	**286,902**	**286,902**	**286,902**	**286,902**	**286,902**	**286,902**	**286,902**

Ex Situ Treatment Quantities for Area 6W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Weight of Diatomaceous Earth for Stabilization/Solidification Sediments (TON)	**14,345**	**14,345**	**14,345**	**14,345**	**14,345**	**14,345**	**14,345**	**14,345**
Volume of Diatomaceous Earth for Stabilization/Solidification Sediments (CY)	**55,174**	**55,174**	**55,174**	**55,174**	**55,174**	**55,174**	**55,174**	**55,174**
Weight of Quicklime for Amendment (TON)	**19,796**	**19,796**	**19,796**	**19,796**	**19,796**	**19,796**	**19,796**	**19,796**
Volume of Quicklime for Amendment (CY)	**7,225**	**7,225**	**7,225**	**7,225**	**7,225**	**7,225**	**7,225**	**7,225**
Total Weight of Amended Area 6W NRC/NAPL PTW for Subtitle C Disposal (TON)	**321,043**	**321,043**	**321,043**	**321,043**	**321,043**	**321,043**	**321,043**	**321,043**
Total Volume of Amended Area 6W NRC/NAPL PTW for Subtitle C Disposal (CY)	**247,496**	**247,496**	**247,496**	**247,496**	**247,496**	**247,496**	**247,496**	**247,496**

CDM Smith

PROJECT:	Portland Harbor FS
JOB NO.:	79171.3383.345.FSZ
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Quantity Estimate - High Overdredge Factor (Continued)

Quantities for Area 7W NRC/NAPL PTW

Subtitle C Disposal Quantities for Area 7W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Total Area 7W NRC/NAPL PTW Dredged for Subtitle C Disposal (CY)	50,442	50,442	50,442	50,442	50,442	50,442	50,442	50,442
Total Weight of Area 7W NRC/NAPL PTW Dredged for Subtitle C Disposal (TON)	78,186	78,186	78,186	78,186	78,186	78,186	78,186	78,186

Area 7W NRC/NAPL PTW - 1/3 of Volume - No Treatment Required

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for No Treatment (CY)	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812
Weight of Sediments for No Treatment (TON)	26,059	26,059	26,059	26,059	26,059	26,059	26,059	26,059
Weight of Diatomaceous Earth for No Treatment Sediments (TON)	2,606	2,606	2,606	2,606	2,606	2,606	2,606	2,606
Volume of Diatomaceous Earth for No Treatment Sediments (CY)	10,024	10,024	10,024	10,024	10,024	10,024	10,024	10,024
Total Weight of No Treatment Sediments (with Diatomaceous Earth) (TON)	28,665	28,665	28,665	28,665	28,665	28,665	28,665	28,665
Total Volume of No Treatment Sediments (with Diatomaceous Earth) (CY)	26,836	26,836	26,836	26,836	26,836	26,836	26,836	26,836

Area 7W NRC/NAPL PTW - 1/3 of Volume - Thermal Treatment at Subtitle C Facility

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for Thermal Treatment (CY)	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812
Weight of Sediments for Thermal Treatment (TON)	26,059	26,059	26,059	26,059	26,059	26,059	26,059	26,059
Weight of Diatomaceous Earth for Thermal Treatment Sediments (TON)	2,606	2,606	2,606	2,606	2,606	2,606	2,606	2,606
Volume of Diatomaceous Earth for Thermal Treatment Sediments (CY)	10,024	10,024	10,024	10,024	10,024	10,024	10,024	10,024
Total Weight of Thermal Treatment Sediments (with Diatomaceous Earth) (TON)	28,665	28,665	28,665	28,665	28,665	28,665	28,665	28,665
Total Volume of Thermal Treatment Sediments (with Diatomaceous Earth) (CY)	26,836	26,836	26,836	26,836	26,836	26,836	26,836	26,836
Weight of Thermal Treatment Sediments for Low End of Thermal Cost Range (TON)	14,332	14,332	14,332	14,332	14,332	14,332	14,332	14,332
Volume of Thermal Treatment Sediments for Low End of Thermal Cost Range (CY)	13,418	13,418	13,418	13,418	13,418	13,418	13,418	13,418
Weight of Thermal Treatment Sediments for High End of Thermal Cost Range (TON)	14,333	14,333	14,333	14,333	14,333	14,333	14,333	14,333
Volume of Thermal Treatment Sediments for High End of Thermal Cost Range (CY)	13,418	13,418	13,418	13,418	13,418	13,418	13,418	13,418

CDM Smith

PROJECT:	Portland Harbor FS
JOB NO.:	79171.3383.345.FSZ
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Quantity Estimate - High Overdredge Factor (Continued)

Area 7W NRC/NAPL PTW - 1/3 of Volume - Stabilization/Solidification

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for Stabilization/Solidification Treatment (CY)	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812
Weight of Sediments for Stabilization/Solidification Treatment (TON)	26,059	26,059	26,059	26,059	26,059	26,059	26,059	26,059
Weight of Diatomaceous Earth for Stabilization/Solidification Sediments (TON)	1,303	1,303	1,303	1,303	1,303	1,303	1,303	1,303
Volume of Diatomaceous Earth for Stabilization/Solidification Sediments (CY)	5,012	5,012	5,012	5,012	5,012	5,012	5,012	5,012
Weight of Quicklime for Stabilization/Solidification Sediments (TON)	1,798	1,798	1,798	1,798	1,798	1,798	1,798	1,798
Volume of Quicklime for Stabilization/Solidification Sediments (CY)	657	657	657	657	657	657	657	657
Total Weight of Quicklime/Diatomaceous Earth Amended Sediments (TON)	29,160	29,160	29,160	29,160	29,160	29,160	29,160	29,160
Total Volume of Quicklime/Diatomaceous Earth Amended Sediments (CY)	22,481	22,481	22,481	22,481	22,481	22,481	22,481	22,481

Area 7W NRC/NAPL PTW - Total Volume for Subtitle C Disposal

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Weight of Thermal Treatment Sediments for Low End of Thermal Cost Range (TON)	14,332	14,332	14,332	14,332	14,332	14,332	14,332	14,332
Weight of Thermal Treatment Sediments for High End of Thermal Cost Range (TON)	14,333	14,333	14,333	14,333	14,333	14,333	14,333	14,333
Weight of Quicklime for Stabilization/Solidification Sediments (TON)	1,798	1,798	1,798	1,798	1,798	1,798	1,798	1,798
Total Weight of Diatomaceous Earth for 7W PTW Sediments (TON)	6,515	6,515	6,515	6,515	6,515	6,515	6,515	6,515
Total Volume of Diatomaceous Earth for 7W PTW Sediments (CY)	25,060	25,060	25,060	25,060	25,060	25,060	25,060	25,060
Total Weight of Amended Area 7W NRC/NAPL PTW for Subtitle C Disposal (TON)	86,490	86,490	86,490	86,490	86,490	86,490	86,490	86,490
Total Volume of Amended Area 7W NRC/NAPL PTW for Subtitle C Disposal (CY)	76,153	76,153	76,153	76,153	76,153	76,153	76,153	76,153

Subtitle D Disposal

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Riverbanks for Subtitle D (CY)	46,272	54,619	71,385	97,027	126,977	145,025	166,783	104,349
Total Dredge for Subtitle D Disposal (CY)	480,617	619,278	1,112,774	2,075,662	5,002,112	8,214,540	33,429,052	1,764,828
Total Dredge for Subtitle D Disposal (TON)	744,957	959,881	1,724,800	3,217,277	7,753,274	12,732,537	51,815,031	2,735,484
Diatomaceous Earth Rate for dewatering and material handling (% by weight)	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Weight of Diatomaceous Earth for Subtitle D Materials (TON)	37,248	47,994	86,240	160,864	387,664	636,627	2,590,752	136,774
Volume of Diatomaceous Earth for Subtitle D Materials (CY)	143,262	184,593	331,693	618,708	1,491,016	2,448,566	9,964,431	526,054
Total Weight of Subtitle D Materials (with Diatomaceous Earth) (TON)	782,205	1,007,875	1,811,040	3,378,141	8,140,938	13,369,164	54,405,783	2,872,258
Total Volume of Subtitle D Materials (with Diatomaceous Earth) (CY)	623,879	803,871	1,444,467	2,694,370	6,493,128	10,663,106	43,393,483	2,290,882

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Quantity Estimate - Low Overdredge Factor (1.5)

Quantities presented below represent dredge and disposal volume quantities for the Low Overdredge Factor Scenario for the Sensitivity Analysis. All other quantities for this Scenario will be the same as for the base estimate and can be found in Appendix D.

Summary of Dredge Volumes

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Low Volume with Overdredge (Open Water)	440,435	535,179	887,640	1,573,304	3,719,390	6,094,598	24,953,004	1,334,228
Low Volume with Overdredge (Confined)	54,036	57,027	62,114	79,385	105,674	126,251	162,410	79,844
Total Volume Dredged (CY)	**494,471**	**592,206**	**949,754**	**1,652,689**	**3,825,064**	**6,220,849**	**25,115,414**	**1,414,072**

Dredge and Dewatering Productivity Quantities

Assumed Dredging Productivity (CY/DY) 5,100 *See Appendix D3 for additional information regarding productivity calculations*

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Estimated Number of Dredging Days (DY)	**97**	**116**	**186**	**324**	**750**	**1,220**	**4,925**	**277**
Estimated Number of Days for Dewatering/Water Treatment Operations (DY)	**97**	**116**	**186**	**324**	**750**	**1,220**	**4,925**	**277**

Quantities for Area 6W NRC/NAPL PTW

Subtitle C Disposal Quantities for Area 6W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (Not Including Riverbanks) (CY)	**130,881**	**130,881**	**130,881**	**130,881**	**130,881**	**130,881**	**130,881**	**130,881**
Area 6W NRC/NAPL PTW from Riverbank Excavation for Subtitle C Disposal (CY)	**10,590**	**10,590**	**10,590**	**10,590**	**10,590**	**10,590**	**10,590**	**10,590**
Total Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (CY)	**141,471**	**141,471**	**141,471**	**141,471**	**141,471**	**141,471**	**141,471**	**141,471**
Total Weight of Area 6W NRC/NAPL PTW Dredged for Subtitle C Disposal (TON)	**219,280**	**219,280**	**219,280**	**219,280**	**219,280**	**219,280**	**219,280**	**219,280**

Ex Situ Treatment Quantities for Area 6W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Weight of Diatomaceous Earth for Stabilization/Solidification Sediments (TON)	**10,964**	**10,964**	**10,964**	**10,964**	**10,964**	**10,964**	**10,964**	**10,964**
Volume of Diatomaceous Earth for Stabilization/Solidification Sediments (CY)	**42,170**	**42,170**	**42,170**	**42,170**	**42,170**	**42,170**	**42,170**	**42,170**
Weight of Quicklime for Amendment (TON)	**15,130**	**15,130**	**15,130**	**15,130**	**15,130**	**15,130**	**15,130**	**15,130**
Volume of Quicklime for Amendment (CY)	**5,522**	**5,522**	**5,522**	**5,522**	**5,522**	**5,522**	**5,522**	**5,522**
Total Weight of Amended Area 6W NRC/NAPL PTW for Subtitle C Disposal (TON)	**245,374**	**245,374**	**245,374**	**245,374**	**245,374**	**245,374**	**245,374**	**245,374**
Total Volume of Amended Area 6W NRC/NAPL PTW for Subtitle C Disposal (CY)	**189,163**	**189,163**	**189,163**	**189,163**	**189,163**	**189,163**	**189,163**	**189,163**

Subtitle C Disposal Quantities for Area 7W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Total Area 7W NRC/NAPL PTW Dredged for Subtitle C Disposal (CY)	**37,832**	**37,832**	**37,832**	**37,832**	**37,832**	**37,832**	**37,832**	**37,832**
Total Weight of Area 7W NRC/NAPL PTW Dredged for Subtitle C Disposal (TON)	**58,639**	**58,639**	**58,639**	**58,639**	**58,639**	**58,639**	**58,639**	**58,639**

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PROJECT:	Portland Harbor FS
JOB NO.:	79171.3383.345.FSZ
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WRKSHT NO. :	SEN-AN-OVER-05

Quantity Estimate - Low Overdredge Factor (Continued)

Ex Situ Treatment Quantities for Area 7W NRC/NAPL PTW

Area 7W NRC/NAPL PTW - 1/3 of Volume - No Treatment Required

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for No Treatment (CY)	12,609	12,609	12,609	12,609	12,609	12,609	12,609	12,609
Weight of Sediments for No Treatment (TON)	19,544	19,544	19,544	19,544	19,544	19,544	19,544	19,544
Weight of Diatomaceous Earth for No Treatment Sediments (TON)	1,954	1,954	1,954	1,954	1,954	1,954	1,954	1,954
Volume of Diatomaceous Earth for No Treatment Sediments (CY)	7,516	7,516	7,516	7,516	7,516	7,516	7,516	7,516
Total Weight of No Treatment Sediments (with Diatomaceous Earth) (TON)	21,498	21,498	21,498	21,498	21,498	21,498	21,498	21,498
Total Volume of No Treatment Sediments (with Diatomaceous Earth) (CY)	20,125	20,125	20,125	20,125	20,125	20,125	20,125	20,125

Area 7W NRC/NAPL PTW - 1/3 of Volume - Thermal Treatment at Subtitle C Facility

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for Thermal Treatment (CY)	12,609	12,609	12,609	12,609	12,609	12,609	12,609	12,609
Weight of Sediments for Thermal Treatment (TON)	19,544	19,544	19,544	19,544	19,544	19,544	19,544	19,544
Weight of Diatomaceous Earth for Thermal Treatment Sediments (TON)	1,954	1,954	1,954	1,954	1,954	1,954	1,954	1,954
Volume of Diatomaceous Earth for Thermal Treatment Sediments (CY)	7,516	7,516	7,516	7,516	7,516	7,516	7,516	7,516
Total Weight of Thermal Treatment Sediments (with Diatomaceous Earth) (TON)	21,498	21,498	21,498	21,498	21,498	21,498	21,498	21,498
Total Volume of Thermal Treatment Sediments (with Diatomaceous Earth) (CY)	20,125	20,125	20,125	20,125	20,125	20,125	20,125	20,125
Weight of Thermal Treatment Sediments for Low End of Thermal Cost Range (TON)	10,749	10,749	10,749	10,749	10,749	10,749	10,749	10,749
Volume of Thermal Treatment Sediments for Low End of Thermal Cost Range (CY)	10,062	10,062	10,062	10,062	10,062	10,062	10,062	10,062
Weight of Thermal Treatment Sediments for High End of Thermal Cost Range (TON)	10,749	10,749	10,749	10,749	10,749	10,749	10,749	10,749
Volume of Thermal Treatment Sediments for High End of Thermal Cost Range (CY)	10,063	10,063	10,063	10,063	10,063	10,063	10,063	10,063

Area 7W NRC/NAPL PTW - 1/3 of Volume - Stabilization/Solidification

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Sediments for Stabilization/Solidification Treatment (CY)	12,609	12,609	12,609	12,609	12,609	12,609	12,609	12,609
Weight of Sediments for Stabilization/Solidification Treatment (TON)	19,544	19,544	19,544	19,544	19,544	19,544	19,544	19,544
Weight of Diatomaceous Earth for Stabilization/Solidification Sediments (TON)	977	977	977	977	977	977	977	977
Volume of Diatomaceous Earth for Stabilization/Solidification Sediments (CY)	3,758	3,758	3,758	3,758	3,758	3,758	3,758	3,758
Weight of Quicklime for Stabilization/Solidification Sediments (TON)	1,349	1,349	1,349	1,349	1,349	1,349	1,349	1,349
Volume of Quicklime for Stabilization/Solidification Sediments (CY)	493	493	493	493	493	493	493	493
Total Weight of Quicklime/Diatomaceous Earth Amended Sediments (TON)	21,870	21,870	21,870	21,870	21,870	21,870	21,870	21,870
Total Volume of Quicklime/Diatomaceous Earth Amended Sediments (CY)	16,860	16,860	16,860	16,860	16,860	16,860	16,860	16,860

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JOB NO.:	79171.3383.345.FSZ
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Quantity Estimate - Low Overdredge Factor (Continued)

Summary of Subtitle C Disposal and Ex Situ Treatment Volumes for Area 7W NRC/NAPL PTW

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Weight of Thermal Treatment Sediments for Low End of Thermal Cost Range (TON)	10,749	10,749	10,749	10,749	10,749	10,749	10,749	10,749
Weight of Thermal Treatment Sediments for High End of Thermal Cost Range (TON)	10,749	10,749	10,749	10,749	10,749	10,749	10,749	10,749
Weight of Quicklime for Stabilization/Solidification Sediments (TON)	1,349	1,349	1,349	1,349	1,349	1,349	1,349	1,349
Total Weight of Diatomaceous Earth for 7W PTW Sediments (TON)	4,885	4,885	4,885	4,885	4,885	4,885	4,885	4,885
Total Volume of Diatomaceous Earth for 7W PTW Sediments (CY)	18,790	18,790	18,790	18,790	18,790	18,790	18,790	18,790
Total Weight of Amended Area 7W NRC/NAPL PTW for Subtitle C Disposal (TON)	64,866	64,866	64,866	64,866	64,866	64,866	64,866	64,866
Total Volume of Amended Area 7W NRC/NAPL PTW for Subtitle C Disposal (CY)	57,110	57,110	57,110	57,110	57,110	57,110	57,110	57,110

Subtitle D Disposal Quantities

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G	Alt. H	Alt. I
Volume of Riverbanks for Subtitle D (CY)	46,272	54,619	71,385	97,027	126,977	145,025	166,783	104,349
Total Dredge for Subtitle D Disposal (CY)	372,031	478,113	852,427	1,581,004	3,783,329	6,197,162	25,113,485	1,349,709
Total Dredge for Subtitle D Disposal (TON)	576,649	741,076	1,321,262	2,450,557	5,864,160	9,605,602	38,925,902	2,092,049
Diatomaceous Earth Rate for dewatering and material handling (% by weight)	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Weight of Diatomaceous Earth for Subtitle D Materials (TON)	28,832	37,054	66,063	122,528	293,208	480,280	1,946,295	104,602
Volume of Diatomaceous Earth for Subtitle D Materials (CY)	110,893	142,516	254,089	471,262	1,127,724	1,847,231	7,485,750	402,316
Total Weight of Subtitle D Materials (with Diatomaceous Earth) (TON)	605,481	778,130	1,387,325	2,573,085	6,157,368	10,085,882	40,872,197	2,196,651
Total Volume of Subtitle D Materials (with Diatomaceous Earth) (CY)	482,924	620,629	1,106,516	2,052,266	4,911,053	8,044,393	32,599,235	1,752,025