

# Environmental Cost Estimate for the 200-UP-1 Southeast Chromium Plume Remedial Options

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy  
under Contract DE-AC06-08RL14788

**CH2MHILL**  
Plateau Remediation Company

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**Richland, Washington 99352**

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**APPROVED**

*By Lynn M. Ayers at 6:30 am, May 23, 2019*

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Release Approval

Date

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**CHPRC ENVIRONMENTAL COST ESTIMATE COVER PAGE**

**Part 1: To be completed by the ER&QA Lead Cost Estimator**

Project: 200-UP-1 Southeast Chromium Plume

Date: 05/8/2019

Calculation Title & Description: Environmental Cost Estimate for the 200-UP-1 Southeast Chromium Plume Remedial Options

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**Part 2: To be completed by Project Cost Estimator**

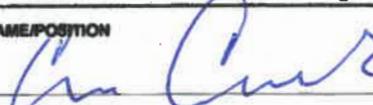
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0	Intial Release	8/2/2018	All
1	Change number of MNA wells, and changes to source control P&T	5/8/2019	All

**Part 3: Document Review & Approval**

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## Executive Summary

This 200-UP-1 Operable Unit cost estimate is based on the development of remedy options for the southeast chromium plume identified in Chapter 4 in the associated remedial design investigation report.<sup>1</sup> The options were developed to support the remedy design for the southeast chromium plume. The southeast chromium plume remedy was identified in the Record of Decision for the 200-UP-1 Operable Unit that was issued in 2012.<sup>2</sup>

The following remedial options were evaluated (as described in remedial design investigation report<sup>1</sup>):

- **Option 1:** Source control via pump and treat (P&T), and monitored natural attenuation (MNA)
- **Option 2a:** Source control via P&T, main plume P&T with site treatment, and MNA
- **Option 2b:** Source control via P&T, dispersed plume P&T with chromium only treatment at the 200 West P&T, and MNA
- **Option 2c:** Source control via P&T, main plume P&T with treatment at the 200 West P&T, and MNA
- **Option 3:** Source control via P&T, aggressive main plume P&T with site treatment, and MNA

Cost estimates were developed for each of the alternatives using U.S. Environmental Protection Agency guidance,<sup>3</sup> cost estimating classification system guidelines,<sup>4</sup>

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<sup>1</sup> DOE/RL-2017-60, *Remedial Design Investigation Report for the 200-UP-1 Operable Unit Southeast Chromium Plume*, Rev. 0 pending, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

<sup>2</sup> EPA, Ecology, and DOE, 2012, *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site 200-UP-1 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: <https://pdw.hanford.gov/arpir/pdf.cfm?accession=0091413>.

<sup>3</sup> EPA 540-R-00-002, 2000, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, OSWER 9355.0-75, U.S. Army Corps of Engineers and U.S. Environmental Protection Agency, Washington, D.C. Available at: <https://semspub.epa.gov/work/HQ/174890.pdf>.

<sup>4</sup> AACE, 2011, *AACE International Recommended Practice No. 17R-97, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries*, American Association for the Advancement of Cost Engineering International, Morgantown, West Virginia. Available at: [http://web.aacei.org/docs/default-source/toc/toc\\_17r-97.pdf](http://web.aacei.org/docs/default-source/toc/toc_17r-97.pdf).

and standard industry practices. The estimates created for this report are considered to be Category 4, with an accuracy range of +50%/-30%. This environmental cost estimate describes this estimate, and Table ES-1 provides a summary of the marked-up costs for each option.

**Table ES-1. Summary of Cost Estimates for Each Remedial Option**

	<b>Option 1</b>	<b>Option 2a</b>	<b>Option 2b</b>	<b>Option 2c</b>	<b>Option 3</b>
Total project duration (years)	275	120	120	120	32
Capital cost	\$18,000,000	\$79,000,000	\$88,000,000	\$154,000,000	\$218,000,000
Annual O&M cost	\$18,000,000	\$84,000,000	\$84,000,000	\$322,000,000	\$296,000,000
Periodic O&M cost	\$57,000,000	\$61,000,000	\$59,000,000	\$59,000,000	\$91,000,000
Total nondiscounted cost	\$94,000,000	\$223,000,000	\$231,000,000	\$535,000,000	\$605,000,000
Total present value of alternative	\$57,000,000	\$203,000,000	\$211,000,000	\$490,000,000	\$558,000,000
-30%	\$40,000,000	\$142,000,000	\$148,000,000	\$343,000,000	\$391,000,000
50%	\$86,000,000	\$304,000,000	\$316,000,000	\$735,000,000	\$837,000,000

O&M = operations and maintenance

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## Terms

CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CHPRC	CH2M HILL Plateau Remediation Company
ECE	environmental cost estimate
EPA	U.S. Environmental Protection Agency
G&A	general and administrative
IC	institutional control
IX	ion exchange
MNA	monitored natural attenuation
O&M	operations and maintenance
OH&P	overhead and profit
OU	operable unit
P&T	pump and treat
RD/RAWP	remedial design/remedial action work plan
ROD	record of decision

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## 1 Introduction

CH2M HILL Plateau Remediation Company (CHPRC) prepared this environmental cost estimate (ECE) to support DOE/RL-2017-60, *Remedial Design Investigation Report for the 200-UP-1 Operable Unit Southeast Chromium Plume*. The following sections provide the basis of the cost estimate. Cost estimates for each remedial option summarized in this ECE have been prepared to support remedial design based on information available at the time this ECE was prepared. The cost estimates reflect specific design approaches, scope assumptions, exclusions, and cost-estimating methodologies. Section 5.5 describes the ranges of accuracy for the response action cost estimates. The final costs of the selected response action will depend on actual labor and material costs, site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other factors.

## 2 Purpose of Estimate

This ECE supports the remedy options analysis provided in DOE/RL-2017-60. The ECE provides an overview of response action-specific cost inputs, methodology, and results, including the following:

- Describes the methodology applied in performing the cost estimates
- Describes the assumptions and cost inputs applied to the subject cost estimates
- Summarizes the remedy option cost estimates

This ECE also documents references that provide more detailed information used to prepare the cost estimates.

## 3 General Project Description

Groundwater in the southeast portion of the Hanford Site 200-UP-1 Operable Unit (OU) at the Hanford Site is contaminated with chromium (hereinafter referred to as the southeast chromium plume). The source of the chromium was historical contaminated liquid discharges to waste sites overlying the 200-UP-1 OU.

The Record of Decision (ROD) for the 200-UP-1 OU was issued in 2012 (EPA et al., 2012, *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site 200-UP-1 Operable Unit* [hereinafter referred to as the 200-UP-1 OU ROD]). The remedy selected for the dispersed southeast chromium plume is groundwater restoration using pump and treat (P&T) and monitored natural attenuation (MNA). The 200-UP-1 OU ROD specifies that the remedy will be conducted in accordance with the remedial design/remedial action work plan (RD/RAWP) that was issued in 2013 (DOE/RL-2013-07, *200-UP-1 Groundwater Operable Unit Remedial Design/Remedial Action Work Plan*). The RD/RAWP stated that additional monitoring wells were needed to further characterize the vertical and lateral extent of the southeast chromium plume to support remedial design (Section 3.1.1 of DOE/RL-2013-07).

To address the need for additional characterization identified in the RD/RAWP (DOE/RL-2013-07), 11 wells were drilled and sampled in 2016 and 2017 to further define the lateral and vertical extent of the southeast chromium plume. Based on groundwater sample results from the new wells, the southeast chromium plume extends further to the east, south, and west than the inferred plume geometry from 2011 that was used in the 200-UP-1 OU ROD (EPA et al., 2012). The refined plume configuration (Figure 1) was used to develop and evaluate remedial alternatives, including cost, to support remedial design.

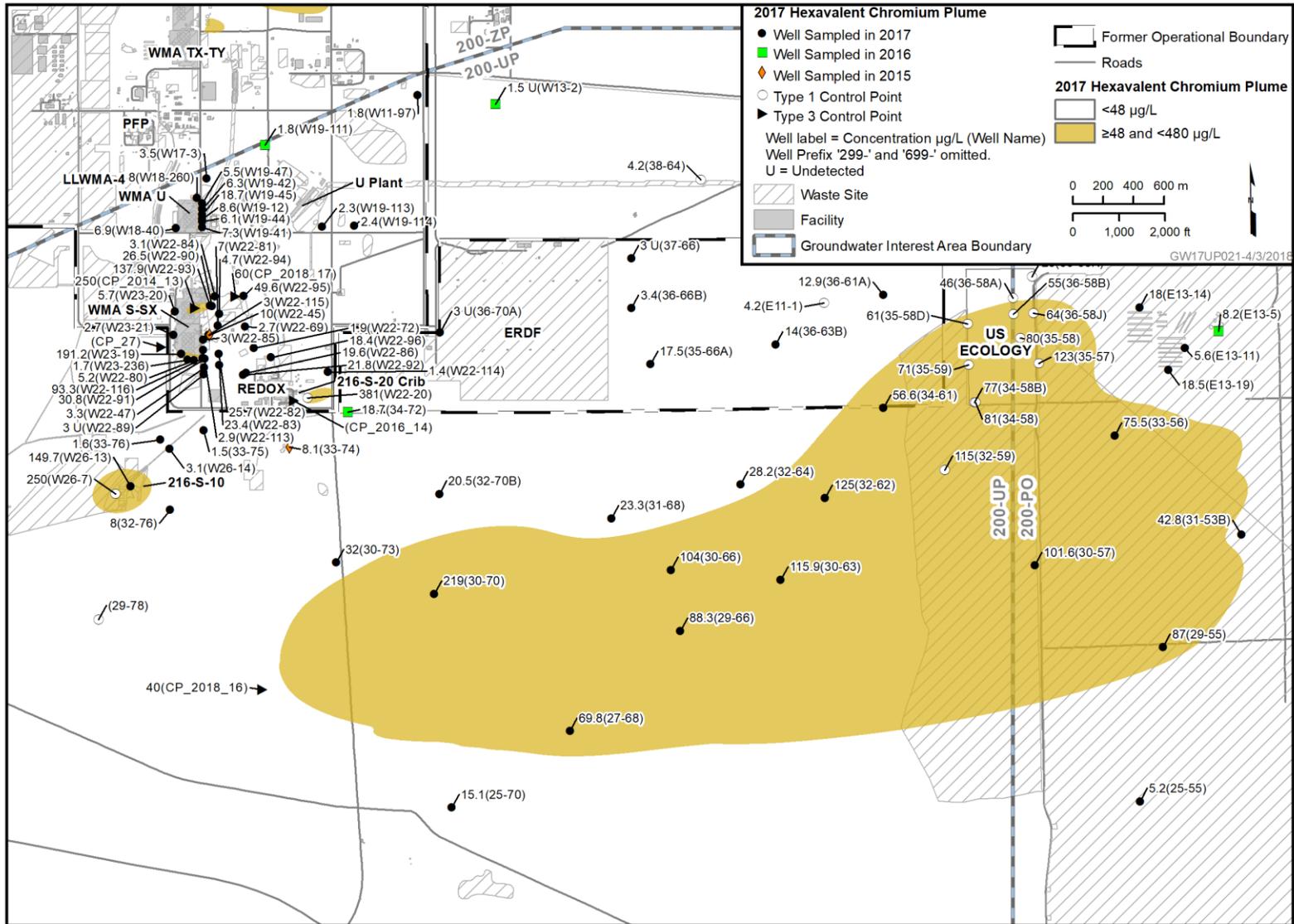


Figure 1. 200-UP-1 Southeast Chromium Plume, 2017

## 4 Scope of Work

The cost estimate for the 200-UP-1 OU southeast chromium plume project was developed in accordance with EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, and standard industry practices. Quantities used to generate this estimate were based on the information provided by project staff.

Five remedial options were developed and are summarized in the following sections. Table 1 summarizes the remedial options, listing the key components for each. The following sections provide details for each of the five remedial options and the quantities used to prepare the cost estimates. Table 2 shows the number of wells that will be replaced over each remedial option duration, assuming that monitoring wells are replaced every 30 years, extraction wells are replaced every 20 years, and monitoring wells are replaced every 10 years. Well monitoring reporting is assumed to be annually for the active remedial option duration (25 years) and every 5 years thereafter.

**Table 1. Summary of Alternative Components**

Component	Remedial Option				
	1	2a	2b	2c	3
Institutional controls restricting groundwater use (after 125 years)	X				
189 L/min (50 gal/min) groundwater P&T at two source sites	X	X	X	X	X
Groundwater treatment at 200 West P&T	X		X	X	
Groundwater treatment onsite		X			X
1,893 L/min (500 gal/min) main plume P&T		X	X	X	
10,221 L/min (2,700 gal/min) main plume P&T					X
Monitored natural attenuation for groundwater	X	X	X	X	X

P&T = pump and treat

**Table 2. New and Replacement Wells**

Remedial Option	New Monitoring Wells	Replacement Monitoring Wells	New Extraction Wells	Replacement Extraction Wells	New Injection Wells	Replacement Injection Wells
1	6	54	2	0	1	0
2a	6	18	10	8	10	20
2b	6	18	10	8	10	20
2c	6	18	10	8	10	20
3	6	0	29	22	26	42

Note: Only replacement wells costed for Option 3 are 22 extraction and 21 injection wells that will be operated past the first phase of pump and treat (12 years).

#### **4.1 Remedial Option 1 – Source Control with Monitored Natural Attenuation**

Option 1 consists of 25 years of P&T downgradient of two potential chromium sources to groundwater and monitored natural attenuation (MNA) for the dispersed plume. Option 1 consists of the following components (Figure 2):

- Active groundwater remediation using P&T for source control at the 216-S-10 Pond/Ditches and 216-S-20 Crib (one extraction well at each of the two sites) for 5 years at a total flow rate of 189 L/min (50 gal/min).
- Groundwater treatment for chromium from source control wells using a smaller scale ion-exchange (IX) resin treatment train installed in an extraction transfer building currently associated with the 200 West P&T operations.
- MNA and groundwater monitoring for chromium for 275 years.
- Maintenance of institutional controls (ICs) for remedy years 126 to 275.

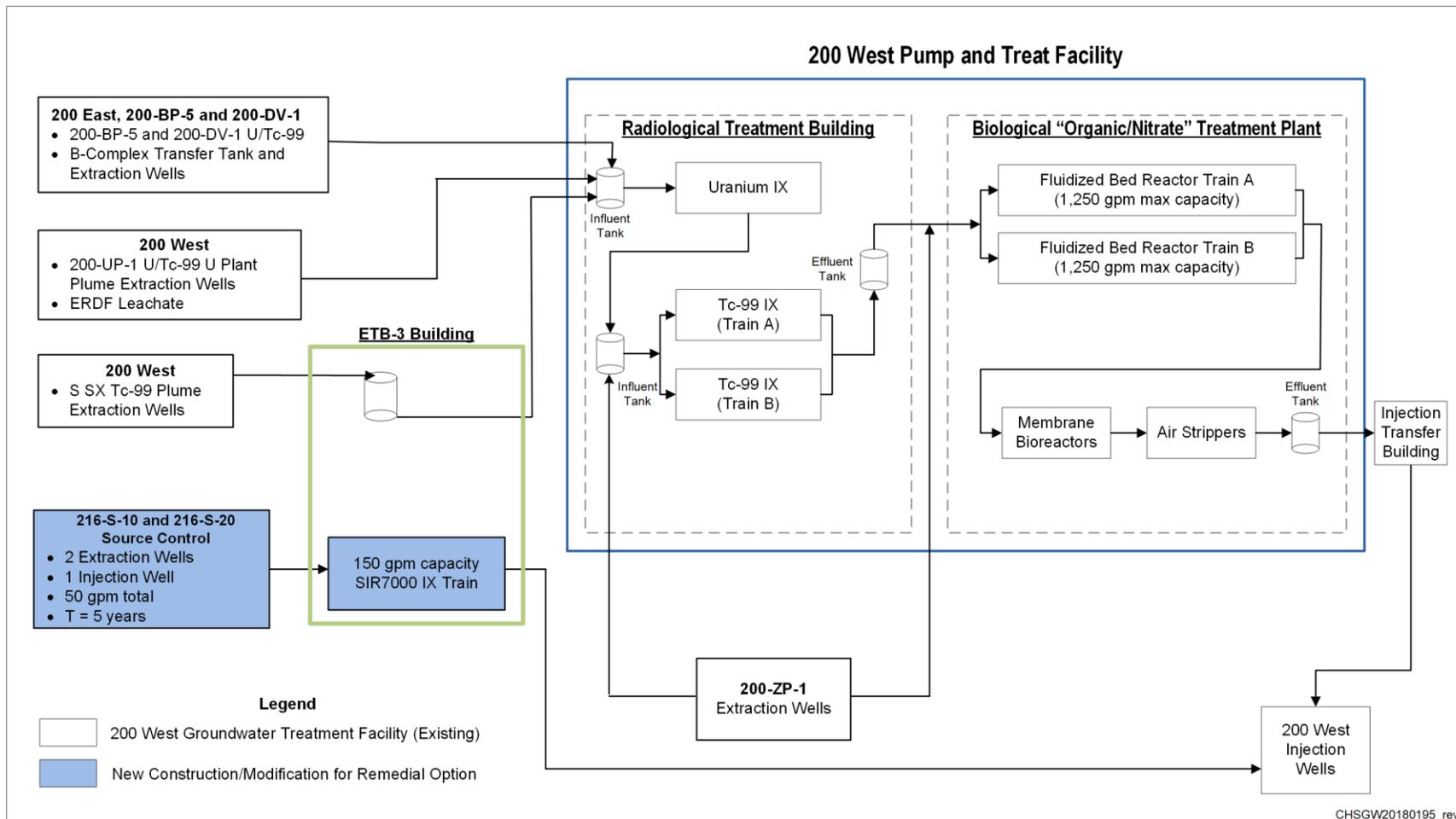
#### **4.2 Remedial Option 2a – Source Control, 25 Years P&T for Dispersed Plume Using Onsite Treatment, and Monitored Natural Attenuation**

Option 2a consists of 5 years of P&T downgradient of two potential chromium sources to groundwater, 25 years of P&T for the dispersed plume, followed by MNA. Option 2a consists of the following components (Figure 3):

- Active groundwater remediation using P&T for source control at the 216-S-10 Pond/Ditches and 216-S-20 Crib (one extraction well at each of the two sites) for 5 years at a total flow rate of 189 L/min (50 gal/min).
- Active groundwater remediation using P&T for the dispersed chromium plume using 8 extraction wells and 11 injections wells for 25 years at a total flow rate of 1,893 L/min (500 gal/min).
- Groundwater treatment for chromium at a new onsite treatment facility within the 200-UP-1 OU using IX resin with a design capacity of 2,839 L/min (750 gal/min). Injection of treated water would occur in the dispersed chromium plume area.
- MNA and groundwater monitoring for chromium for 120 years.

#### **4.3 Remedial Option 2b – Source Control, 25 Years P&T for Dispersed Plume Using Chromium Only Treat at 200 West P&T, and Monitored Natural Attenuation**

Option 2b is the same as Option 2a, except the groundwater extracted from the dispersed plume will be routed through the existing 200 West P&T instead of constructing a new onsite facility within the 200-UP-1 OU (Figure 4). Groundwater treatment for the dispersed chromium plume at the 200 West P&T in Option 2b assumes the 200 West P&T will be modified to treat the extracted 200-UP-1 OU southeast chromium plume water to be treated for chromium only. The modification would include making building modifications and installing a new chromium treatment train (Figure 5). A new transfer station would be constructed to convey water from the dispersed chromium plume to the 200 West P&T.



**Figure 2. Block Diagram of Option 1 Remedy Components**

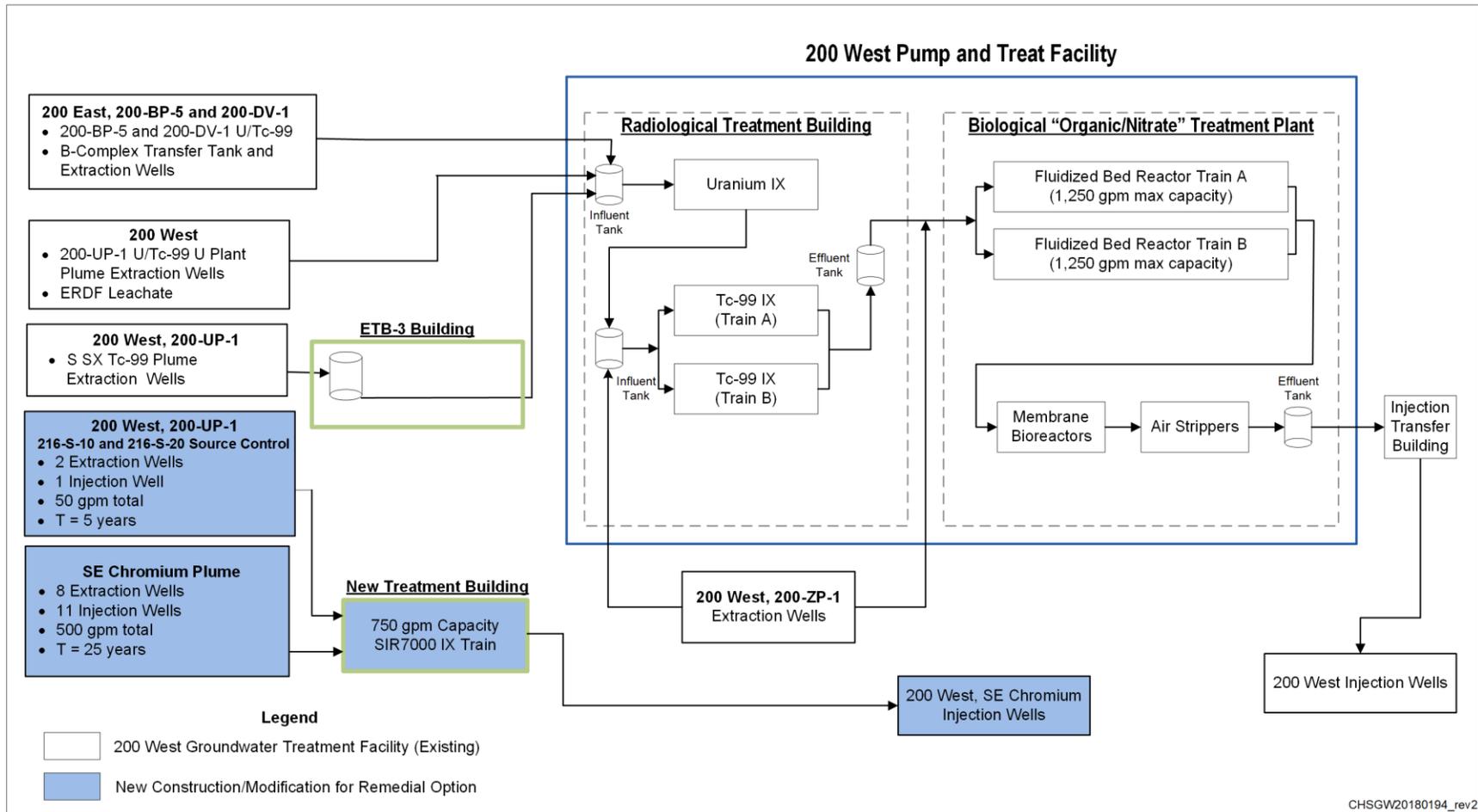
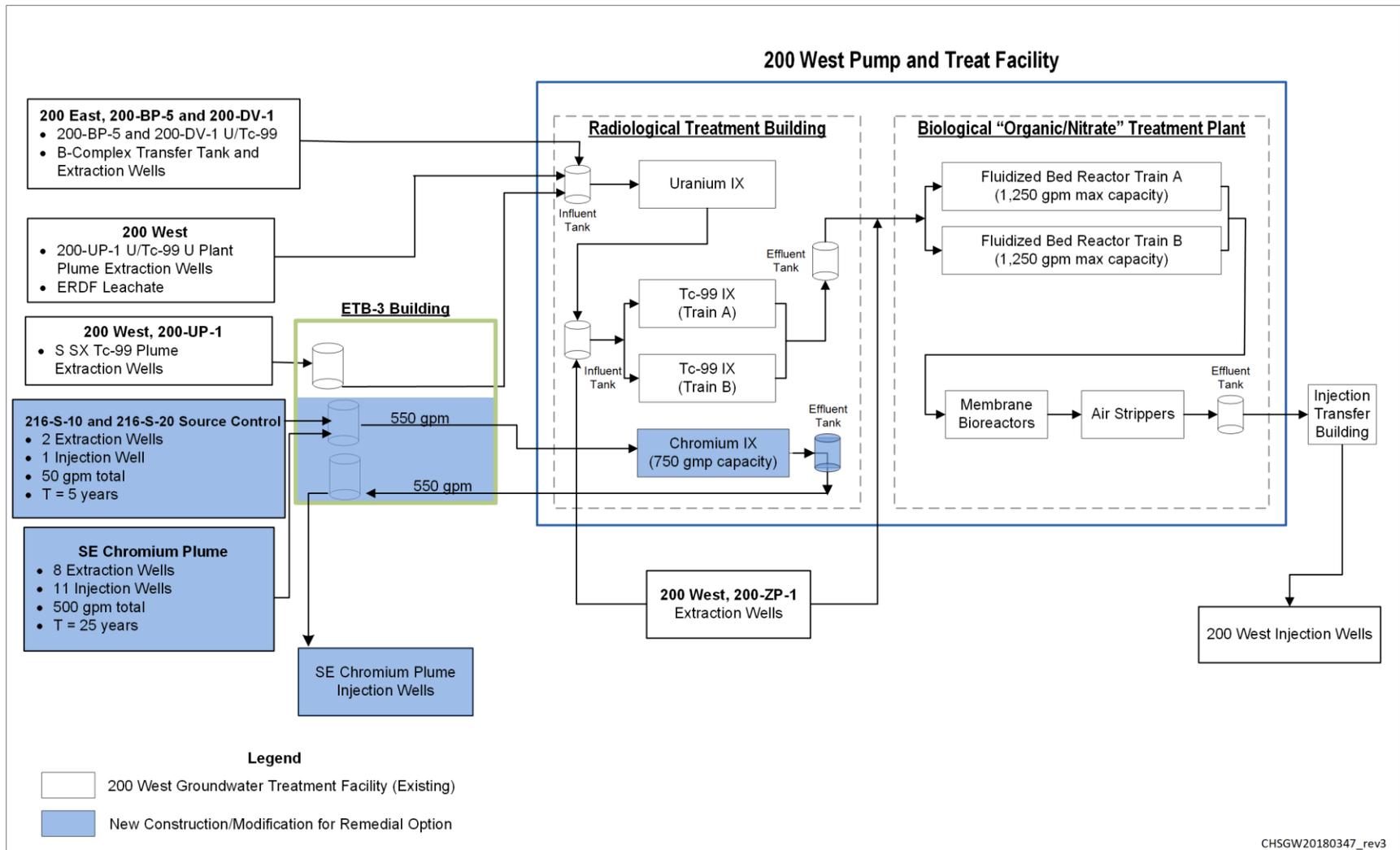


Figure 3. Block Diagram of Option 2a Remedy Components



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Figure 4. Block Diagram of Option 2b Remedy Components

#### 4.4 Remedial Option 2c – Source Control, 25 Years P&T for Dispersed Plume Using 200 West P&T, and Monitored Natural Attenuation

Option 2c is the same as Option 2b, except the groundwater extracted from the dispersed plume will be routed through the existing 200 West P&T instead of modifying to treat the extracted groundwater for chromium only treatment (Figure 5). Groundwater treatment for the dispersed chromium plume at the 200 West P&T assumes the addition of fluidized bed reactors, membrane biological reactors, an air stripper, and additional granular activated carbon containers. A minimum design capacity of 2,839 L/min (750 gal/min) is required. A new transfer station would be constructed to convey water from the dispersed chromium plume to the 200 West P&T.

#### 4.5 Remedial Option 3 – Source Control and 25 Years P&T for Dispersed Plume to Below Cleanup Levels Using Onsite Treatment

Option 3 consists of 5 years of P&T downgradient of two potential chromium sources to groundwater, and 25 years of P&T for the dispersed plume to below cleanup levels using a new onsite treatment facility within the 200-UP-1 OU. Option 3 consists of the following components (Figure 6):

- Active groundwater remediation using P&T for source control at the 216-S-10 Pond/Ditches and 216-S-20 Crib (one extraction well at each of the two sites) for 5 years at a total flow rate of 189 L/min (50 gal/min).
- Active groundwater remediation using P&T for the dispersed chromium plume using 54 extraction/injection wells for 25 years at a total flow rate of 10,221 L/min (2,700 gal/min).
- Groundwater treatment for chromium at a new onsite treatment facility using IX resin with a design capacity of 11,356 L/min (3,000 gal/min). Injection of treated water would occur in the dispersed chromium plume area.
- Maintenance of ICs for 25 years.

#### 4.6 Institutional Controls

The current Hanford Site programmatic ICs are to control access onto and specific uses of the Hanford Site (DOE/RL-2001-41, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions* (hereinafter called the Hanford Sitewide IC plan). In addition to preserving the Hanford Reach National Monument and maintaining Hanford Site security and safety, the ICs also protect human health and the environment by limiting potential exposure to hazardous substances. Many of these multipurpose or programmatic controls are typically required as ICs by each *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) ROD on the Hanford Site. The programmatic controls include site access, personnel badging, real estate and deed restrictions, and warning signs along the Columbia River bank and other access points. Also included are maintaining a current Hanford Sitewide IC plan, including controls for excavating soil; accessing and using groundwater; and irrigation restrictions. While these controls transcend any specific CERCLA ROD or even the overall CERCLA cleanup process, the U.S. Department of Energy and the U.S. Environmental Protection Agency (EPA) recognize the importance of maintaining these controls until unrestricted use related to the protection of human health and the environment is permitted.

The programmatic IC costs for the Hanford Site have been projected for the next 1,000 years. The total nondiscounted cost for the ICs for 1,000 years is estimated to be \$542,527,000 (about \$22,700,000 per ROD over 1,000 years, or about \$23,000 per year). The total discounted cost for the ICs are estimated at \$83,220,000 (about \$3,500,000 per ROD). The ICs were included in the costs for options with durations >125 years, since the 200-UP-1 ROD (EPA et al., 2012) accounted for remedies lasting 125 years.

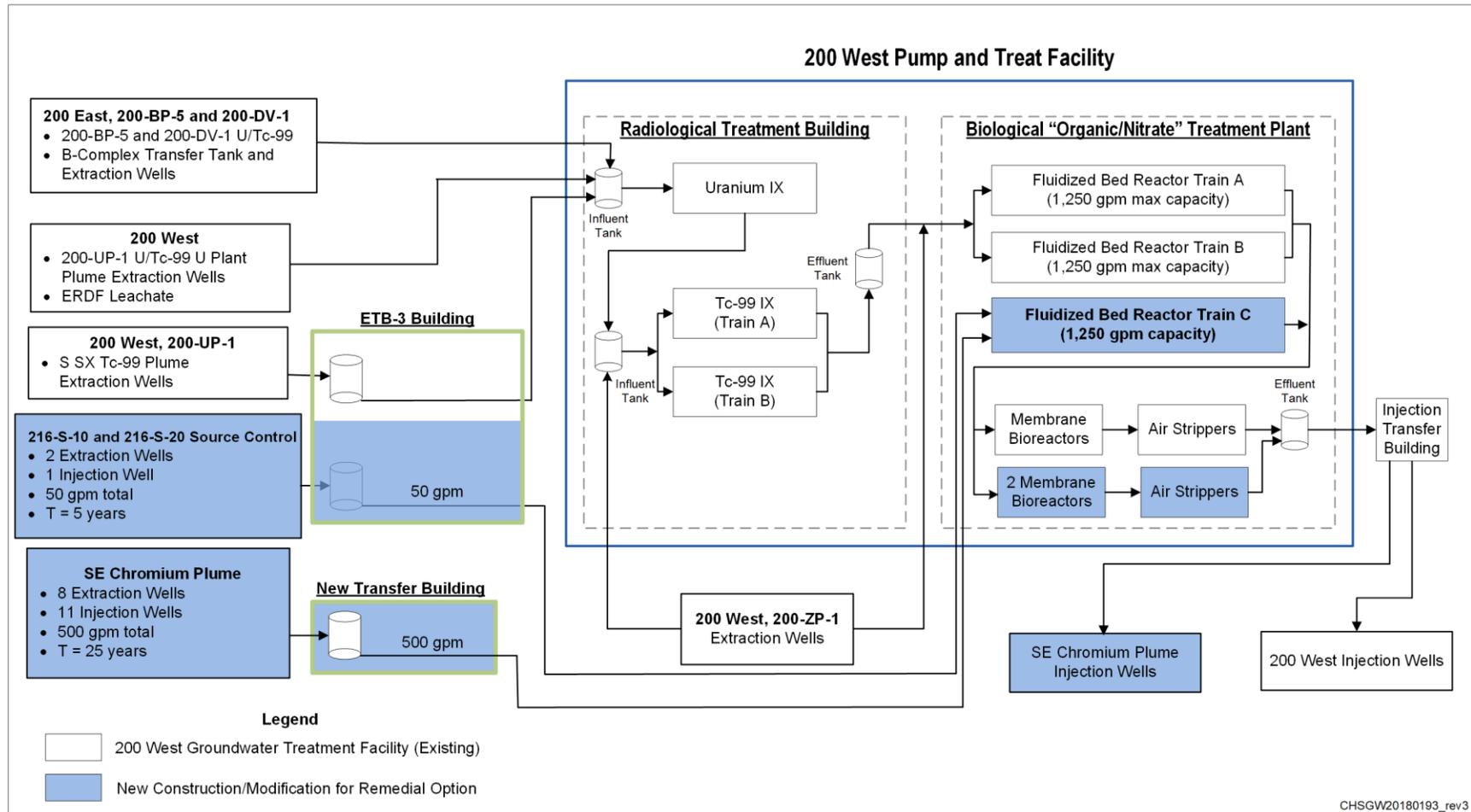
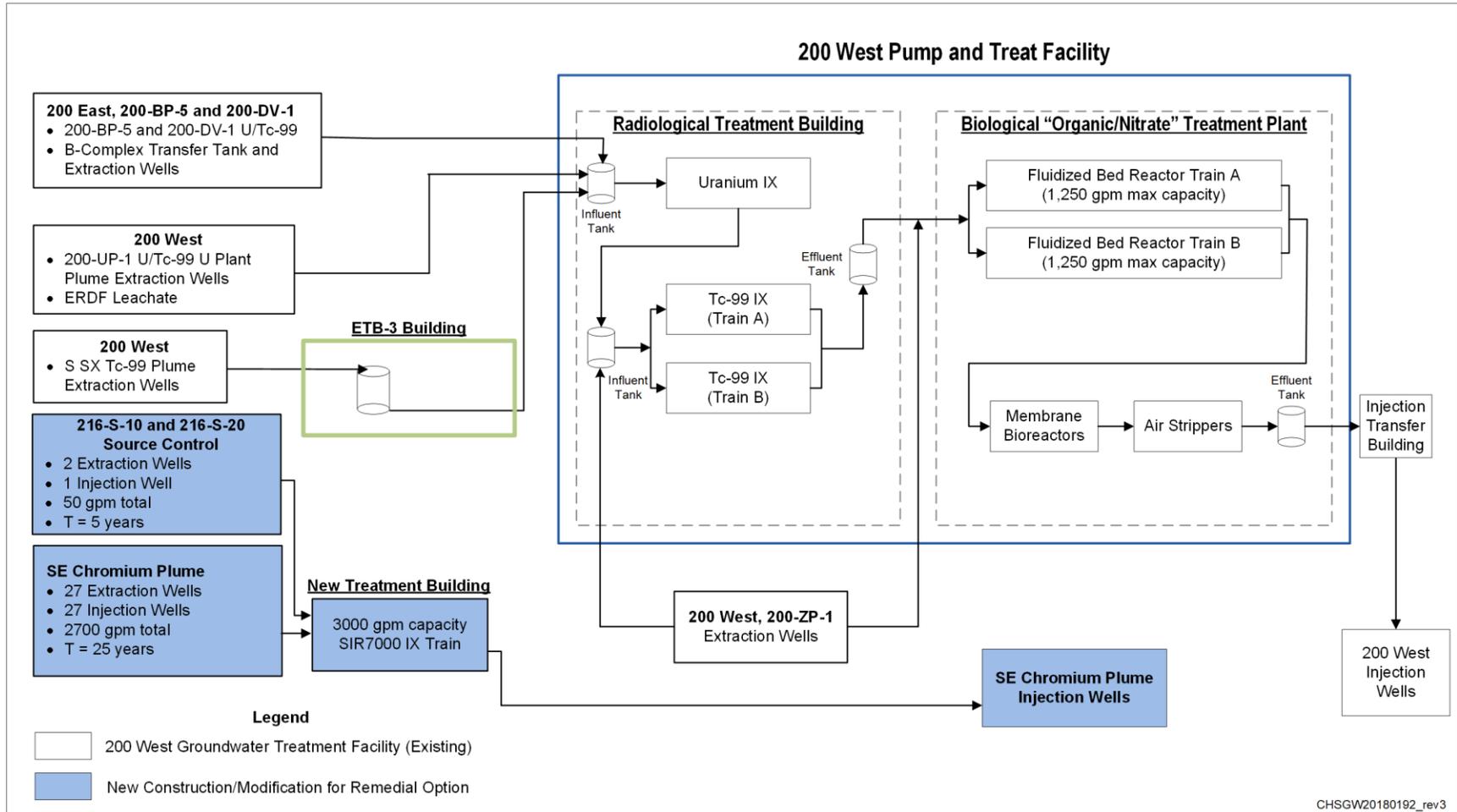


Figure 5. Block Diagram of Option 2c Remedy Components



**Figure 6. Block Diagram of Option 3 Remedy Components**

The ICs for groundwater include the following:

- Excavation permits required for excavations on the Hanford Site to prevent unplanned disturbance or infiltration, as prohibited by CERCLA decision documents.
- Land-use and real property controls (e.g., proprietary controls including irrigation restrictions, easements, and covenants) ensure that the use of land is in accordance with Hanford Site plans and CERCLA decision documents.
- Groundwater-use management, as described in the Hanford Sitewide IC plan (DOE/RL-2001-41), ensures proper use of groundwater through groundwater controls.
- Administrative mechanisms (e.g., the Waste Information Data System database) to maintain and provide access to information on the location and nature of contamination.

Costs for ICs for the 200-UP-1 OU were included in the feasibility study cost estimates for a duration of 125 years (DOE/RL-2009-122, *Remedial Investigation/Feasibility Study for the 200-UP-1 Groundwater Operable Unit*). Therefore, for this cost estimate, only ICs for remedial options extending past 125 years were included.

## 4.7 Overall Costs

Table 3 presents the total marked-up costs for each remedial option. The cost summary lists total capital, annual operations and maintenance (O&M) costs, and a nondiscounted total for these cost components. Total discounted costs are also presented for each remedial option. Appendix A provides summary reports and a cost basis summary for the alternatives.

**Table 3. Summary of Cost Estimates for Each Remedial Option**

	Option 1	Option 2a	Option 2b	Option 2c	Option 3
Total project duration (years)	275	120	120	120	32
Capital cost	\$18,000,000	\$79,000,000	\$88,000,000	\$154,000,000	\$218,000,000
Annual O&M cost	\$18,000,000	\$84,000,000	\$84,000,000	\$322,000,000	\$296,000,000
Periodic O&M cost	\$57,000,000	\$61,000,000	\$59,000,000	\$59,000,000	\$91,000,000
Total nondiscounted cost	\$94,000,000	\$223,000,000	\$231,000,000	\$535,000,000	\$605,000,000
Total present value of alternative	\$57,000,000	\$203,000,000	\$211,000,000	\$490,000,000	\$558,000,000
-30%	\$40,000,000	\$142,000,000	\$148,000,000	\$343,000,000	\$391,000,000
50%	\$86,000,000	\$304,000,000	\$316,000,000	\$735,000,000	\$837,000,000

O&M = operations and maintenance

## 5 Estimate Methodology

Assumed project scope items were itemized at a major assembly level, and unit costs were applied for the major assemblies, with some breakout of more detailed support costs when deemed necessary for clarity. Where available, costs for major systems were based on existing system costs or previously estimated

costs at the Hanford Site. Percentage allowances were applied for some of the capital and O&M cost items based on Hanford Site and environmental project experience.

This cost estimate has been prepared for use in project evaluations and is based on the information available at the time that this estimate was prepared. The final cost of the project will depend on final design, selected scope of work, actual labor and material costs, competitive market conditions, implementation schedule, and other factors. As a result, the final project costs may vary from the estimate presented herein. Therefore, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

Appendix B provides detailed cost-estimating worksheets for each of the remedial options in this estimate. Appendix C provides the line item costs used in the estimate.

## 5.1 Markups

The following typical markups were applied to the cost estimate:

- Mobilization/Demobilization Bond & Insurance applied to capital costs of 10%
- Contractor overhead and profit (OH&P) of 15% and 10%, respectively (when CHPRC only)
- Washington State sales tax of 8.6% (6.5% state general sales tax, plus 2.1% city tax rate)
- Scope contingency of 15% and bid contingency of 10%
- Project management, remedial design, and construction management percentages are based upon the total cost of the capital for each alternative, therefore the percentages change per alternative:
  - Project management of 5%; remedial design of 6%; and construction management of 6% for capital costs, technical support services for O&M
- CHPRC general and administrative (G&A) of 19.26%

The markups were added in the following order:

1. Mobilization/Demobilization Bond & Insurance
2. Contractor OH&P markup was applied to any non-CHPRC labor, equipment, and materials; where there was no contractor under CHPRC, this markup is 0%
3. Washington State sales tax
4. Project management, remedial design, and construction management
5. CHPRC G&A markup was added to the subtotal after OH&P markup

## 5.2 Contingencies

The following contingencies were used in the cost estimate:

- Scope contingency of 15% (Figure 7)
- Bid contingency of 10% based on EPA guidance for feasibility study costs, “Bid contingency typically ranges from 10 to 20 percent” (EPA 540-R-00-002, p. 5-11)
- Scope and bid contingencies based on EPA guidance (EPA 540-R-00-002, pp. 5-10 and 5-11)

<b>Exhibit 5-6 Example FS-Level Scope Contingency Percentages</b>	
<b>Remedial Technology</b>	<b>Scope Contingency (%)</b>
Soil Excavation	15-55
Groundwater Treatment (Multiple)	15-35
On-Site Incineration	15-35
Extraction Wells	10-30
Vertical Barriers	10-30
Synthetic Cap	10-20
Sludge Stabilization	10-20
Off-Site Disposal	5-15
Off-Site Incineration	5-15
Drum Processing	5-15
Bulk Liquid Processing	5-15
Groundwater Treatment (Single)	5-10
Clay Cap	5-10
Surface Grading/Diking	5-10
Revegetation	5-10

Source: Exhibit 5-6, "Example FS-Level Scope Contingency Percentages," in EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*.

**Figure 7. Scope Contingency Percentages Ranges**

### 5.3 Project Management, Remedial Design, and Construction Management Costs

Project management, remedial design, and construction management capital costs are estimated using factors based on EPA 540-R-00-002, Exhibit 5-8:

- **For projects with subtotal construction costs <\$100,000:** Remedial design is planned at 20%, project management is planned at 10%, and construction management is planned at 15% of the construction cost
- **For projects with subtotal construction costs from \$100,000 to \$500,000:** Remedial design is planned at 15%, project management is planned at 8%, and construction management is planned at 10% of the construction cost
- **For projects with subtotal construction costs from \$500,000 to \$2 million:** Remedial design is planned at 12%, project management is planned at 6%, and construction management is planned at 8% of the construction cost
- **For projects with subtotal construction costs from \$2 million to \$10 million:** Remedial design is planned at 8%, project management is planned at 5%, and construction management is planned at 6% of the construction cost
- **For projects with subtotal construction costs >\$10 million:** Remedial design is planned at 6%, project management is planned at 5%, and construction management is planned at 6% of the construction cost

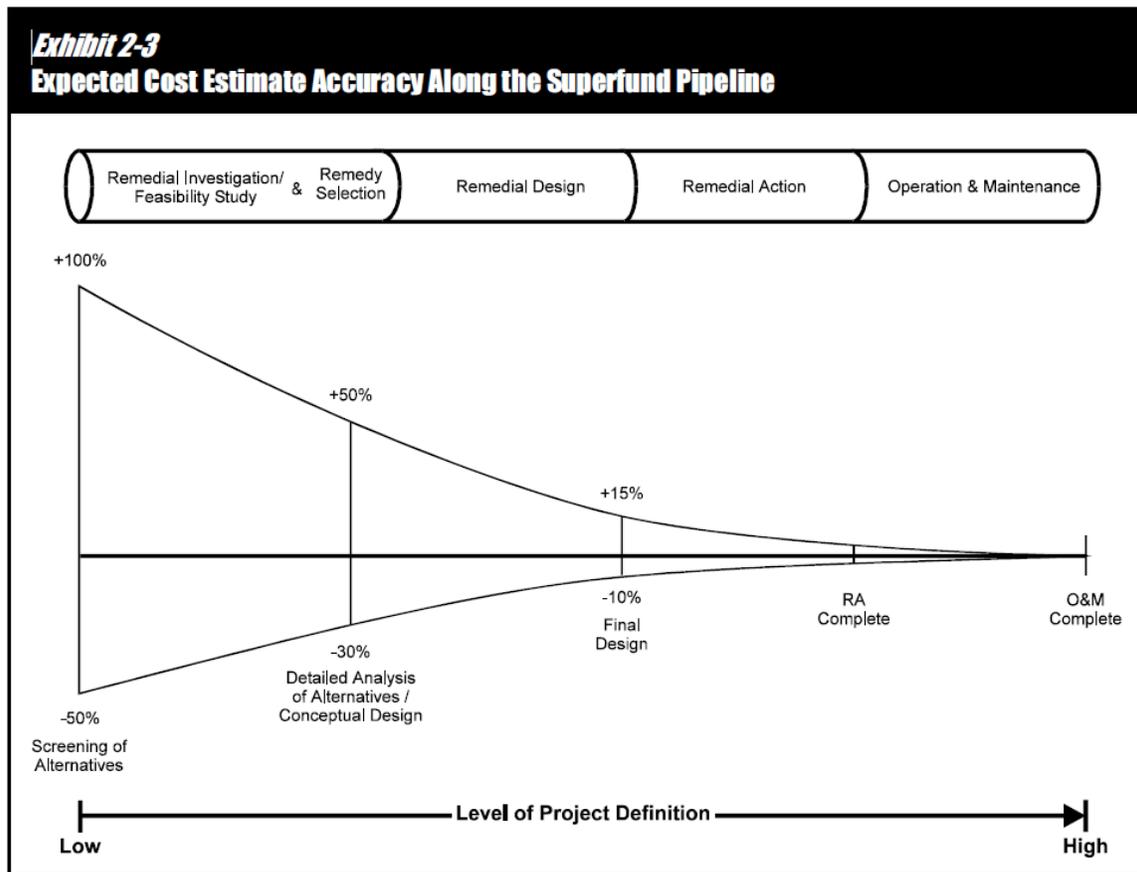
For the all groundwater and waste site remedial options, the subtotal construction costs are all greater than \$10 million, so remedial design is estimated at 6%, project management is estimated at 5%, and construction management is estimated at 6% of the construction cost.

## 5.4 Escalation Rate

Escalation was not calculated in this estimate. The estimates are presented as 2018 costs.

## 5.5 Estimate Classification

The expected accuracy range of the cost estimate at this stage is approximately +50%, -30%. This accuracy range is consistent with EPA guidance (EPA 540-R-00-002) (Figure 8) for the level of project definition available at this point in the CERCLA/Superfund process.



Source: Exhibit 2-3, "Expected Cost Estimate Accuracy Along the Superfund Pipeline," in EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*.

**Figure 8. Cost Estimate Accuracy**

The expected accuracy range is an indication of the degree to which the final cost outcome for a given project could vary from the estimated cost. Accuracy is traditionally expressed as a "±" percentage range around the point estimate after application of contingency, with a stated level of confidence that the actual cost outcome would fall within this range ("±" measures are a useful simplification, given that actual cost outcomes have different frequency distributions for different types of projects). Typically, this results in a 90% confidence that the actual cost will fall within the bounds of the low and high ranges.

The accuracy range of an estimate depends upon a number of characteristics of the estimate input information and the estimating process. The extent and maturity of the input information as measured by percentage completion (and related to level of project definition) is an important determinant of accuracy. However, there are additional factors, other than the available input information, that also greatly affect the estimate accuracy measures. Primary among these factors are the state of technology in the project and the quality of reference cost-estimating data.

The accuracy of any given estimate is not fixed or determined by its classification category. Significant variations in accuracy from estimate to estimate are possible if any of the determinants of accuracy (e.g., technology, quality of reference cost data, quality of the estimating process, and skill and knowledge of the estimator) may vary. Accuracy is also not necessarily determined by the methodology used or the effort expended. Estimate accuracy must be evaluated on an estimate-by-estimate basis, usually in conjunction with some form of risk analysis process.

## 5.6 Present-Value Analysis

In accordance with EPA guidance (EPA 540-R-00-002), the cost estimate includes present-value calculations for work performed throughout multiple years. The present-value method establishes a common baseline for evaluating costs that occur during different time periods, thus allowing for direct cost comparisons between different alternatives. The present value represents the dollars that would need to be set aside today, at the defined real discount rate, to ensure that funds would be available in the future as they are needed to perform the response action option. The purpose of the present-value spreadsheets is to calculate the total present value for each alternative.

For federal facility sites being cleaned up using CERCLA/Superfund authority, it is generally appropriate to apply the real discount rates found in Appendix C of OMB Circular A-94, “Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs” (Table 4).

**Table 4. Real Interest Rates on Treasury Notes and Bonds of Specified Maturities**

3 Year	5 Year	7 Year	10 Year	20 Year	30 Year
-0.8%	-0.6%	-0.3%	-0.1%	0.2%	0.6%
Analyses of programs with terms different from those presented above may use a linear interpolation. For example, a 4-year project can be evaluated with a rate equal to the average of the 3-year and 5-year rates. Programs with durations longer than 30 years may use the 30-year interest rate.					

Note: From OMB Circular A-94, “Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs,” Appendix C, “Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses,” revised November 2017.

## 5.7 Cost Resources

The following cost resources were used to develop the cost estimate:

- CHPRC historical data
- Vendor quotes and subcontracts (well drilling, completion costs, and pipeline fabrication)
- CHPRC finance (labor and overhead rates)
- Estimator judgment
- Subject matter expert information

## 5.8 Labor Costs

The estimate has been adjusted for local area labor rates using finance department resource rates as agreed upon in current contracts. Labor unit prices reflect a burden rate, including workers' compensation, unemployment taxes, fringe benefits, and medical insurance (i.e., at 2018 rates).

## 5.9 Sales Tax

Sales tax is included in nonlabor costs based on previous Hanford Site P&T systems and components used in this estimate. Washington State sales tax rate used was 8.3%.

### 5.9.1 Construction

The following assumptions were made in regard to construction for this cost estimate:

- Extraction, injection, and monitoring well line item costs, including the following:
  - Monitoring well installation
  - Well pads
  - Access roads
  - Well sampling during drilling (includes sampling crew)
  - Pump assembly, pump setting crew
  - Onsite geologist/geophysicist/hydrogeologist

### 5.9.2 Operations and Maintenance

The following assumptions were made in regard to O&M for this cost estimate:

- Operating costs for the P&T system are based on actual costs for the 200 West P&T or similar onsite P&T treatment facilities. For treatment at the 200 West P&T, O&M costs for extracted water were assumed to be \$0.0231 per gallon, and for chromium only treatment at a new onsite treatment facility or at the 200 West P&T, the costs are assumed to be \$0.0055 per gallon.
- Annual well maintenance activities include well rehabilitation and pump replacement when necessary.
- Extraction, injection, and monitoring wells are replaced every 20 years, 10 years, and 30 years, respectively.

## 6 Major Assumptions

There are two different types of assumptions and inputs for cost estimation: general assumptions and response activity-specific.

### 6.1 General Assumptions and Inputs

General assumptions apply to all response action cost estimates. The general assumptions discussed in the following sections include direct and indirect cost assumptions and other general pricing assumptions.

## 6.2 General Direct Cost Assumptions

Direct costs include all costs that can be directly attributed to a particular construction activity or item of work required to accomplish the project. Typical direct cost items include labor, material, equipment, and subcontract items. Direct cost assumptions for this estimate include the following:

- Scope and bid contingencies (Section 5.2)
- Project management, remedial design, and construction management capital costs (Section 5.3)
- Construction labor costs (Section 5.8)

## 6.3 General Indirect Cost Assumptions

Indirect costs are not directly attributable to the completion of an activity. Indirect costs are typically allocated or spread across all activities on a predetermined basis. Indirect costs items can include the following job-related overhead items:

- Taxes
- Project-specific insurance
- Bonds, permits, and licenses
- General supervision
- Temporary office personnel
- Schedules
- Preparatory work and testing services
- Temporary project facilities
- Temporary utilities
- O&M of temporary project site facilities
- Project vehicles
- Personal protective equipment and Occupational Safety and Health Administration requirements
- Quality controls
- Mobilization and demobilization
- Site security

General indirect cost assumptions for this estimate include the following:

- Markups for profit and G&A
- Mobilization/demobilization and bonding/insurance (a standard percentage allowance was used based on project size and using the high-percentage value from the low, medium, and high percentages for the project size)

## 6.4 Other General Cost Assumptions

Quantities used in the cost estimate were provided by the 200-UP-1 OU project team and are accurate for the assumed project scope.

## 7 Exclusions

This chapter identifies costs that have not been included in the estimate.

Separate escalation has not been included in these calculations. The costs are all based on fiscal year 2018 costs distributed into years that the activities and associated costs would occur, and a present-value analysis is performed to convert all costs back to fiscal year 2018 basis using the alternative-specific stated OMB real discount rate (OMB Circular No. A-94, 2016).

The IC costs for years prior to year 125 are excluded because these costs were already included in the cost estimates prepared for the overall remedies as part of the 200-UP-1 OU feasibility study (DOE/RL-2009-122). The feasibility study did not include remedy durations >125 years.

## 8 Sensitivity Analysis

Sensitivity analysis for this cost estimate was not performed. The following factors might cause the estimate to significantly change:

- Levels of contamination
- Depth and extent of contamination encountered in the aquifer during drilling
- Actual plume extent and concentration changes and associated monitoring requirements
- Actual number of monitoring, injection, and extraction wells required, and any follow-up maintenance and replacement requirements
- Less favorable working conditions and/or increased monitoring requirements that would significantly increase the impact of working in health and safety protection and/or increase the health and safety protection requirements

Because of these factors, the remedy selection process should consider differences in response action cost uncertainties/cost risks in addition to response action-specific cost estimates and ranges. Also, funding needs must be carefully reviewed before making specific financial decisions or establishing final budgets.

## 9 Labor Costs

The estimate has been adjusted for local area labor rates through the use of finance department resource rates as agreed upon in current contracts.

## 10 References

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# **Appendix A**

## **Reports**

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## **A Reports**

This appendix provides summary sheets comparing the overall costs of the 200-UP-1 Operable Unit southeast chromium plume remedial options.

**Table A-1. Comparison of Total Cost of Remedial Action Alternatives**

Location: 200-UP-1		Base Year: 2019			
Phase: SE Chromium Plume		Date: 1/1/2019			
	Option 1	Option 2a	Option 2b	Option 2c	Option 3
	Source Area P&T and MNA for 275 years	Source Control P&T, Dispersed Plume P&T for 25 years with on-site treatment, and MNA for 120 years	Source Control P&T, Dispersed Plume P&T for 25 years with Cr Only treatment at 200W P&T, and MNA for 120 years	Source Control P&T, Dispersed Plume P&T for 25 years with treatment at 200W P&T, and MNA for 120 years	Source Control P&T, Dispersed Plume P&T for 25 years with on-site treatment to below cleanup levels, and MNA for 25 years
<b>Total Project Duration (Years)</b>	275	120	120	120	32
<b>Capital Cost</b>	\$18,000,000	\$79,000,000	\$88,000,000	\$154,000,000	\$218,000,000
<b>Annual O&amp;M Cost</b>	\$18,000,000	\$84,000,000	\$84,000,000	\$322,000,000	\$296,000,000
<b>Periodic O&amp;M Cost</b>	\$57,000,000	\$61,000,000	\$59,000,000	\$59,000,000	\$91,000,000
<b>Total Non-Discounted Cost</b>	\$94,000,000	\$223,000,000	\$232,000,000	\$536,000,000	\$605,000,000
<b>Total Present Value of Alternative</b>	\$57,000,000	\$203,000,000	\$211,000,000	\$490,000,000	\$558,000,000
<b>Expected Accuracy Range for Total Present Value is -30% to +50%</b>					
<b>-30%</b>	\$40,000,000	\$142,000,000	\$148,000,000	\$343,000,000	\$391,000,000
<b>50%</b>	\$86,000,000	\$304,000,000	\$316,000,000	\$736,000,000	\$837,000,000
Disclaimer: The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial actions. Changes in the cost elements may occur as a result of new information and data collected during the engineering design of the remedial alternatives. This is an order-of-magnitude cost estimate that is expected to be within -30 to +50 percent of the actual project costs.					

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**Table A-2. Comparison of Total Cost of Remedial Action Alternatives by Site**

Location: 200-UP-1		Base Year: 2019					
Phase: SE Chromium Plume		Date: 1/1/2019					
		Option 1	Option 2a	Option 2b	Option 2c	Option 3	
		Source Area P&T and MNA for 275 years		Source Control P&T, Dispersed Plume P&T for 25 years with on-site treatment, and MNA for 120 years	Source Control P&T, Dispersed Plume P&T for 25 years with Cr Only treatment at 200W P&T, and MNA for 120 years	Source Control P&T, Dispersed Plume P&T for 25 years with treatment at 200W P&T, and MNA for 120 years	
Site	Site Name	Total Project Duration (Years)	275	120	120	120	32
1 Design		Capital Cost	\$420,000	\$420,000	\$420,000	\$420,000	\$420,000
		Annual O&M Cost	\$0	\$0	\$0	\$0	\$0
		Periodic O&M Cost	\$0	\$0	\$0	\$0	\$0
		Total Non-Discounted Cost	\$420,000	\$420,000	\$420,000	\$420,000	\$420,000
		Total Present Value of Alternative	\$420,000	\$420,000	\$420,000	\$420,000	\$420,000
2 Well Installation		Capital Cost	\$12,600,000	\$43,400,000	\$43,400,000	\$43,400,000	\$106,500,000
		Annual O&M Cost	\$0	\$0	\$0	\$0	\$0
		Periodic O&M Cost	\$0	\$0	\$0	\$0	\$0
		Total Non-Discounted Cost	\$12,600,000	\$43,400,000	\$43,400,000	\$43,400,000	\$106,500,000
		Total Present Value of Alternative	\$12,500,000	\$43,000,000	\$43,000,000	\$43,000,000	\$104,600,000
3 Construction		Capital Cost	\$5,300,000	\$34,800,000	\$44,500,000	\$110,300,000	\$111,300,000
		Annual O&M Cost	\$0	\$0	\$0	\$0	\$0
		Periodic O&M Cost	\$0	\$0	\$0	\$0	\$0
		Total Non-Discounted Cost	\$5,300,000	\$34,800,000	\$44,500,000	\$110,300,000	\$111,300,000
		Total Present Value of Alternative	\$5,300,000	\$34,300,000	\$44,000,000	\$109,000,000	\$109,300,000
4 Operations and Maintenance		Capital Cost	\$0	\$0	\$0	\$0	\$0
		Annual O&M Cost	\$6,900,000	\$79,800,000	\$79,800,000	\$318,000,000	\$291,800,000
		Periodic O&M Cost	\$52,300,000	\$55,500,000	\$55,500,000	\$55,500,000	\$87,300,000
		Total Non-Discounted Cost	\$59,300,000	\$135,300,000	\$135,300,000	\$373,500,000	\$379,100,000
		Total Present Value of Alternative	\$30,600,000	\$117,300,000	\$117,300,000	\$331,600,000	\$336,700,000
5 Remedy Performance Monitoring/Reporting		Capital Cost	\$0	\$0	\$0	\$0	\$0
		Annual O&M Cost	\$4,100,000	\$4,200,000	\$4,200,000	\$4,200,000	\$4,400,000
		Periodic O&M Cost	\$4,200,000	\$2,500,000	\$2,500,000	\$2,500,000	\$0
		Total Non-Discounted Cost	\$8,300,000	\$6,800,000	\$6,800,000	\$6,800,000	\$4,400,000
		Total Present Value of Alternative	\$6,000,000	\$5,500,000	\$5,500,000	\$5,500,000	\$4,000,000
6 Closeout		Capital Cost	\$0	\$0	\$0	\$0	\$0
		Annual O&M Cost	\$0	\$0	\$0	\$0	\$0
		Periodic O&M Cost	\$960,000	\$2,700,000	\$1,100,000	\$1,100,000	\$3,600,000
		Total Non-Discounted Cost	\$960,000	\$2,700,000	\$1,100,000	\$1,100,000	\$3,600,000
		Total Present Value of Alternative	\$430,000	\$2,200,000	\$860,000	\$860,000	\$3,000,000
7 Institutional Controls		Capital Cost	\$0	\$0	\$0	\$0	\$0
		Annual O&M Cost	\$7,000,000	\$0	\$0	\$0	\$0
		Periodic O&M Cost	\$0	\$0	\$0	\$0	\$0
		Total Non-Discounted Cost	\$7,000,000	\$0	\$0	\$0	\$0
		Total Present Value of Alternative	\$2,200,000	\$0	\$0	\$0	\$0

Table A-3. Cost Basis Summary

Element	Cost	Alternative 2a - Source Control +MNA	Alternative 2b - 600 gpm + MNA	Alternative 2c - 600 gpm + MNA	Alternative 3 - 2800 gpm + MNA	Notes		
		100 gpm treatment at 2 source sites 275 years MNA	100 gpm treatment at 2 source sites 500 gpm treatment	100 gpm treatment at 2 source sites 500 gpm treatment	100 gpm treatment at 2 source sites 2700 gpm			
	Extraction rate	100	600	600	2800			
	Years Treatment	25	25	25	25			
	Years MNA	275	120	120	25			
		Unit Cost	Unit	# Units	# Units			
<b>Planning</b>								
	Permitting and Reviews	\$ 23,000	lump	1	1	1	180 labor + \$5,000 MSA	
<b>Design</b>								
	Functional Design Requirements Document	\$ 138,000	lump	1	1	1	480 hrs + \$90K subc modeling	
	30% Design	4%	%Construction	4%	4%	4%	4%	Unit cost percentage based on ratio of 30% design to construction cost for 200-UP-1 RD/RAWP (ECE-200UP113-00001)
	60% Design	4%	%Construction	4%	4%	4%	4%	Unit cost percentage based on ratio of 30% design to construction cost for 200-UP-1 RD/RAWP (ECE-200UP113-00001)
	90% Design	4%	%Construction	4%	4%	4%	4%	Unit cost percentage based on ratio of 30% design to construction cost for 200-UP-1 RD/RAWP (ECE-200UP113-00001)
<b>Well Installation - Initial</b>								
	Extraction Well Installation	\$ 575,000	8" well	2	10	10	27	Assume well depth of 400 ft. Includes direct drilling cost and CHPRC field and oversight labor.
	Injection Well Installation	\$ 575,000	8" well	1	10	10	27	Assume well depth of 400 ft. Includes direct drilling cost and CHPRC field and oversight labor.
	Monitoring Well Installation	\$ 400,000	4" well	6	6	6	6	Assume 6 new wells needed for MNA monitoring, and well depth of 425 ft.
	Wells pads	\$ 15,000	well pad	9	26	26	60	Cost based on previous project work
	Access roads	\$ 115,500	mile	0.8	7	7	18	gravel road for Well 199-K-224. Total for Alts 1 and 2 assumes 0.1 mile road per well pad
<b>Construction</b>								
	Contruction Management	6%	Construction	6%	6%	6%	6%	
	Extraction Transfer Bldg 3 (ETB3)Mods							
	150 gpm Cr treatment Train	\$ 800,000	Train	1	1	1	1	
	Other mods	\$ 50,000	lump	1	1	1	1	
	200 West P&T Modifications adding							
	FBR	\$ 2,800,000	Unit	0	0	1	0	Unit cost from other project estimates of ~\$2.7 million 2016 dollars escalated at 2% per year to 2018
	MBR	\$ 10,700,000	Unit	0	0	2	0	Unit cost of \$9.7 million based on 200-UP-1 RD/RAWP in 2013, escalated 2% per year to 2018
	Air Stripper	\$ 3,500,000	Unit	0	0	1	0	Unit cost of \$3.2 million based on 200-UP-1 RD/RAWP in 2013, escalated 2% per year to 2018
	GAC	\$ 500,000	Unit	0	0	2	0	
	Other mods	\$ 50,000	lump	0	0	1	0	
	<b>Site Specific Treatment System</b>							
	Building	\$ 900,000	Bldg	0	1	0	1	Unit cost based on previous project estimates
	750 gpm Cr treatment Train	\$ 1,200,000	Train	0	1	0	0	Unit cost based on previous project estimates
	3000 gpm Cr treatment Train	\$ 4,500,000	Train	0	0	0	1	Unit cost based on previous project estimates
	Other	\$ 50,000	lump	0	1	0	1	Unit cost based on previous project estimates
	<b>Balance of Plant</b>							
	3" SWHDPE Pipeline	\$ 29	Foot	20500	56000	120600	96000	Unit Cost includes \$4/ft materials, and \$25/ft labor. Labor cost from 2013 200-UP-1 RD/RAWP cost estimate.
	Paved Crossings	\$ 60,000	Crossing	0	5	5	5	Unit cost from 200-UP-1 RD/RAWP in 2013 and based on FFS invoice that averaged ~\$60K per crossing
	Gravel Crossings	\$ 16,000	Crossing	10	6	6	6	from Urquidi e-mail 3/14. Total feet for Alt 3b includes 56,000 ft plus
	Mechanical Rack	\$ 25,000	Rack	2	2	2	2	From 200-BP-5 est
	Electrical Rack	\$ 40,000	Rack	2	2	2	2	Unit cost from 200-UP-1 RD/RAWP in 2013 which used KX as basis
	On Ground Electrical Cable	\$ 8	Foot	4000	4000	4000	4000	
	Instrument cable	\$ 5	Foot	4000	4000	4000	4000	
	Power Service/transformers	\$ 50,000	lump	1	1	1	1	
	Misc							
	Water Level Montoring System	\$ 6,500	well	10	10	10	10	Unit cost based on materials and labor from 200-UP-1 2013 RD/RAWP cost estimate

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Element	Cost		Alternative 2a - Source Control +MNA	Alternative 2b - 600 gpm + MNA	Alternative 2c - 600 gpm + MNA	Alternative 3 - 2800 gpm + MNA	Notes
			100 gpm treatment at 2 source sites 275 years MNA	100 gpm treatment at 2 source sites 500 gpm treatment	100 gpm treatment at 2 source sites 500 gpm treatment	100 gpm treatment at 2 source sites 2700 gpm	
	Extraction rate		100	600	600	2800	
	Years Treatment		25	25	25	25	
	Years MNA		275	120	120	25	
		<b>Unit Cost</b>	<b># Units</b>	<b># Units</b>	<b># Units</b>	<b># Units</b>	
		<b>Unit</b>					
<b>Operations and Maintenance</b>							
Operations and Maintenance -Treatment							
	Annual 100 gpm	0.0055 \$/Gal	52560000	52560000	52560000	52560000	Ave KX, DX & HX 2016 unit costs
	Annual 500 gpm Site Specific	0.0055 \$/Gal	0	262800000	0	0	Ave KX, DX & HX 2016 unit costs
	Annual 500 gpm 2WP&T	0.0231 \$/Gal	0	0	262800000	0	200WP&T 2016 unit costs
	Annual 2700 gpm Site specific	0.0039 \$/Gal	0	0	0	1419120000	DX 2016 unit costs
	Annual subtotal						
	25 yr subtotal						
Well Maintenance							
	Extraction Well	\$ 5,000 well year	2	10	10	29	
	Injection Well	\$ 2,500 well year	1	10	10	27	
	Monitoring Well	\$ 500 well year	12	12	12	12	
	Annual subtotal						
	25 yr subtotal						
Replacement Wells							
	Extraction Well Installation	\$ 575,000 8" well	2	10	10	22	Assume well depth of 400 ft. Includes direct drilling cost and CHPRC field and oversight labor. Well cost from Bonnie Howard e-mail on 3/12/2018. R/FS Appendix D
	Injection Well Installation	\$ 575,000 8" well	4	22	22	22	Assume well depth of 400 ft. Includes direct drilling cost and CHPRC field and oversight labor.
	Monitoring Well Installation	\$ 400,000 4" well	108	48	48	12	Assume 6 new wells needed for MNA monitoring, and well depth of 425 ft.
	Wells pads	\$ 15,000 well pad	114	80	80	56	Costs based on previous project costs
	Access roads	\$ 115,500 mile	0.1	0.1	0.1	0.1	Price based on linear foot cost for gravel road for Well 199-K-224
	Subtotal						
	Water Level Monitoring System Maintenance	\$ 500 well year	12	12	12	12	
<b>Remedy Performance Monitoring/Reporting</b>							
	Groundwater Sampling and Analysis	\$ 1,000 sample	12	12	12	12	Includes analytical costs for Cr, and Hexavalent Chromium analysis, and CHPRC sampling crew (2 hours per well per sampling event)
	Monitoring Data Evaluation	\$ 24,000 Annual Lump	1	1	1	1	20 hrs/month = 240 hrs/yr
	Reporting	\$ 48,000 Annual Lump	1	1	1	1	480 hr effort
<b>Institutional Controls</b>							
	Institutional Controls	\$ 23,000 yr	150	0	0	0	From ECF-HANFORD-12-0067 Rev. 1. Costs for Year 126 to 275 only included.

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**Appendix B**  
**Estimate Detail**

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## **B Estimate Detail**

This appendix provides the detailed cost estimating worksheets for each of the 200-UP-1 Operable Unit southeast chromium plume remedial options.

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ANNUAL O&M COST												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	UNIT COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
4	Operations and Maintenance	GW Monitoring, Extraction, Injection or Containment	387 P&T influent 500 gpm 2WP&T	26280000	\$/gal	\$0.0231	\$605,995	0	5	9	1	
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	2	29	1	Assumes 6 wells per year to year 29
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	8	EA	\$500	\$4,000	0	2	9	1	Assumes 6 monitoring wells and 2 extraction wells per year to year 9 to monitoring source P&T
4	Operations and Maintenance	Well Maintenance	389 Extraction Well Maintenance	2	EA	\$5,500	\$11,000	0	5	9	1	
4	Operations and Maintenance	Well Maintenance	390 Injection Well Maintenance	1	EA	\$3,300	\$3,300	0	5	9	1	
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	2	EA	\$1,000	\$2,000	OTHER	5	9	1	Assumes 2 extraction wells per year through year 9
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	1	29	1	1 report per year for 29 years (4 years construction plus 4 years of P&T), continue annual reporting for MNA
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,665	OTHER	1	29	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	1	29	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	1	29	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	1	29	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	1	29	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	1	29	1	Annual data evaluation for 29 years (20 hours per month)
7	Institutional Controls	Institutional Controls	853 OU institutional controls	1	EA	\$23,000	\$23,000	0	126	275	1	Including for years after 125

ANNUAL O&M MARKUPS																
MDBI	0%	15%	10%	8.6%	15%	10%	WA States Sales Tax		Scope Contingency		Bid Contingency		CHPRC G&A	Institutional Controls	COST PER YEAR	
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	\$0	\$605,995	\$90,899	\$60,600	\$757,494	\$65,144	\$822,639	\$123,396	\$82,264	\$1,028,298			\$1,028,298	\$198,050	\$0	\$1,226,349
	\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308			\$17,308	\$3,334	\$0	\$20,642
	\$0	\$4,000	\$600	\$400	\$5,000	\$430	\$5,430	\$815	\$543	\$6,788			\$6,788	\$1,307	\$0	\$8,095
	\$0	\$11,000	\$1,650	\$1,100	\$13,750	\$1,183	\$14,933	\$2,240	\$1,493	\$18,666			\$18,666	\$3,595	\$0	\$22,261
	\$0	\$3,300	\$495	\$330	\$4,125	\$355	\$4,480	\$672	\$448	\$5,600			\$5,600	\$1,078	\$0	\$6,678
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0	\$0	\$0
	\$0	\$2,000	\$300	\$200	\$2,500	\$215	\$2,715	\$407	\$272	\$3,394			\$3,394	\$654	\$0	\$4,047
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0	\$0	\$0
	\$0	\$17,332	\$0	\$0	\$17,332	\$1,491	\$18,823	\$2,823	\$1,882	\$23,528			\$23,528	\$4,532	\$0	\$28,060
	\$0	\$5,665	\$850	\$567	\$7,082	\$609	\$7,691	\$1,154	\$769	\$9,613			\$9,613	\$1,851	\$0	\$11,465
	\$0	\$10,603	\$1,590	\$1,060	\$13,254	\$1,140	\$14,394	\$2,159	\$1,439	\$17,992			\$17,992	\$3,465	\$0	\$21,458
	\$0	\$8,289	\$1,243	\$829	\$10,361	\$891	\$11,252	\$1,688	\$1,125	\$14,065			\$14,065	\$2,709	\$0	\$16,774
	\$0	\$3,264	\$490	\$326	\$4,081	\$351	\$4,431	\$665	\$443	\$5,539			\$5,539	\$1,067	\$0	\$6,606
	\$0	\$2,990	\$448	\$299	\$3,737	\$321	\$4,058	\$609	\$406	\$5,073			\$5,073	\$977	\$0	\$6,050
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0	\$0	\$0
	\$0	\$24,866	\$3,730	\$2,487	\$31,083	\$2,673	\$33,756	\$5,063	\$3,376	\$42,195			\$42,195	\$8,127	\$0	\$50,322
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0	\$0	\$0
	\$0	\$23,000	\$3,450	\$2,300	\$28,750	\$2,473	\$31,223	\$4,683	\$3,122	\$39,028			\$39,028	\$7,517	\$0	\$46,545
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0	\$0	\$0

PERIODIC O&M COST												
SITE	SITE NAME	WBS		QTY	UNIT	UNIT		SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
		Top Tier	DESCRIPTION			COST	SUBTOTAL					
4	Operations and Maintenance	Monitoring Well Replacement	378 Monitoring Well Installation	6	EA	\$400,000	\$2,400,000	OTHER	30	150	30	
4	Operations and Maintenance	Monitoring Well Replacement	376 Groundwater Sampling and Analysis	120	EA	\$1,000	\$120,000	OTHER	30	150	30	Assumes 20 samples per well
4	Operations and Maintenance	Monitoring Well Replacement	380 Well Sampling Crew	240	HR	\$463	\$111,160	OTHER	30	150	30	Assumes 2 crew hours per sample
4	Operations and Maintenance	Monitoring Well Replacement	381 Well Pads	6	EA	\$15,000	\$90,000	OTHER	30	150	30	Assumes 0.1 miles of access road per well pad
4	Operations and Maintenance	Monitoring Well Replacement	382 Access Roads	0.6	Mile	\$115,000	\$69,000	OTHER	30	150	30	
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	6	EA	\$7,500	\$45,000	OTHER	30	150	30	Monitoring wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	3	EA	\$7,500	\$22,500	OTHER	9	9	1	Remaining injection and extraction wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	6	EA	\$7,500	\$45,000	OTHER	275	275	1	Remaining monitoring wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	6	EA	\$7,500	\$45,000	OTHER	180	275	30	Monitoring wells
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	35	150	5	6 wells from year after P&T operations cease to 150 years after P&T operations start
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	170	275	20	6 wells from year 155 to 275 based on Figures 6-31 to 6-36 of ECF-200UP1-18-0008
4	Operations and Maintenance	Monitoring Well Replacement	378 Monitoring Well Installation	6	EA	\$400,000	\$2,400,000	OTHER	180	275	30	
4	Operations and Maintenance	Monitoring Well Replacement	376 Groundwater Sampling and Analysis	120	EA	\$1,000	\$120,000	OTHER	180	275	30	Assumes 20 samples per well
4	Operations and Maintenance	Monitoring Well Replacement	380 Well Sampling Crew	240	HR	\$463	\$111,160	OTHER	170	275	30	Assumes 2 crew hours per sample
4	Operations and Maintenance	Monitoring Well Replacement	381 Well Pads	6	EA	\$15,000	\$90,000	OTHER	180	275	30	
4	Operations and Maintenance	Monitoring Well Replacement	382 Access Roads	0.6	Mile	\$115,000	\$69,000	OTHER	180	275	30	Assumes 0.1 miles of access road per well pad
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	35	150	5	6 wells from year 50 to year 150 based on Figures 6-31 to 6-36 of ECF-200-UP1-18-0008
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	6	EA	\$500	\$3,000	0	35	150	5	
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	170	275	20	6 wells from year 155 to 275 based on Figures 6-31 to 6-36 of ECF-200UP1-18-0008
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	6	EA	\$500	\$3,000	0	170	275	20	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	35	150	5	reporting every 5 years from year 35 to 150 (end of annual report at year 30 to every 5 years to year 150)
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,665	OTHER	35	150	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	35	150	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	35	150	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	35	150	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	35	150	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	35	150	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	170	275	20	reporting every 20 years from year 150 to 275
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,665	OTHER	170	275	20	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	170	275	20	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	170	275	20	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	170	275	20	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	170	275	20	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	170	275	20	
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	3	30	3	
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	3	30	3	

PERIODIC O&M MARKUPS																	
MDBI	0%	SUBTOTAL	Overhead		Profit		WA States Sales Tax		Contingency			Technical Support Services		SUBTOTAL	CHPRC G&A	Institutional	COST PER YEAR
			15%	10%	10%	5%	8.6%	15%	10%	Percent	Subtotal						
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$2,400,000	\$0	\$360,000	\$240,000	\$3,000,000	\$258,000	\$3,258,000	\$488,700	\$325,800	\$4,072,500	0%	\$0	\$4,072,500	\$784,364	\$0	\$4,856,864	
\$0	\$120,000	\$0	\$18,000	\$12,000	\$150,000	\$12,900	\$162,900	\$24,435	\$16,290	\$203,625	0%	\$0	\$203,625	\$39,218	\$0	\$242,843	
\$0	\$111,160	\$0	\$16,674	\$11,116	\$138,950	\$11,950	\$150,899	\$22,635	\$15,090	\$188,624	0%	\$0	\$188,624	\$36,329	\$0	\$224,953	
\$0	\$90,000	\$0	\$13,500	\$9,000	\$112,500	\$9,675	\$122,175	\$18,326	\$12,218	\$152,719	0%	\$0	\$152,719	\$29,414	\$0	\$182,132	
\$0	\$69,000	\$0	\$10,350	\$6,900	\$86,250	\$7,418	\$93,668	\$14,050	\$9,367	\$117,084	0%	\$0	\$117,084	\$22,550	\$0	\$139,635	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0%	\$0	\$0	\$0	\$0	\$0	
\$0	\$45,000	\$0	\$6,750	\$4,500	\$56,250	\$4,838	\$61,088	\$9,163	\$6,109	\$76,359	0%	\$0	\$76,359	\$14,707	\$0	\$91,066	
\$0	\$22,500	\$0	\$3,375	\$2,250	\$28,125	\$2,419	\$30,544	\$4,582	\$3,054	\$38,180	0%	\$0	\$38,180	\$7,353	\$0	\$45,533	
\$0	\$45,000	\$0	\$6,750	\$4,500	\$56,250	\$4,838	\$61,088	\$9,163	\$6,109	\$76,359	0%	\$0	\$76,359	\$14,707	\$0	\$91,066	
\$0	\$45,000	\$0	\$6,750	\$4,500	\$56,250	\$4,838	\$61,088	\$9,163	\$6,109	\$76,359	0%	\$0	\$76,359	\$14,707	\$0	\$91,066	
\$0	\$6,000	\$0	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	0%	\$0	\$10,181	\$1,961	\$0	\$12,142	
\$0	\$6,000	\$0	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	0%	\$0	\$10,181	\$1,961	\$0	\$12,142	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0%	\$0	\$0	\$0	\$0	\$0	
\$0	\$2,400,000	\$0	\$360,000	\$240,000	\$3,000,000	\$258,000	\$3,258,000	\$488,700	\$325,800	\$4,072,500	0%	\$0	\$4,072,500	\$784,364	\$0	\$4,856,864	
\$0	\$120,000	\$0	\$18,000	\$12,000	\$150,000	\$12,900	\$162,900	\$24,435	\$16,290	\$203,625	0%	\$0	\$203,625	\$39,218	\$0	\$242,843	
\$0	\$111,160	\$0	\$16,674	\$11,116	\$138,950	\$11,950	\$150,899	\$22,635	\$15,090	\$188,624	0%	\$0	\$188,624	\$36,329	\$0	\$224,953	
\$0	\$90,000	\$0	\$13,500	\$9,000	\$112,500	\$9,675	\$122,175	\$18,326	\$12,218	\$152,719	0%	\$0	\$152,719	\$29,414	\$0	\$182,132	
\$0	\$69,000	\$0	\$10,350	\$6,900	\$86,250	\$7,418	\$93,668	\$14,050	\$9,367	\$117,084	0%	\$0	\$117,084	\$22,550	\$0	\$139,635	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0%	\$0	\$0	\$0	\$0	\$0	
\$0	\$10,200	\$0	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	0%	\$0	\$17,308	\$3,334	\$0	\$20,642	
\$0	\$3,000	\$0	\$450	\$300	\$3,750	\$323	\$4,073	\$611	\$407	\$5,091	0%	\$0	\$5,091	\$980	\$0	\$6,071	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0%	\$0	\$0	\$0	\$0	\$0	
\$0	\$10,200	\$0	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	0%	\$0	\$17,308	\$3,334	\$0	\$20,642	
\$0	\$3,000	\$0	\$450	\$300	\$3,750	\$323	\$4,073	\$611	\$407	\$5,091	0%	\$0	\$5,091	\$980	\$0	\$6,071	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0%	\$0	\$0	\$0	\$0	\$0	
\$0	\$17,332	\$0	\$0	\$0	\$17,332	\$1,491	\$18,823	\$2,823	\$1,882	\$23,528	0%	\$0	\$23,528	\$4,532	\$0	\$28,060	
\$0	\$5,665	\$0	\$850	\$567	\$7,082	\$609	\$7,691	\$1,154	\$769	\$9,613	0%	\$0	\$9,613	\$1,851	\$0	\$11,465	
\$0	\$10,603	\$0	\$1,590	\$1,060	\$13,254	\$1,140	\$14,394	\$2,159	\$1,439	\$17,992	0%	\$0	\$17,992	\$3,465	\$0	\$21,458	
\$0	\$8,289	\$0	\$1,243	\$829	\$10,361	\$891	\$11,252	\$1,688	\$1,125	\$14,065	0%	\$0	\$14,065	\$2,709	\$0	\$16,774	
\$0	\$3,264	\$0	\$490	\$326	\$4,081	\$351	\$4,431	\$665	\$443	\$5,539	0%	\$0	\$5,539	\$1,067	\$0	\$6,606	
\$0	\$2,990	\$0	\$448	\$299	\$3,737	\$321	\$4,058	\$609	\$406	\$5,073	0%	\$0	\$5,073	\$977	\$0	\$6,050	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0%	\$0	\$0	\$0	\$0	\$0	
\$0	\$24,866	\$0	\$3,730	\$2,487	\$31,083	\$2,673	\$33,756	\$5,063	\$3,376	\$42,195	0%	\$0	\$42,195	\$8,127	\$0	\$50,322	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0%	\$0	\$0	\$0	\$0	\$0	
\$0	\$17,332	\$0	\$0	\$0	\$17,332	\$1,491	\$18,823	\$2,823	\$1,882	\$23,528	0%	\$0	\$23,528	\$4,532	\$0	\$28,060	
\$0	\$5,665	\$0	\$850	\$567	\$7,082	\$609	\$7,691	\$1,154	\$769	\$9,613	0%	\$0	\$9,613	\$1,851	\$0	\$11,465	
\$0	\$10,603	\$0	\$1,590	\$1,060	\$13,254	\$1,140	\$14,394	\$2,159	\$1,439	\$17,992	0%	\$0	\$17,992	\$3,465	\$0	\$21,458	
\$0	\$8,289	\$0	\$1,243	\$829	\$10,361	\$891	\$11,252	\$1,688	\$1,125	\$14,065	0%	\$0	\$14,065	\$2,709	\$0	\$16,774	
\$0	\$3,264	\$0	\$490	\$326	\$4,081	\$351	\$4,431	\$665	\$443	\$5,539	0%	\$0	\$5,539	\$1,067	\$0	\$6,606	
\$0	\$2,990	\$0	\$448	\$299	\$3,737	\$321	\$4,058	\$609	\$406	\$5,073	0%	\$0	\$5,073	\$977	\$0	\$6,050	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0%	\$0	\$0	\$0	\$0	\$0	
\$0	\$24,866	\$0	\$3,730	\$2,487	\$31,083	\$2,673	\$33,75										

Table B-2. Option 2a Cost Estimate Details

<b>Option 2a</b>			
Source Control, Dispersed Plume P&T using On-Site Treatment, with MNA			
Location:	200-UP-1	Base Year:	2019
Phase:	SE Chromium Plume	Date:	1/1/2019
Description:	Source Control P&T, Dispersed Plume P&T for 25 years with on-site treatment, and MNA for 120 years		

CAPITAL COSTS												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	UNIT COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
1	Design	Permitting and Reviews	1051 Environmental Engineers	10	hr	\$124	\$1,238	0	0	0	1	
1	Design	Permitting and Reviews	1053 Managers & Executives	5	hr	\$142	\$708	0	0	0	1	
1	Design	Permitting and Reviews	1054 Geologists/Geophysicists/Hydro	30	hr	\$133	\$3,976	0	0	0	1	
1	Design	Permitting and Reviews	1055 Environmental Scientists	60	hr	\$104	\$6,216	0	0	0	1	
1	Design	Permitting and Reviews	1056 Technical Writers & Editors	40	hr	\$82	\$3,264	0	0	0	1	
1	Design	Permitting and Reviews	1052 Administrative Assistants	35	hr	\$75	\$2,616	0	0	0	1	
1	Design	Permitting and Reviews	1057 MSA Labor for Permitting	1	ea	\$5,000	\$5,000	0	0	0	1	
1	Design	Design Document	1051 Environmental Engineers	140	hr	\$124	\$17,332	0	0	0	1	
1	Design	Design Document	1053 Managers & Executives	40	hr	\$142	\$5,665	0	0	0	1	
1	Design	Design Document	1054 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,600	0	0	0	1	
1	Design	Design Document	1055 Environmental Scientists	80	hr	\$104	\$8,289	0	0	0	1	
1	Design	Design Document	1056 Technical Writers & Editors	40	hr	\$82	\$3,264	0	0	0	1	
1	Design	Design Document	1052 Administrative Assistants	40	hr	\$75	\$2,990	0	0	0	1	
1	Design	Design Document	1058 Modeling Subcontractor	1	ea	\$90,000	\$90,000	0	0	0	1	
2	Well Installation	Drilling and Well Installation	267 Monitoring Well Installation	6	EA	\$400,000	\$2,400,000	HISTORICAL	3	3	1	
2	Well Installation	Drilling and Well Installation	269 Well Pads	6	EA	\$15,000	\$90,000	HISTORICAL	3	3	1	Cost includes well pads for 6 new wells and future replacement wells if needed (2 pads per well)
2	Well Installation	Drilling and Well Installation	270 Access Roads	0.6	Mile	\$115,000	\$69,000	OTHER	3	3	1	Assumes 0.1 mile road for each well
2	Well Installation	Drilling and Well Installation	271 Well Sampling	220	Sample	\$1,000	\$220,000	HISTORICAL	1	1	1	Injection wells: 20 Samples per well (11 wells)
2	Well Installation	Drilling and Well Installation	272 Well Sampling Crew	440	Hr	\$463	\$203,793	OTHER	1	1	1	2 hours sample crew per sample
2	Well Installation	Drilling and Well Installation	266 Injection Well Installation	10	EA	\$575,000	\$5,750,000	HISTORICAL	1	1	1	
2	Well Installation	Drilling and Well Installation	269 Well Pads	10	EA	\$15,000	\$150,000	HISTORICAL	1	1	1	
2	Well Installation	Drilling and Well Installation	270 Access Roads	6	Mile	\$115,000	\$644,000	OTHER	1	1	1	Access road length from figure CHSGW20180181c
2	Well Installation	Drilling and Well Installation	268 Extraction Well Installation	10	EA	\$625,000	\$6,250,000	HISTORICAL	2	2	1	
2	Well Installation	Drilling and Well Installation	269 Well Pads	10	EA	\$15,000	\$150,000	HISTORICAL	2	2	1	
2	Well Installation	Drilling and Well Installation	270 Access Roads	1.1	Mile	\$115,000	\$126,500	OTHER	2	2	1	Access road length from figure CHSGW20180181c
3	Construction	Water Level Monitoring System	273 AWLN Monitoring System	10	EA	\$9,000	\$90,000	OTHER	2	2	1	10 wells
3	Construction	CAT/ATP/OTP	951 CAT/ATP/OTP	261719	ea	\$1	\$261,719	0	4	4	1	
3	Construction	Groundwater Pump and Treat Systems	366 New Treatment Building	1	ea	\$1,200,000	\$1,200,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	367 750 GPM Cr Treatment Train	1	ea	\$1,200,000	\$1,200,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	351 Misc. Modifications	1	ea	\$50,000	\$50,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	357 3" Single Wall HDPE Pipe	40984	ft	\$10	\$409,840	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	358 4" X 8" Dual Wall HDPE Pipeline	79677	ft	\$33	\$2,629,341	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	359 Paved Road Crossing	19	ea	\$60,000	\$1,140,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	360 Gravel Road Crossing	19	ea	\$16,000	\$304,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	361 Mechanical Rack	21	ea	\$25,000	\$525,000	OTHER	2	3	2	10 Extraction and 11 Injection Wells
3	Construction	Groundwater Pump and Treat Systems	362 Electrical Rack	21	ea	\$40,000	\$840,000	OTHER	2	3	2	10 Extraction and 11 Injection Wells
3	Construction	Groundwater Pump and Treat Systems	363 On Ground electric cable	23515	ft	\$8	\$188,120	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	364 Instrument Cable	101932	ft	\$5	\$509,660	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	365 Power Service Transformers	2	ea	\$2,000,000	\$4,000,000	OTHER	2	3	2	
2	Well Installation	Drilling and Well Installation	271 Well Sampling	200	Sample	\$1,000	\$200,000	HISTORICAL	2	2	1	Well sampling Extraction wells (10 wells, 20 samples per well)
2	Well Installation	Drilling and Well Installation	272 Well Sampling Crew	400	Hr	\$463	\$185,266	OTHER	2	2	1	2 hours sample crew per sample
2	Well Installation	Drilling and Well Installation	271 Well Sampling	120	Sample	\$1,000	\$120,000	HISTORICAL	3	3	1	Well Sampling Monitoring wells (6 wells, 20 samples per well)
2	Well Installation	Drilling and Well Installation	272 Well Sampling Crew	240	Hr	\$463	\$111,160	OTHER	3	3	1	2 hours sample crew per sample

CAPITAL MARKUPS																						
MDBI	SUBTOTAL	Overhead 15%	Profit 10%	SUBTOTAL	WA States Sales Tax 8.6%	SUBTOTAL	Scope Contingency Bid Contingency			SUBTOTAL	Project Management		Remedial Design		Construction Management		SUBTOTAL	CHPRC G&A 19.26%	Institutional Controls	COST PER YEAR		
							15%	10%	5%		5%	Percent	5%	Percent	6%	Percent					6%	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
\$124	\$1,362	\$204	\$136	\$1,702	\$146	\$1,849	\$277	\$185	\$2,311	\$116	\$139	\$139	\$2,704	\$521	\$298	\$0	\$2,704	\$521	\$298	\$0	\$3,224	
\$71	\$779	\$117	\$78	\$974	\$84	\$1,057	\$159	\$106	\$1,322	\$66	\$79	\$79	\$1,547	\$298	\$0	\$0	\$1,547	\$298	\$0	\$0	\$1,844	
\$398	\$4,374	\$656	\$437	\$5,467	\$470	\$5,937	\$891	\$594	\$7,422	\$371	\$445	\$445	\$8,684	\$1,672	\$0	\$0	\$8,684	\$1,672	\$0	\$0	\$10,356	
\$622	\$6,838	\$1,026	\$684	\$8,548	\$735	\$9,283	\$1,392	\$928	\$11,604	\$580	\$696	\$696	\$13,576	\$2,615	\$0	\$0	\$13,576	\$2,615	\$0	\$0	\$16,191	
\$326	\$3,591	\$539	\$359	\$4,489	\$386	\$4,875	\$731	\$487	\$6,093	\$305	\$366	\$366	\$7,129	\$1,373	\$0	\$0	\$7,129	\$1,373	\$0	\$0	\$8,502	
\$262	\$2,877	\$432	\$288	\$3,597	\$309	\$3,906	\$586	\$391	\$4,883	\$244	\$293	\$293	\$5,713	\$1,100	\$0	\$0	\$5,713	\$1,100	\$0	\$0	\$6,813	
\$500	\$5,500	\$825	\$550	\$6,875	\$591	\$7,466	\$1,120	\$747	\$9,333	\$467	\$560	\$560	\$10,919	\$2,103	\$0	\$0	\$10,919	\$2,103	\$0	\$0	\$13,022	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$1,733	\$19,065	\$2,860	\$1,907	\$23,832	\$2,050	\$25,881	\$3,882	\$2,588	\$32,351	\$1,618	\$1,941	\$1,941	\$37,851	\$7,290	\$0	\$0	\$37,851	\$7,290	\$0	\$0	\$45,141	
\$567	\$6,232	\$935	\$623	\$7,790	\$670	\$8,460	\$1,269	\$846	\$10,574	\$529	\$634	\$634	\$12,372	\$2,383	\$0	\$0	\$12,372	\$2,383	\$0	\$0	\$14,755	
\$1,060	\$11,664	\$1,750	\$1,166	\$14,579	\$1,254	\$15,833	\$2,375	\$1,583	\$19,792	\$990	\$1,187	\$1,187	\$23,156	\$4,460	\$0	\$0	\$23,156	\$4,460	\$0	\$0	\$27,616	
\$829	\$8,916	\$1,368	\$912	\$11,397	\$980	\$12,377	\$1,857	\$1,238	\$15,472	\$774	\$928	\$928	\$18,102	\$3,466	\$0	\$0	\$18,102	\$3,466	\$0	\$0	\$21,568	
\$326	\$3,591	\$539	\$359	\$4,489	\$386	\$4,875	\$731	\$487	\$6,093	\$305	\$366	\$366	\$7,129	\$1,373	\$0	\$0	\$7,129	\$1,373	\$0	\$0	\$8,502	
\$299	\$3,289	\$493	\$329	\$4,111	\$354	\$4,464	\$670	\$446	\$5,580	\$279	\$335	\$335	\$6,529	\$1,257	\$0	\$0	\$6,529	\$1,257	\$0	\$0	\$7,786	
\$9,000	\$99,000	\$14,850	\$9,900	\$123,750	\$10,643	\$134,393	\$20,159	\$13,439	\$167,991	\$8,400	\$10,079	\$10,079	\$196,549	\$37,855	\$0	\$0	\$196,549	\$37,855	\$0	\$0	\$234,404	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$240,000	\$2,640,000	\$396,000	\$264,000	\$3,300,000	\$283,800	\$3,583,800	\$537,570	\$358,380	\$4,479,750	\$223,988	\$268,785	\$268,785	\$5,241,308	\$1,009,476	\$0	\$0	\$5,241,308	\$1,009,476	\$0	\$0	\$6,250,783	
\$9,000	\$99,000	\$14,850	\$9,900	\$123,750	\$10,643	\$134,393	\$20,159	\$13,439	\$167,991	\$8,400	\$10,079	\$10,079	\$196,549	\$37,855	\$0	\$0	\$196,549	\$37,855	\$0	\$0	\$234,404	
\$6,900	\$75,900	\$11,385	\$7,590	\$94,875	\$8,159	\$103,034	\$15,455	\$10,303	\$128,793	\$6,440	\$7,728	\$7,728	\$150,688	\$29,022	\$0	\$0	\$150,688	\$29,022	\$0	\$0	\$179,710	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$22,000	\$242,000	\$36,300	\$24,200	\$302,500	\$26,015	\$328,515	\$49,277	\$32,852	\$410,644	\$20,532	\$24,639	\$24,639	\$488,453	\$92,535	\$0	\$0	\$488,453	\$92,535	\$0	\$0	\$572,988	
\$20,379	\$224,172	\$33,626	\$22,417	\$280,215	\$24,098	\$304,314	\$45,647	\$30,431	\$380,392	\$19,020	\$22,824	\$22,824	\$445,059	\$85,718	\$0	\$0	\$445,059	\$85,718	\$0	\$0	\$530,777	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$575,000	\$6,325,000	\$948,750	\$632,500	\$7,906,250	\$679,938	\$8,586,188	\$1,287,928	\$858,619	\$10,732,734	\$536,637	\$643,964	\$643,964	\$12,557,299	\$2,418,536	\$0	\$0	\$12,557,299	\$2,418,536	\$0	\$0	\$14,975,835	
\$15,000	\$165,000	\$24,750	\$16,500	\$206,250	\$17,738	\$223,988	\$33,598	\$22,399	\$279,984	\$13,999	\$16,799	\$16,799	\$327,582	\$63,092	\$0	\$0	\$327,582	\$63,092	\$0	\$0	\$390,674	
\$64,400	\$708,400	\$106,260	\$70,840	\$885,500	\$76,153	\$961,653	\$144,248	\$96,165	\$1,202,066	\$60,103	\$72,124	\$72,124	\$1,406,418	\$270,876	\$0	\$0	\$1,406,418	\$270,876	\$0	\$0	\$1,677,294	
\$625,000	\$6,875,000	\$1,031,250	\$687,500	\$8,593,750	\$739,063	\$9,332,813	\$1,399,922	\$933,281														

ANNUAL O&M COST												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	UNIT COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
							\$0					
4	Operations and Maintenance	GW Monitoring, Extraction, Injection or Containment	385 P&T influent - 100 gpm	26280000	\$/gal	\$0.0055	\$144,388	0	6	10	1	Source control extraction - 2 wells at 25 gpm each
4	Operations and Maintenance	GW Monitoring, Extraction, Injection or Containment	386 P&T influent - 500 gpm site specific	262800000	\$/gal	\$0.0055	\$1,443,882	0	6	30	1	
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	4	30	1	Assumes 6 wells per year through 25 years P&T starting in year 6
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	12	EA	\$500	\$6,000	0	4	30	1	Assumes 12 wells per year through 25 years P&T starting in year 6
4	Operations and Maintenance	Well Maintenance	389 Extraction Well Maintenance	8	EA	\$5,500	\$44,000	0	6	30	1	
4	Operations and Maintenance	Well Maintenance	390 Injection Well Maintenance	10	EA	\$3,300	\$33,000	0	6	30	1	
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	5	30	1	Assumes 12 wells per year for 30 years
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	1	30	1	1 report per year for 30 years
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,685	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	1	30	1	Annual data evaluation for 30 years (20 hours per month)
4	Operations and Maintenance	Well Maintenance	389 Extraction Well Maintenance	2	EA	\$5,500	\$11,000	0	6	10		2 source control extraction wells

ANNUAL O&M MARKUPS														
MDBI	SUBTOTAL	Overhead		Profit		WA States Sales Tax		Scope Contingency		Bid Contingency		SUBTOTAL	SUBTOTAL	SUBTOTAL
		15%	10%	15%	10%	15%	10%	15%	10%					
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$144,388	\$21,658	\$14,439	\$180,485	\$15,522	\$196,007	\$29,401	\$19,601	\$245,009	\$245,009	\$47,189	\$0	\$0	\$292,197
\$0	\$1,443,882	\$216,582	\$144,388	\$1,804,852	\$155,217	\$1,960,070	\$294,010	\$196,007	\$2,450,087	\$2,450,087	\$471,887	\$0	\$0	\$2,921,974
\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	\$17,308	\$3,334	\$0	\$0	\$20,642
\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	\$10,181	\$1,961	\$0	\$0	\$12,142
\$0	\$44,000	\$6,600	\$4,400	\$55,000	\$4,730	\$59,730	\$8,960	\$5,973	\$74,663	\$74,663	\$14,380	\$0	\$0	\$89,042
\$0	\$33,000	\$4,950	\$3,300	\$41,250	\$3,548	\$44,798	\$6,720	\$4,480	\$55,997	\$55,997	\$10,785	\$0	\$0	\$66,782
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	\$10,181	\$1,961	\$0	\$0	\$12,142
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$17,332	\$0	\$0	\$17,332	\$1,491	\$18,823	\$2,823	\$1,882	\$23,528	\$23,528	\$4,532	\$0	\$0	\$28,060
\$0	\$5,685	\$850	\$567	\$7,082	\$609	\$7,691	\$1,154	\$769	\$9,613	\$9,613	\$1,851	\$0	\$0	\$11,465
\$0	\$10,603	\$1,590	\$1,060	\$13,254	\$1,140	\$14,394	\$2,159	\$1,439	\$17,992	\$17,992	\$3,465	\$0	\$0	\$21,458
\$0	\$8,289	\$1,243	\$829	\$10,361	\$891	\$11,252	\$1,688	\$1,125	\$14,065	\$14,065	\$2,709	\$0	\$0	\$16,774
\$0	\$3,264	\$490	\$326	\$4,081	\$351	\$4,431	\$665	\$443	\$5,539	\$5,539	\$1,067	\$0	\$0	\$6,606
\$0	\$2,990	\$448	\$299	\$3,737	\$321	\$4,058	\$609	\$406	\$5,073	\$5,073	\$977	\$0	\$0	\$6,050
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$24,866	\$3,730	\$2,487	\$31,083	\$2,673	\$33,756	\$5,063	\$3,376	\$42,195	\$42,195	\$8,127	\$0	\$0	\$50,322
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$11,000	\$1,650	\$1,100	\$13,750	\$1,183	\$14,933	\$2,240	\$1,493	\$18,666	\$18,666	\$3,595	\$0	\$0	\$22,261
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

PERIODIC O&M COST												
SITE	SITE NAME	WBS		QTY	UNIT	COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
		Top Tier	DESCRIPTION									
4	Operations and Maintenance	Monitoring Well Replacement	378 Monitoring Well Installation	6	EA	\$400,000	\$0	OTHER	33	120	30	
4	Operations and Maintenance	Monitoring Well Replacement	376 Groundwater Sampling and Analysis	120	EA	\$1,000	\$120,000	OTHER	33	120	30	Assumes 20 samples per well
4	Operations and Maintenance	Monitoring Well Replacement	380 Well Sampling Crew	240	HR	\$463	\$111,160	OTHER	33	120	30	Assumes 2 crew hours per sample
4	Operations and Maintenance	Monitoring Well Replacement	381 Well Pads	6	EA	\$15,000	\$90,000	OTHER	33	120	30	Assumes 0.1 miles of access road per well pad
4	Operations and Maintenance	Monitoring Well Replacement	382 Access Roads	0.6	Mile	\$115,000	\$69,000	OTHER	33	120	30	
4	Operations and Maintenance	Extraction Well Replacement	379 Extraction Well Installation	8	EA	\$675,000	\$5,400,000	OTHER	25	25	1	Extraction wells replaced once at year 25 (P&T starts in year 5)
4	Operations and Maintenance	Extraction Well Replacement	376 Groundwater Sampling and Analysis	180	EA	\$1,000	\$180,000	OTHER	25	25	1	
4	Operations and Maintenance	Extraction Well Replacement	380 Well Sampling Crew	320	HR	\$463	\$148,213	OTHER	25	25	1	
4	Operations and Maintenance	Extraction Well Replacement	381 Well Pads	8	EA	\$15,000	\$120,000	OTHER	25	25	1	
4	Operations and Maintenance	Extraction Well Replacement	382 Access Roads	0.80	Mile	\$115,000	\$92,000	OTHER	25	25	1	
4	Operations and Maintenance	Injection Well Replacement	377 Injection Well Installation	10	EA	\$575,000	\$5,750,000	OTHER	15	30	10	Injection wells replaced every 10 years
4	Operations and Maintenance	Injection Well Replacement	376 Groundwater Sampling and Analysis	200	EA	\$1,000	\$200,000	OTHER	15	30	10	
4	Operations and Maintenance	Injection Well Replacement	380 Well Sampling Crew	400	HR	\$463	\$185,266	OTHER	15	30	10	
4	Operations and Maintenance	Injection Well Replacement	381 Well Pads	10	EA	\$15,000	\$150,000	OTHER	15	30	10	
4	Operations and Maintenance	Injection Well Replacement	382 Access Roads	1	Mile	\$115,000	\$115,000	OTHER	15	30	10	
6	Closeout	GW Monitoring, Extraction, Injection or Containment	391 P&T Facility Decommissioning	1	EA	\$800,000	\$800,000	0	31	31	1	Decommission new P&T building
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	6	EA	\$7,500	\$45,000	OTHER	33	120	30	Monitoring wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	10	EA	\$7,500	\$75,000	OTHER	25	25	1	Extraction wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	10	EA	\$7,500	\$75,000	OTHER	15	30	10	Injection wells replaced every 10 years
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	18	EA	\$7,500	\$135,000	OTHER	30	30	1	Remaining injection and extraction wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	6	EA	\$7,500	\$45,000	OTHER	120	120	1	Remaining monitoring wells
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	35	100	5	well maintenance every 5 years from year 31 to 100
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	6	EA	\$500	\$3,000	0	35	100	5	
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	105	120	5	Well Maintenance every 5 years, 6 wells, based on figures 6-57 to 6-59 of ECF-200UP1-18-0008
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	6	EA	\$500	\$3,000	0	105	120	5	
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	35	100	5	Monitoring every 5 years from year 31 to 100
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	105	120	5	Monitoring every 5 years, 6 wells, based on figures 6-57 to 6-59 of ECF-200UP1-18-0008
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	35	120	5	Progress reports every 5 years, years 31 to 120
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,685	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	35	120	5	Progress reports every 5 years, years 31 to 120

PERIODIC O&M MARKUPS																						
MDBI	0%	SUBTOTAL	Overhead		10%	SUBTOTAL	WA States Sales Tax		8.6%	SUBTOTAL	Contingency		15%	10%	SUBTOTAL	Technical Support Services		19.26%	CHPRC G&A	Institutional	Controls	COST PER YEAR
			15%	Profit			8.6%	8.6%			Percent	Subtotal										
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$2,400,000	\$360,000	\$240,000	\$3,000,000	\$258,000	\$3,258,000	\$488,700	\$325,800	\$4,072,500	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$4,072,500	\$784,364	\$0	\$4,856,864
\$0	\$120,000	\$18,000	\$12,000	\$150,000	\$12,900	\$162,900	\$24,435	\$16,290	\$203,625	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$203,625	\$39,218	\$0	\$242,843
\$0	\$111,160	\$16,674	\$11,116	\$138,950	\$11,950	\$150,899	\$22,635	\$15,090	\$188,624	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$188,624	\$36,329	\$0	\$224,953
\$0	\$90,000	\$13,500	\$9,000	\$112,500	\$9,675	\$122,175	\$18,326	\$12,218	\$152,719	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$152,719	\$29,414	\$0	\$182,133
\$0	\$69,000	\$10,350	\$6,900	\$86,250	\$7,418	\$93,668	\$14,050	\$9,367	\$117,084	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$117,084	\$22,550	\$0	\$139,633
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$5,400,000	\$810,000	\$540,000	\$6,750,000	\$580,500	\$7,330,500	\$1,099,575	\$733,050	\$9,163,125	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$9,163,125	\$1,764,818	\$0	\$10,927,943
\$0	\$160,000	\$24,000	\$16,000	\$200,000	\$17,200	\$217,200	\$32,580	\$21,720	\$271,500	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$271,500	\$52,291	\$0	\$323,791
\$0	\$148,213	\$22,232	\$14,821	\$185,266	\$15,933	\$201,199	\$30,180	\$20,120	\$251,499	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$251,499	\$48,439	\$0	\$299,937
\$0	\$120,000	\$18,000	\$12,000	\$150,000	\$12,900	\$162,900	\$24,435	\$16,290	\$203,625	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$203,625	\$39,218	\$0	\$242,843
\$0	\$92,000	\$13,800	\$9,200	\$115,000	\$9,890	\$124,890	\$18,734	\$12,489	\$156,113	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$156,113	\$30,067	\$0	\$186,180
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$5,750,000	\$862,500	\$575,000	\$7,187,500	\$618,125	\$7,805,625	\$1,170,844	\$780,563	\$9,757,031	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$9,757,031	\$1,879,204	\$0	\$11,636,235
\$0	\$200,000	\$30,000	\$20,000	\$250,000	\$21,500	\$271,500	\$40,725	\$27,150	\$339,375	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$339,375	\$65,364	\$0	\$404,739
\$0	\$185,266	\$27,790	\$18,527	\$231,583	\$19,916	\$251,499	\$37,725	\$25,150	\$314,374	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$314,374	\$60,548	\$0	\$374,922
\$0	\$150,000	\$22,500	\$15,000	\$187,500	\$16,125	\$203,625	\$30,544	\$20,363	\$254,531	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$254,531	\$49,023	\$0	\$303,554
\$0	\$115,000	\$17,250	\$11,500	\$143,750	\$12,363	\$156,113	\$23,417	\$15,611	\$195,141	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$195,141	\$37,564	\$0	\$232,725
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$800,000	\$120,000	\$80,000	\$1,000,000	\$86,000	\$1,086,000	\$162,900	\$108,600	\$1,357,500	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$1,357,500	\$261,455	\$0	\$1,618,955
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$45,000	\$6,750	\$4,500	\$56,250	\$4,838	\$61,088	\$9,163	\$6,109	\$76,359	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$76,359	\$14,707	\$0	\$91,066
\$0	\$75,000	\$11,250	\$7,500	\$93,750	\$8,063	\$101,813	\$15,272	\$10,181	\$127,266	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$127,266	\$24,511	\$0	\$151,777
\$0	\$75,000	\$11,250	\$7,500	\$93,750	\$8,063	\$101,813	\$15,272	\$10,181	\$127,266	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$127,266	\$24,511	\$0	\$151,777
\$0	\$135,000	\$20,250	\$13,500	\$168,750	\$14,513	\$183,263	\$27,489	\$18,326	\$229,078	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$229,078	\$44,120	\$0	\$273,199
\$0	\$45,000	\$6,750	\$4,500	\$56,250	\$4,838	\$61,088	\$9,163	\$6,109	\$76,359	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$76,359	\$14,707	\$0	\$91,066
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$17,308	\$3,334	\$0	\$20,642
\$0	\$3,000	\$450	\$300	\$3,750	\$323	\$4,073	\$611	\$407	\$5,091	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$5,091	\$980	\$0	\$6,071
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$17,308	\$3,334	\$0	\$20,642
\$0	\$3,000	\$450	\$300	\$3,750	\$323	\$4,073	\$611	\$407	\$5,091	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$5,091	\$980	\$0	\$6,071
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,181	\$1,961	\$0	\$12,142
\$0	\$0	\$																				



ANNUAL O&M COST												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	UNIT COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
4	Operations and Maintenance	GW Monitoring, Extraction, Injection or Containment	386 P&T influent - 500 gpm site specific	26280000	\$/gal	\$0.0055	\$144,388	0	6	10	1	
4	Operations and Maintenance	GW Monitoring, Extraction, Injection or Containment	386 P&T influent - 500 gpm site specific	262800000	\$/gal	\$0.0055	\$1,443,882	0	6	30	1	
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	4	30	1	Assumes 6 wells per year for 30 years
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	12	EA	\$500	\$6,000	0	4	30	1	Assumes 12 wells per year for 30 years
4	Operations and Maintenance	Well Maintenance	389 Extraction Well Maintenance	8	EA	\$5,500	\$44,000	0	6	30	1	
4	Operations and Maintenance	Well Maintenance	390 Injection Well Maintenance	10	EA	\$3,300	\$33,000	0	6	30	1	
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	5	30	1	Assumes 6 wells per year for 30 years
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	1	30	1	1 report per year for 30 years
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,665	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	1	30	1	Annual data evaluation for 30 years (20 hours per month)
4	Operations and Maintenance	Well Maintenance	389 Extraction Well Maintenance	2	EA	\$5,500	\$11,000	0	6	10	1	2 source extraction wells

ANNUAL O&M MARKUPS													
MDBI	0%	15%	10%	8.6%	15%	10%	CHPRC G&A	Institutional	COST PER YEAR				
	SUBTOTAL	Overhead	Profit	WA States Sales Tax	Scope Contingency	Bid Contingency	19.26%	Controls					
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			
\$0	\$144,388	\$21,658	\$14,439	\$180,485	\$15,522	\$196,007	\$29,401	\$19,601	\$245,009	\$47,189	\$0	\$282,197	
\$0	\$1,443,882	\$216,582	\$144,388	\$1,804,852	\$155,217	\$1,960,070	\$294,010	\$196,007	\$2,450,087	\$471,887	\$0	\$2,921,974	
\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	\$3,334	\$0	\$20,642	
\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	\$1,961	\$0	\$12,142	
\$0	\$44,000	\$6,600	\$4,400	\$55,000	\$4,730	\$59,730	\$8,960	\$5,973	\$74,663	\$14,380	\$0	\$89,042	
\$0	\$33,000	\$4,950	\$3,300	\$41,250	\$3,548	\$44,798	\$6,720	\$4,480	\$55,997	\$10,785	\$0	\$66,782	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	\$1,961	\$0	\$12,142	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
\$0	\$17,332	\$0	\$0	\$17,332	\$1,491	\$18,823	\$2,823	\$1,882	\$23,528	\$4,532	\$0	\$28,060	
\$0	\$5,665	\$850	\$567	\$7,082	\$609	\$7,691	\$1,154	\$769	\$9,613	\$1,851	\$0	\$11,465	
\$0	\$10,603	\$1,590	\$1,060	\$13,254	\$1,140	\$14,394	\$2,159	\$1,439	\$17,992	\$3,465	\$0	\$21,458	
\$0	\$8,289	\$1,243	\$829	\$10,361	\$891	\$11,252	\$1,688	\$1,125	\$14,065	\$2,709	\$0	\$16,774	
\$0	\$3,264	\$490	\$326	\$4,081	\$351	\$4,431	\$665	\$443	\$5,539	\$1,067	\$0	\$6,606	
\$0	\$2,990	\$448	\$299	\$3,737	\$321	\$4,058	\$609	\$406	\$5,073	\$977	\$0	\$6,050	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
\$0	\$24,866	\$3,730	\$2,487	\$31,083	\$2,673	\$33,756	\$5,063	\$3,376	\$42,195	\$8,127	\$0	\$50,322	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
\$0	\$11,000	\$1,650	\$1,100	\$13,750	\$1,183	\$14,933	\$2,240	\$1,493	\$18,666	\$3,595	\$0	\$22,261	
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	

PERIODIC O&M COST												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	COST	SUBTOTAL	SOURCE	START	END	NOTES	
									YEAR	YEAR		INTERVAL
4	Operations and Maintenance	Monitoring Well Replacement	378 Monitoring Well Installation	6	EA	\$400,000	\$2,400,000	OTHER	33	120	30	
4	Operations and Maintenance	Monitoring Well Replacement	376 Groundwater Sampling and Analysis	120	EA	\$1,000	\$120,000	OTHER	33	120	30	Assumes 20 samples per well
4	Operations and Maintenance	Monitoring Well Replacement	380 Well Sampling Crew	240	HR	\$463	\$111,160	OTHER	33	120	30	Assumes 2 crew hours per sample
4	Operations and Maintenance	Monitoring Well Replacement	381 Well Pads	6	EA	\$15,000	\$90,000	OTHER	33	120	30	
4	Operations and Maintenance	Monitoring Well Replacement	382 Access Roads	0.6	Mile	\$115,000	\$69,000	OTHER	33	120	30	Assumes 0.1 miles of access road per well pad
4	Operations and Maintenance	Extraction Well Replacement	379 Extraction Well Installation	8	EA	\$675,000	\$5,400,000	OTHER	25	25	1	Extraction wells replaced once at year 20
4	Operations and Maintenance	Extraction Well Replacement	376 Groundwater Sampling and Analysis	160	EA	\$1,000	\$160,000	OTHER	25	25	1	
4	Operations and Maintenance	Extraction Well Replacement	380 Well Sampling Crew	320	HR	\$463	\$148,213	OTHER	25	25	1	
4	Operations and Maintenance	Extraction Well Replacement	381 Well Pads	8	EA	\$15,000	\$120,000	OTHER	25	25	1	
4	Operations and Maintenance	Extraction Well Replacement	382 Access Roads	0.80	Mile	\$115,000	\$92,000	OTHER	25	25	1	
4	Operations and Maintenance	Injection Well Replacement	377 Injection Well Installation	10	EA	\$575,000	\$5,750,000	OTHER	15	30	10	Injection wells replaced every 10 years
4	Operations and Maintenance	Injection Well Replacement	376 Groundwater Sampling and Analysis	200	EA	\$1,000	\$200,000	OTHER	15	30	10	
4	Operations and Maintenance	Injection Well Replacement	380 Well Sampling Crew	400	HR	\$463	\$185,266	OTHER	15	30	10	
4	Operations and Maintenance	Injection Well Replacement	381 Well Pads	10	EA	\$15,000	\$150,000	OTHER	15	30	10	
4	Operations and Maintenance	Injection Well Replacement	382 Access Roads	1	Mile	\$115,000	\$115,000	OTHER	15	30	10	
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	6	EA	\$7,500	\$45,000	OTHER	33	120	30	Monitoring wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	10	EA	\$7,500	\$75,000	OTHER	25	25	1	Extraction wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	10	EA	\$7,500	\$75,000	OTHER	15	30	10	Injection wells replaced every 10 years
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	18	EA	\$7,500	\$135,000	OTHER	30	30	1	Remaining injection and extraction wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	6	EA	\$7,500	\$45,000	OTHER	120	120	1	Remaining monitoring wells
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	35	100	5	well maintenance every 5 years from year 31 to 100
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	6	EA	\$500	\$3,000	0	35	100	5	
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	105	120	5	Well Maintenance every 5 years, 6 wells, based on figures 6-57 to 6-59 of ECF-200UP1-18-0008
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	6	EA	\$500	\$3,000	0	105	120	5	
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	35	100	5	Monitoring every 5 years from year 31 to 100
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	105	120	5	Monitoring every 5 years, 6 wells, based on figures 6-57 to 6-59 of ECF-200UP1-18-0008
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	35	120	5	Progress reports every 5 years, years 31 to 120
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,665	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	35	120	5	Progress reports every 5 years, years 31 to 120

PERIODIC O&M MARKUPS														
MDBI	0%	SUBTOTAL	Overhead		SUBTOTAL	WA States Sales Tax		SUBTOTAL	Contingency		SUBTOTAL	CHPRC G&A	Institutional Controls	COST PER YEAR
			15%	10%		8.6%	8.6%		15%	10%				
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$0	\$2,400,000	\$360,000	\$240,000	\$3,000,000	\$258,000	\$3,258,000	\$488,700	\$325,800	\$4,072,500	\$4,072,500	\$784,364	\$0	\$4,856,864
	\$0	\$120,000	\$18,000	\$12,000	\$150,000	\$12,900	\$162,900	\$24,435	\$16,290	\$203,625	\$203,625	\$39,218	\$0	\$242,843
	\$0	\$111,160	\$16,674	\$11,116	\$138,950	\$11,950	\$150,899	\$22,635	\$15,090	\$188,624	\$188,624	\$36,329	\$0	\$224,953
	\$0	\$90,000	\$13,500	\$9,000	\$112,500	\$9,675	\$122,175	\$18,326	\$12,218	\$152,719	\$152,719	\$29,414	\$0	\$182,132
	\$0	\$69,000	\$10,350	\$6,900	\$86,250	\$7,418	\$93,668	\$14,050	\$9,367	\$117,084	\$117,084	\$22,550	\$0	\$139,635
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$0	\$5,400,000	\$810,000	\$540,000	\$6,750,000	\$580,500	\$7,330,500	\$1,099,575	\$733,050	\$9,163,125	\$9,163,125	\$1,764,818	\$0	\$10,927,943
	\$0	\$160,000	\$24,000	\$16,000	\$200,000	\$17,200	\$217,200	\$32,550	\$21,720	\$271,900	\$271,900	\$52,291	\$0	\$323,791
	\$0	\$148,213	\$22,232	\$14,821	\$185,266	\$15,933	\$201,199	\$30,180	\$20,120	\$251,499	\$251,499	\$48,439	\$0	\$299,937
	\$0	\$120,000	\$18,000	\$12,000	\$150,000	\$12,900	\$162,900	\$24,435	\$16,290	\$203,625	\$203,625	\$39,218	\$0	\$242,843
	\$0	\$92,000	\$13,800	\$9,200	\$115,000	\$9,890	\$124,890	\$18,734	\$12,489	\$156,113	\$156,113	\$30,067	\$0	\$186,180
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$0	\$5,750,000	\$862,500	\$575,000	\$7,187,500	\$618,125	\$7,805,625	\$1,170,844	\$780,563	\$9,757,031	\$9,757,031	\$1,879,204	\$0	\$11,636,235
	\$0	\$200,000	\$30,000	\$20,000	\$250,000	\$21,500	\$271,500	\$40,725	\$27,150	\$339,375	\$339,375	\$65,364	\$0	\$404,739
	\$0	\$185,266	\$27,790	\$18,527	\$231,583	\$19,916	\$251,499	\$37,725	\$25,150	\$314,374	\$314,374	\$60,548	\$0	\$374,922
	\$0	\$150,000	\$22,500	\$15,000	\$187,500	\$16,125	\$203,625	\$30,544	\$20,363	\$254,531	\$254,531	\$49,023	\$0	\$303,554
	\$0	\$115,000	\$17,250	\$11,500	\$143,750	\$12,363	\$156,113	\$23,417	\$15,611	\$195,141	\$195,141	\$37,584	\$0	\$232,725
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$0	\$45,000	\$6,750	\$4,500	\$56,250	\$4,838	\$61,088	\$9,163	\$6,109	\$76,359	\$76,359	\$14,707	\$0	\$91,066
	\$0	\$75,000	\$11,250	\$7,500	\$93,750	\$8,063	\$101,813	\$15,272	\$10,181	\$127,266	\$127,266	\$24,511	\$0	\$151,777
	\$0	\$75,000	\$11,250	\$7,500	\$93,750	\$8,063	\$101,813	\$15,272	\$10,181	\$127,266	\$127,266	\$24,511	\$0	\$151,777
	\$0	\$135,000	\$20,250	\$13,500	\$168,750	\$14,513	\$183,263	\$27,489	\$18,326	\$229,078	\$229,078	\$44,120	\$0	\$273,199
	\$0	\$45,000	\$6,750	\$4,500	\$56,250	\$4,838	\$61,088	\$9,163	\$6,109	\$76,359	\$76,359	\$14,707	\$0	\$91,066
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	\$17,308	\$3,334	\$0	\$20,642
	\$0	\$3,000	\$450	\$300	\$3,750	\$323	\$4,073	\$611	\$407	\$5,091	\$5,091	\$980	\$0	\$6,071
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	\$17,308	\$3,334	\$0	\$20,642
	\$0	\$3,000	\$450	\$300	\$3,750	\$323	\$4,073	\$611	\$407	\$5,091	\$5,091	\$980	\$0	\$6,071
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	\$10,181	\$1,961	\$0	\$12,142
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$0	\$17,332	\$0	\$0	\$17,332	\$1,491	\$18,823	\$2,823	\$1,882	\$23,528	\$23,528	\$4,532	\$0	\$28,060
	\$0	\$5,665	\$850	\$567	\$7,082	\$609	\$7,691	\$1,154	\$769	\$9,613	\$9,613	\$1,851	\$0	\$11,465
	\$0	\$10,603	\$1,590	\$1,060	\$13,254	\$1,140	\$14,394	\$2,159	\$1,439	\$17,992	\$17,992	\$3,465	\$0	\$21,458
	\$0	\$8,289	\$1,243	\$829	\$10,361	\$891	\$11,252	\$1,688	\$1,125	\$14,065	\$14,065	\$2,709	\$0	\$16,774
	\$0	\$3,264	\$490	\$326	\$4,081	\$351	\$4,431	\$665	\$443	\$5,539	\$5,539	\$1,067	\$0	\$6,606
	\$0	\$2,990	\$448	\$299	\$3,737	\$321	\$4,058	\$609	\$406	\$5,073	\$5,073	\$977	\$0	\$6,050
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$0	\$24,866	\$3,730	\$2,487	\$31,083	\$2,673	\$33,756	\$5,063	\$3,376	\$42,195	\$42,195	\$8,127	\$0	\$50,322
	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Table B-4. Option 2c Cost Estimate Details

<b>Option 2c</b>			
Source Control, Dispersed Plume P&T using Treatment at 200W, with MNA			
Location:	200 LIP-1	Base Year:	2019
Phase:	SE Chromium Plume	Date:	1/1/2019
Description:	Source Control P&T, Dispersed Plume P&T for 25 years with treatment at 200W P&T, and MNA for 120 years		

CAPITAL COSTS												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	UNIT COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
1	Design	Permitting and Reviews	1051 Environmental Engineers	10	hr	\$124	\$1,238	0	0	0	1	
1	Design	Permitting and Reviews	1053 Managers & Executives	5	hr	\$142	\$708	0	0	0	1	
1	Design	Permitting and Reviews	1054 Geologists/Geophysicists/Hydro	30	hr	\$133	\$3,976	0	0	0	1	
1	Design	Permitting and Reviews	1055 Environmental Scientists	60	hr	\$104	\$6,217	0	0	0	1	
1	Design	Permitting and Reviews	1056 Technical Writers & Editors	40	hr	\$82	\$3,264	0	0	0	1	
1	Design	Permitting and Reviews	1052 Administrative Assistants	35	hr	\$75	\$2,616	0	0	0	1	
1	Design	Permitting and Reviews	1057 MSA Labor for Permitting	1	ea	\$5,000	\$5,000	0	0	0	1	
1	Design	Design Document	1051 Environmental Engineers	140	hr	\$124	\$17,332	0	0	0	1	
1	Design	Design Document	1053 Managers & Executives	40	hr	\$142	\$5,665	0	0	0	1	
1	Design	Design Document	1054 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,660	0	0	0	1	
1	Design	Design Document	1055 Environmental Scientists	80	hr	\$104	\$8,289	0	0	0	1	
1	Design	Design Document	1056 Technical Writers & Editors	40	hr	\$82	\$3,264	0	0	0	1	
1	Design	Design Document	1052 Administrative Assistants	40	hr	\$75	\$2,990	0	0	0	1	
1	Design	Design Document	1058 Modeling Subcontractor	1	ea	\$90,000	\$90,000	0	0	0	1	
2	Well Installation	Drilling and Well Installation	267 Monitoring Well Installation	6	EA	\$400,000	\$2,400,000	HISTORICAL	3	3	1	
2	Well Installation	Drilling and Well Installation	269 Well Pads	6	EA	\$15,000	\$90,000	HISTORICAL	3	3	1	Cost includes well pads for 6 new wells and future replacement wells if needed
2	Well Installation	Drilling and Well Installation	270 Access Roads	0.6	Mile	\$115,000	\$69,000	OTHER	3	3	1	Assumes 0.1 mile road for each well
2	Well Installation	Drilling and Well Installation	271 Well Sampling	220	Sample	\$1,000	\$220,000	HISTORICAL	1	1	1	20 Samples per well (11 injection wells)
2	Well Installation	Drilling and Well Installation	272 Well Sampling Crew	440	Hr	\$463	\$203,793	OTHER	1	1	1	2 hours sample crew per sample
2	Well Installation	Drilling and Well Installation	266 Injection Well Installation	10	EA	\$575,000	\$5,750,000	HISTORICAL	1	1	1	
2	Well Installation	Drilling and Well Installation	269 Well Pads	10	EA	\$15,000	\$150,000	HISTORICAL	1	1	1	
2	Well Installation	Drilling and Well Installation	270 Access Roads	6	Mile	\$115,000	\$690,000	OTHER	1	1	1	Access road length from figure CHSGW20180181c
2	Well Installation	Drilling and Well Installation	268 Extraction Well Installation	10	EA	\$625,000	\$6,250,000	HISTORICAL	2	2	1	
2	Well Installation	Drilling and Well Installation	269 Well Pads	10	EA	\$15,000	\$150,000	HISTORICAL	2	2	1	
2	Well Installation	Drilling and Well Installation	270 Access Roads	1.1	Mile	\$115,000	\$126,500	OTHER	2	2	1	Access road length from figure CHSGW20180181c
3	Construction	Water Level Monitoring System	273 AWLN Monitoring System	10	EA	\$9,000	\$90,000	OTHER	2	2	1	
3	Construction	CAT/ATP/OTP	951 CAT/ATP/OTP	830719	ea	\$1	\$830,719	0	4	4	1	10 wells
3	Construction	Groundwater Pump and Treat Systems	367 750 GPM Cr Treatment Train	1	ea	\$1,200,000	\$1,200,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	351 Misc. Modifications	1	ea	\$50,000	\$50,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	357 3" Single Wall HDPE Pipe	40984	ft	\$10	\$409,840	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	358 4" X 8" Dual Wall HDPE Pipeline	79677	ft	\$33	\$2,629,341	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	359 Paved Road Crossing	19	ea	\$60,000	\$1,140,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	360 Gravel Road Crossing	19	ea	\$16,000	\$304,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	361 Mechanical Rack	21	ea	\$25,000	\$525,000	OTHER	2	3	2	10 Extraction and 11 Injection Wells
3	Construction	Groundwater Pump and Treat Systems	362 Electrical Rack	21	ea	\$40,000	\$840,000	OTHER	2	3	2	10 Extraction and 11 Injection Wells
3	Construction	Groundwater Pump and Treat Systems	363 On Ground electric cable	23515	ft	\$8	\$188,120	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	364 Instrument Cable	101932	ft	\$5	\$509,660	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	365 Power Service Transformers	2	ea	\$2,000,000	\$4,000,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	353 Fluidized Bed Reactor (FBR)	1	ea	\$4,900,000	\$4,900,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	354 Membrane Bioreactor (MBR)	1	ea	\$15,200,000	\$15,200,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	355 Air Stripper	1	ea	\$7,550,000	\$7,550,000	OTHER	2	3	2	
3	Construction	Groundwater Pump and Treat Systems	356 Granular Activated Carbon (GAC)	2	ea	\$1,000,000	\$2,000,000	OTHER	2	3	2	
2	Well Installation	Drilling and Well Installation	271 Well Sampling	200	Sample	\$1,000	\$200,000	HISTORICAL	2	2	1	Well sampling Extraction wells (10 wells, 20 samples per well)
2	Well Installation	Drilling and Well Installation	272 Well Sampling Crew	400	Hr	\$463	\$185,266	OTHER	2	2	1	2 hours sample crew per sample
2	Well Installation	Drilling and Well Installation	271 Well Sampling	120	Sample	\$1,000	\$120,000	HISTORICAL	3	3	1	Well Sampling Monitoring wells (6 wells, 20 samples per well)
2	Well Installation	Drilling and Well Installation	272 Well Sampling Crew	240	Hr	\$463	\$111,160	OTHER	3	3	1	2 hours sample crew per sample

CAPITAL MARKUPS																			
MDBI	SUBTOTAL	Overhead 15%	Profit 10%	SUBTOTAL	WA States Sales Tax 8.6%	SUBTOTAL	Scope Contingency 15%	Bid Contingency 10%	SUBTOTAL	Project Management		Remedial Design		Construction Management		SUBTOTAL	CHPRC G&A 19.26%	Institutional Controls	COST PER YEAR
										Percent	5%	Percent	6%	Percent	6%				
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$124	\$1,362	\$204	\$136	\$1,702	\$146	\$1,848	\$277	\$185	\$2,311	\$116	\$139	\$139	\$2,704	\$521	\$0	\$0	\$0	\$0	\$3,224
\$71	\$779	\$117	\$78	\$974	\$84	\$1,057	\$159	\$106	\$1,322	\$66	\$79	\$79	\$1,547	\$298	\$0	\$0	\$0	\$0	\$1,844
\$398	\$4,374	\$656	\$437	\$5,467	\$470	\$5,937	\$891	\$594	\$7,422	\$371	\$445	\$445	\$8,694	\$1,672	\$0	\$0	\$0	\$0	\$10,356
\$622	\$6,838	\$1,026	\$684	\$8,546	\$735	\$9,283	\$1,382	\$928	\$11,604	\$586	\$696	\$696	\$13,576	\$2,615	\$0	\$0	\$0	\$0	\$16,191
\$326	\$3,591	\$539	\$359	\$4,489	\$386	\$4,875	\$731	\$487	\$6,093	\$305	\$366	\$366	\$7,129	\$1,373	\$0	\$0	\$0	\$0	\$8,502
\$262	\$2,877	\$432	\$288	\$3,597	\$309	\$3,906	\$586	\$391	\$4,883	\$244	\$293	\$293	\$5,713	\$1,100	\$0	\$0	\$0	\$0	\$6,813
\$500	\$5,500	\$825	\$550	\$6,875	\$591	\$7,466	\$1,120	\$747	\$9,333	\$467	\$560	\$560	\$10,919	\$2,103	\$0	\$0	\$0	\$0	\$13,022
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$1,733	\$19,065	\$2,860	\$1,907	\$23,832	\$2,050	\$25,881	\$3,882	\$2,588	\$32,351	\$1,618	\$1,941	\$1,941	\$37,851	\$7,290	\$0	\$0	\$0	\$0	\$45,141
\$567	\$6,232	\$935	\$623	\$7,790	\$670	\$8,460	\$1,269	\$846	\$10,574	\$529	\$634	\$634	\$12,372	\$2,383	\$0	\$0	\$0	\$0	\$14,755
\$1,060	\$11,664	\$1,750	\$1,166	\$14,579	\$1,254	\$15,833	\$2,375	\$1,583	\$19,792	\$990	\$1,187	\$1,187	\$23,156	\$4,460	\$0	\$0	\$0	\$0	\$27,616
\$829	\$9,116	\$1,368	\$912	\$11,297	\$980	\$12,277	\$1,857	\$1,238	\$15,472	\$774	\$928	\$928	\$18,102	\$3,486	\$0	\$0	\$0	\$0	\$21,588
\$326	\$3,591	\$539	\$359	\$4,489	\$386	\$4,875	\$731	\$487	\$6,093	\$305	\$366	\$366	\$7,129	\$1,373	\$0	\$0	\$0	\$0	\$8,502
\$299	\$3,289	\$493	\$329	\$4,111	\$354	\$4,464	\$670	\$446	\$5,580	\$279	\$335	\$335	\$6,529	\$1,257	\$0	\$0	\$0	\$0	\$7,786
\$9,000	\$99,000	\$14,850	\$9,900	\$123,750	\$10,643	\$134,393	\$20,159	\$13,439	\$167,991	\$8,400	\$10,079	\$10,079	\$196,549	\$37,855	\$0	\$0	\$0	\$0	\$234,404
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$240,000	\$2,640,000	\$396,000	\$264,000	\$3,300,000	\$283,800	\$3,583,800	\$537,570	\$358,380	\$4,479,750	\$223,988	\$268,785	\$268,785	\$5,241,308	\$1,009,476	\$0	\$0	\$0	\$0	\$6,250,783
\$9,000	\$99,000	\$14,850	\$9,900	\$123,750	\$10,643	\$134,393	\$20,159	\$13,439	\$167,991	\$8,400	\$10,079	\$10,079	\$196,549	\$37,855	\$0	\$0	\$0	\$0	\$234,404
\$6,900	\$75,900	\$11,385	\$7,590	\$94,875	\$8,159	\$103,034	\$15,455	\$10,303	\$128,793	\$6,440	\$7,728	\$7,728	\$150,688	\$29,022	\$0	\$0	\$0	\$0	\$179,710
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$22,000	\$242,000	\$36,300	\$24,200	\$302,500	\$26,015	\$328,515	\$49,277	\$32,852	\$410,644	\$20,532	\$24,639	\$24,639	\$480,453	\$92,535	\$0	\$0	\$0	\$0	\$572,988
\$203,379	\$224,172	\$33,626	\$22,417	\$280,215	\$24,098	\$304,314	\$45,647	\$30,431	\$380,392	\$19,020	\$22,824	\$22,824	\$445,059	\$85,718	\$0	\$0	\$0	\$0	\$530,777
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$575,000	\$6,325,000	\$948,750	\$632,500	\$7,906,250	\$679,938	\$8,586,188	\$1,287,928	\$858,619	\$10,732,734	\$536,637	\$643,964	\$643,964	\$12,557,299	\$2,418,536	\$0	\$0	\$0	\$0	\$14,975,835
\$15,000	\$165,000	\$24,750	\$16,500	\$206,250	\$17,738	\$223,988	\$33,598	\$22,399	\$279,984	\$13,999	\$16,799	\$16,799	\$327,582	\$63,092	\$0	\$0	\$0	\$0	\$390,674
\$64,400	\$708,400	\$106,260	\$70,840	\$885,500	\$76,153	\$961,653	\$144,248	\$96,165	\$1,202,066	\$60,103	\$72,124	\$72,124	\$1,406,418	\$270,876	\$0	\$0	\$0	\$0	\$1,677,294
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$625,000	\$6,875,000	\$1,031,250	\$687,500	\$8,593,750	\$739,063	\$9,332,813	\$1,399,922	\$933,281	\$11,666,016	\$583,301	\$699,961	\$699,961	\$13,649,238	\$2,628,843	\$0	\$0	\$0	\$0	

ANNUAL O&M COST												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	UNIT COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
							\$0					
4	Operations and Maintenance	GW Monitoring, Extraction, Injection or Containment	387 P&T influent 500 gpm 2WP&T	26280000	\$/gal	\$0.0231	\$605,995	0	6	10	1	
4	Operations and Maintenance	GW Monitoring, Extraction, Injection or Containment	387 P&T influent 500 gpm 2WP&T	26280000	\$/gal	\$0.0231	\$6,059,953	0	6	30	1	
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	4	30	1	Assumes 12 wells per year for 30 years
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	12	EA	\$500	\$6,000	0	4	30	1	Assumes 12 wells per year for 30 years
4	Operations and Maintenance	Well Maintenance	389 Extraction Well Maintenance	8	EA	\$5,500	\$44,000	0	6	30	1	
4	Operations and Maintenance	Well Maintenance	390 Injection Well Maintenance	10	EA	\$3,300	\$33,000	0	6	30	1	
							\$0					
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	5	30	1	Assumes 12 wells per year for 30 years
							\$0					
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	1	30	1	1 report per year for 30 years
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,665	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	1	30	1	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	1	30	1	
							\$0					
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	1	30	1	Annual data evaluation for 120 years (20 hours per month)
							\$0					
4	Operations and Maintenance	Well Maintenance	389 Extraction Well Maintenance	2	EA	\$5,500	\$11,000	0	6	10		2 source extraction wells

ANNUAL O&M MARKUPS												
MDBI	SUBTOTAL	Overhead 15%	Profit 10%	SUBTOTAL	WA States Sales Tax 8.6%	SUBTOTAL	Scope Contingency 15%	Bid Contingency 10%	SUBTOTAL			
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			
\$0	\$605,995	\$90,899	\$60,600	\$757,494	\$65,144	\$822,639	\$123,396	\$82,264	\$1,028,298			
\$0	\$6,059,953	\$908,993	\$605,995	\$7,574,941	\$651,445	\$8,226,386	\$1,233,958	\$822,639	\$10,282,983			
\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308			
\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181			
\$0	\$44,000	\$6,600	\$4,400	\$55,000	\$4,730	\$59,730	\$8,960	\$5,973	\$74,663			
\$0	\$33,000	\$4,950	\$3,300	\$41,250	\$3,548	\$44,798	\$6,720	\$4,480	\$55,997			
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			
\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181			
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			
\$0	\$17,332	\$0	\$0	\$17,332	\$1,491	\$18,823	\$2,823	\$1,882	\$23,528			
\$0	\$5,665	\$850	\$567	\$7,082	\$609	\$7,691	\$1,154	\$769	\$9,613			
\$0	\$10,603	\$1,590	\$1,060	\$13,254	\$1,140	\$14,394	\$2,159	\$1,439	\$17,992			
\$0	\$8,289	\$1,243	\$829	\$10,361	\$891	\$11,252	\$1,688	\$1,125	\$14,065			
\$0	\$3,264	\$490	\$326	\$4,081	\$351	\$4,431	\$665	\$443	\$5,539			
\$0	\$2,990	\$448	\$299	\$3,737	\$321	\$4,058	\$609	\$406	\$5,073			
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			
\$0	\$24,866	\$3,730	\$2,487	\$31,083	\$2,673	\$33,756	\$5,063	\$3,376	\$42,195			
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			
\$0	\$11,000	\$1,650	\$1,100	\$13,750	\$1,183	\$14,933	\$2,240	\$1,493	\$18,666			
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			

PERIODIC O&M COST												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	UNIT COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
4	Operations and Maintenance	Monitoring Well Replacement	376 Groundwater Sampling and Analysis	120	EA	\$1,000	\$120,000	OTHER	33	120	30	Assumes 20 samples per well
4	Operations and Maintenance	Monitoring Well Replacement	380 Well Sampling Crew	240	HR	\$463	\$111,160	OTHER	33	120	30	Assumes 2 crew hours per sample
4	Operations and Maintenance	Monitoring Well Replacement	381 Well Pads	6	EA	\$15,000	\$90,000	OTHER	33	120	30	
4	Operations and Maintenance	Monitoring Well Replacement	382 Access Roads	0.6	Mile	\$115,000	\$69,000	OTHER	33	120	30	Assumes 0.1 miles of access road per well pad
4	Operations and Maintenance	Extraction Well Replacement	379 Extraction Well Installation	8	EA	\$675,000	\$5,400,000	OTHER	25	25	1	Extraction wells replaced once at year 20
4	Operations and Maintenance	Extraction Well Replacement	376 Groundwater Sampling and Analysis	160	EA	\$1,000	\$160,000	OTHER	25	25	1	
4	Operations and Maintenance	Extraction Well Replacement	380 Well Sampling Crew	320	HR	\$463	\$148,213	OTHER	25	25	1	
4	Operations and Maintenance	Extraction Well Replacement	381 Well Pads	8	EA	\$15,000	\$120,000	OTHER	25	25	1	
4	Operations and Maintenance	Extraction Well Replacement	382 Access Roads	0.80	Mile	\$115,000	\$92,000	OTHER	25	25	1	
4	Operations and Maintenance	Injection Well Replacement	377 Injection Well Installation	10	EA	\$575,000	\$5,750,000	OTHER	15	30	10	Injection wells replaced every 10 years
4	Operations and Maintenance	Injection Well Replacement	376 Groundwater Sampling and Analysis	200	EA	\$1,000	\$200,000	OTHER	15	30	10	
4	Operations and Maintenance	Injection Well Replacement	380 Well Sampling Crew	400	HR	\$463	\$185,266	OTHER	15	30	10	
4	Operations and Maintenance	Injection Well Replacement	381 Well Pads	10	EA	\$15,000	\$150,000	OTHER	15	30	10	
4	Operations and Maintenance	Injection Well Replacement	382 Access Roads	1	Mile	\$115,000	\$115,000	OTHER	15	30	10	
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	6	EA	\$7,500	\$45,000	OTHER	33	120	30	Monitoring wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	10	EA	\$7,500	\$75,000	OTHER	25	25	1	Extraction wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	10	EA	\$7,500	\$75,000	OTHER	15	30	10	Injection wells replaced every 10 years
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	18	EA	\$7,500	\$135,000	OTHER	30	30	1	Remaining injection and extraction wells
6	Closeout	GW Monitoring, Extraction, Injection or Containment	384 Well Decommissioning	6	EA	\$7,500	\$45,000	OTHER	120	120	1	Remaining monitoring wells
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	35	100	5	well maintenance every 5 years from year 31 to 100
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	6	EA	\$500	\$3,000	0	35	100	5	
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	6	EA	\$1,700	\$10,200	OTHER	105	120	5	Well Maintenance every 5 years, 6 wells, based on figures 6-57 to 6-59 of ECF-200UP1-18-0008
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	6	EA	\$500	\$3,000	0	105	120	5	
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	35	100	5	Monitoring every 5 years from year 31 to 100
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	6	EA	\$1,000	\$6,000	OTHER	105	120	5	Monitoring every 5 years, 6 wells, based on figures 6-57 to 6-59 of ECF-200UP1-18-0008
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	35	120	5	Progress reports every 5 years, years 31 to 120
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,665	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	35	120	5	
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	35	120	5	Progress reports every 5 years, years 31 to 120

PERIODIC O&M MARKUPS												
MOBI	SUBTOTAL	Overhead		SUBTOTAL	Sales Tax		Contingency		SUBTOTAL	CHPRC G&A	Institutional	COST PER YEAR
		15%	10%		8.6%	15%	10%	19.26%				
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$2,400,000	\$360,000	\$240,000	\$3,000,000	\$258,000	\$3,258,000	\$488,700	\$325,800	\$4,072,500	\$4,072,500	\$784,364	\$4,856,864
\$0	\$120,000	\$18,000	\$12,000	\$150,000	\$12,900	\$162,900	\$24,435	\$16,290	\$203,625	\$203,625	\$39,218	\$242,843
\$0	\$111,160	\$16,674	\$11,116	\$138,950	\$11,950	\$150,899	\$22,635	\$15,090	\$188,624	\$188,624	\$36,329	\$224,953
\$0	\$90,000	\$13,500	\$9,000	\$112,500	\$9,675	\$122,175	\$18,326	\$12,218	\$152,719	\$152,719	\$29,414	\$182,132
\$0	\$69,000	\$10,350	\$6,900	\$86,250	\$7,418	\$93,668	\$14,050	\$9,367	\$117,084	\$117,084	\$22,550	\$139,635
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$5,400,000	\$810,000	\$540,000	\$6,750,000	\$580,500	\$7,330,500	\$1,099,575	\$733,050	\$9,163,125	\$9,163,125	\$1,764,818	\$10,927,943
\$0	\$160,000	\$24,000	\$16,000	\$200,000	\$17,200	\$217,200	\$32,580	\$21,720	\$271,500	\$271,500	\$52,291	\$323,791
\$0	\$148,213	\$22,232	\$14,821	\$185,266	\$15,933	\$201,199	\$30,180	\$20,120	\$251,499	\$251,499	\$48,439	\$299,937
\$0	\$120,000	\$18,000	\$12,000	\$150,000	\$12,900	\$162,900	\$24,435	\$16,290	\$203,625	\$203,625	\$39,218	\$242,843
\$0	\$92,000	\$13,800	\$9,200	\$115,000	\$9,890	\$124,890	\$18,734	\$12,489	\$156,113	\$156,113	\$30,067	\$186,180
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$5,750,000	\$862,500	\$575,000	\$7,187,500	\$618,125	\$7,805,625	\$1,170,844	\$780,563	\$9,757,031	\$9,757,031	\$1,879,204	\$11,636,235
\$0	\$200,000	\$30,000	\$20,000	\$250,000	\$21,500	\$271,500	\$40,725	\$27,150	\$339,375	\$339,375	\$65,364	\$404,739
\$0	\$185,266	\$27,790	\$18,527	\$231,563	\$19,916	\$251,499	\$37,725	\$25,150	\$314,374	\$314,374	\$60,548	\$374,922
\$0	\$150,000	\$22,500	\$15,000	\$187,500	\$16,125	\$203,625	\$30,544	\$20,363	\$254,531	\$254,531	\$49,023	\$303,554
\$0	\$115,000	\$17,250	\$11,500	\$143,750	\$12,363	\$156,113	\$23,417	\$15,611	\$195,141	\$195,141	\$37,584	\$232,725
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$45,000	\$6,750	\$4,500	\$56,250	\$4,838	\$61,088	\$9,163	\$6,109	\$76,359	\$76,359	\$14,707	\$91,066
\$0	\$75,000	\$11,250	\$7,500	\$93,750	\$8,063	\$101,813	\$15,272	\$10,181	\$127,266	\$127,266	\$24,511	\$151,777
\$0	\$75,000	\$11,250	\$7,500	\$93,750	\$8,063	\$101,813	\$15,272	\$10,181	\$127,266	\$127,266	\$24,511	\$151,777
\$0	\$135,000	\$20,250	\$13,500	\$168,750	\$14,513	\$183,263	\$27,489	\$18,326	\$229,078	\$229,078	\$44,120	\$273,199
\$0	\$45,000	\$6,750	\$4,500	\$56,250	\$4,838	\$61,088	\$9,163	\$6,109	\$76,359	\$76,359	\$14,707	\$91,066
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	\$17,308	\$3,334	\$20,642
\$0	\$3,000	\$450	\$300	\$3,750	\$323	\$4,073	\$611	\$407	\$5,091	\$5,091	\$989	\$6,071
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$10,200	\$1,530	\$1,020	\$12,750	\$1,097	\$13,847	\$2,077	\$1,385	\$17,308	\$17,308	\$3,334	\$20,642
\$0	\$3,000	\$450	\$300	\$3,750	\$323	\$4,073	\$611	\$407	\$5,091	\$5,091	\$989	\$6,071
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	\$10,181	\$1,961	\$12,142
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$17,332	\$0	\$0	\$17,332	\$1,491	\$18,823	\$2,823	\$1,882	\$23,528	\$23,528	\$4,532	\$28,060
\$0	\$5,665	\$850	\$567	\$7,082	\$609	\$7,691	\$1,154	\$769	\$9,613	\$9,613	\$1,851	\$11,465
\$0	\$10,603	\$1,590	\$1,060	\$13,254	\$1,140	\$14,394	\$2,159	\$1,439	\$17,992	\$17,992	\$3,465	\$21,458
\$0	\$8,289	\$1,243	\$829	\$10,361	\$891	\$11,252	\$1,688	\$1,125	\$14,065	\$14,065	\$2,709	\$16,774
\$0	\$3,264	\$490	\$326	\$4,081	\$351	\$4,431	\$665	\$443	\$5,539	\$5,539	\$1,067	\$6,606
\$0	\$2,990	\$448	\$299	\$3,737	\$321	\$4,058	\$609	\$406	\$5,073	\$5,073	\$977	\$6,050
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$24,866	\$3,730	\$2,487	\$31,083	\$2,673	\$33,756	\$5,063	\$3,376	\$42,195	\$42,195	\$8,127	\$50,322
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Table B-5. Option 3 Cost Estimate Details

<b>Option 3</b>			
Source Control, Dispersed Plume P&T to Below Cleanup Levels			
Location:	200-UP-1	Base Year:	2019
Phase:	SE Chromium Plume	Date:	1/1/2019
Description:	Source Control P&T, Dispersed Plume P&T for 25 years with on-site treatment to below cleanup levels, and MNA for 25 years		

CAPITAL COSTS												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	UNIT COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
1	Design	Permitting and Reviews	1051 Environmental Engineers	10	hr	\$124	\$1,238	0	0	0	1	
1	Design	Permitting and Reviews	1053 Managers & Executives	5	hr	\$142	\$708	0	0	0	1	
1	Design	Permitting and Reviews	1054 Geologists/Geophysicists/Hydro	30	hr	\$133	\$3,978	0	0	0	1	
1	Design	Permitting and Reviews	1055 Environmental Scientists	60	hr	\$104	\$6,217	0	0	0	1	
1	Design	Permitting and Reviews	1056 Technical Writers & Editors	40	hr	\$82	\$3,264	0	0	0	1	
1	Design	Permitting and Reviews	1052 Administrative Assistants	35	hr	\$75	\$2,616	0	0	0	1	
1	Design	Permitting and Reviews	1057 MSA Labor for Permitting	1	ea	\$5,000	\$5,000	0	0	0	1	
1	Design	Design Document	1051 Environmental Engineers	140	hr	\$124	\$17,332	0	0	0	1	
1	Design	Design Document	1053 Managers & Executives	40	hr	\$142	\$5,665	0	0	0	1	
1	Design	Design Document	1054 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	0	0	0	1	
1	Design	Design Document	1055 Environmental Scientists	80	hr	\$104	\$8,289	0	0	0	1	
1	Design	Design Document	1056 Technical Writers & Editors	40	hr	\$82	\$3,264	0	0	0	1	
1	Design	Design Document	1052 Administrative Assistants	40	hr	\$75	\$2,990	0	0	0	1	
1	Design	Design Document	1058 Modeling Subcontractor	1	ea	\$90,000	\$90,000	0	0	0	1	
2	Well Installation	Drilling and Well Installation	267 Monitoring Well Installation	6	EA	\$400,000	\$2,400,000	HISTORICAL	7	7	1	
2	Well Installation	Drilling and Well Installation	269 Well Pads	6	EA	\$15,000	\$90,000	HISTORICAL	7	7	1	Cost includes well pads for 6 new wells and future replacement wells if needed (2 pads per well)
2	Well Installation	Drilling and Well Installation	270 Access Roads	0.6	Mile	\$115,000	\$69,000	OTHER	7	7	1	Assumes 0.1 mile road for each well
2	Well Installation	Drilling and Well Installation	271 Well Sampling	520	Sample	\$1,000	\$520,000	HISTORICAL	1	3	3	Injection well sampling, 20 Samples per well
2	Well Installation	Drilling and Well Installation	272 Well Sampling Crew	1040	Hr	\$463	\$481,692	OTHER	1	3	3	2 hours sample crew per sample
2	Well Installation	Drilling and Well Installation	266 Injection Well Installation	26	EA	\$575,000	\$14,950,000	HISTORICAL	1	3	3	
2	Well Installation	Drilling and Well Installation	269 Well Pads	26	EA	\$15,000	\$390,000	HISTORICAL	1	3	3	
2	Well Installation	Drilling and Well Installation	270 Access Roads	9	Mile	\$115,000	\$1,035,000	OTHER	1	3	3	Access road length from figure CHSGW20180181d
2	Well Installation	Drilling and Well Installation	268 Extraction Well Installation	29	EA	\$625,000	\$18,125,000	HISTORICAL	4	6	3	
2	Well Installation	Drilling and Well Installation	269 Well Pads	29	EA	\$15,000	\$435,000	HISTORICAL	4	6	3	
2	Well Installation	Drilling and Well Installation	270 Access Roads	9	Mile	\$115,000	\$1,035,000	OTHER	4	6	3	Access road length from figure CHSGW20180181d
3	Construction	Water Level Monitoring System	273 AWLN Monitoring System	10	EA	\$9,000	\$90,000	OTHER	7	7	1	10 wells
3	Construction	CAT/ATP/OTP	951 CAT/ATP/OTP	838065	ea	\$1	\$838,065	0	7	7	1	
3	Construction	Groundwater Pump and Treat Systems	366 New Treatment Building	4	ea	\$1,200,000	\$4,200,000	OTHER	3	5	3	Building cost for 25 year large system about 3.5 times cost of other systems.
3	Construction	Groundwater Pump and Treat Systems	368 3,000 GPM C Treatment Train	1	ea	\$4,500,000	\$4,500,000	OTHER	3	5	3	
3	Construction	Groundwater Pump and Treat Systems	351 Misc. Modifications	1	ea	\$50,000	\$50,000	OTHER	3	5	3	
3	Construction	Groundwater Pump and Treat Systems	357 3" Single Wall HDPE Pipe	37971	ft	\$10	\$379,710	OTHER	3	5	3	
3	Construction	Groundwater Pump and Treat Systems	358 4" X 8" Dual Wall HDPE Pipeline	458875	ft	\$33	\$15,142,875	OTHER	3	5	3	
3	Construction	Groundwater Pump and Treat Systems	359 Paved Road Crossing	54	ea	\$60,000	\$3,240,000	OTHER	3	5	3	Assumes 1 crossing per injection and extraction well
3	Construction	Groundwater Pump and Treat Systems	360 Gravel Road Crossing	54	ea	\$16,000	\$864,000	OTHER	3	5	3	Assumes 1 crossing per injection and extraction well
3	Construction	Groundwater Pump and Treat Systems	361 Mechanical Rack	54	ea	\$25,000	\$1,350,000	OTHER	3	5	3	27 Extraction and 27 Injection Wells
3	Construction	Groundwater Pump and Treat Systems	362 Electrical Rack	54	ea	\$40,000	\$2,160,000	OTHER	3	5	3	27 Extraction and 27 Injection Wells
3	Construction	Groundwater Pump and Treat Systems	363 On Ground electric cable	71280	ft	\$8	\$570,240	OTHER	3	5	3	
3	Construction	Groundwater Pump and Treat Systems	364 Instrument Cable	71280	ft	\$5	\$356,400	OTHER	3	5	3	
3	Construction	Groundwater Pump and Treat Systems	365 Power Service Transformers	5	ea	\$2,000,000	\$9,000,000	OTHER	3	5	3	
2	Well Installation	Drilling and Well Installation	271 Well Sampling	580	Sample	\$1,000	\$580,000	HISTORICAL	4	6	3	
2	Well Installation	Drilling and Well Installation	272 Well Sampling Crew	1160	Hr	\$463	\$537,272	OTHER	4	6	3	
2	Well Installation	Drilling and Well Installation	271 Well Sampling	120	Sample	\$1,000	\$120,000	HISTORICAL	7	7	1	
2	Well Installation	Drilling and Well Installation	272 Well Sampling Crew	240	Hr	\$463	\$111,160	OTHER	7	7	1	

CAPITAL MARKUPS																							
MDBI	10%	SUBTOTAL	Overhead		SUBTOTAL	WA States Sales Tax		SUBTOTAL	Scope Contingency		SUBTOTAL	Bid Contingency		Project Management		Remedial Design		Construction Management		SUBTOTAL	CHPRC GSA 19.26%	Institutional Controls	COST PER YEAR
			15%	10%		8.6%	8.6%		15%	10%		5%	5%	5%	5%	5%	5%						
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$124	\$1,362	\$1,486	\$204	\$136	\$1,702	\$146	\$1,848	\$277	\$185	\$2,311	\$116	\$139	\$139	\$2,704	\$521	\$2,704	\$521	\$2,704	\$521	\$2,704	\$521	\$2,704	\$521
\$71	\$779	\$850	\$117	\$78	\$974	\$84	\$1,057	\$159	\$106	\$1,322	\$66	\$79	\$79	\$1,547	\$298	\$1,547	\$298	\$1,547	\$298	\$1,547	\$298	\$1,547	\$298
\$398	\$4,374	\$4,772	\$656	\$437	\$5,467	\$470	\$5,937	\$891	\$594	\$7,424	\$371	\$445	\$445	\$8,694	\$1,672	\$8,694	\$1,672	\$8,694	\$1,672	\$8,694	\$1,672	\$8,694	\$1,672
\$622	\$6,838	\$7,460	\$1,026	\$684	\$8,548	\$735	\$9,283	\$1,392	\$928	\$11,604	\$580	\$696	\$696	\$13,576	\$2,615	\$13,576	\$2,615	\$13,576	\$2,615	\$13,576	\$2,615	\$13,576	\$2,615
\$326	\$3,591	\$3,917	\$539	\$359	\$4,489	\$386	\$4,875	\$731	\$487	\$5,693	\$305	\$366	\$366	\$7,129	\$1,373	\$7,129	\$1,373	\$7,129	\$1,373	\$7,129	\$1,373	\$7,129	\$1,373
\$262	\$2,877	\$3,139	\$432	\$288	\$3,597	\$309	\$3,906	\$586	\$391	\$4,883	\$244	\$293	\$293	\$5,713	\$1,100	\$5,713	\$1,100	\$5,713	\$1,100	\$5,713	\$1,100	\$5,713	\$1,100
\$500	\$5,500	\$6,000	\$825	\$550	\$6,875	\$591	\$7,466	\$1,120	\$747	\$9,333	\$467	\$560	\$560	\$10,919	\$2,103	\$10,919	\$2,103	\$10,919	\$2,103	\$10,919	\$2,103	\$10,919	\$2,103
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$1,733	\$19,065	\$20,798	\$2,860	\$1,907	\$23,632	\$2,050	\$25,681	\$3,882	\$2,588	\$32,351	\$1,618	\$1,941	\$1,941	\$37,651	\$7,290	\$37,651	\$7,290	\$37,651	\$7,290	\$37,651	\$7,290	\$37,651	\$7,290
\$567	\$6,232	\$6,800	\$935	\$623	\$7,790	\$670	\$8,460	\$1,299	\$846	\$10,574	\$529	\$634	\$634	\$12,372	\$2,383	\$12,372	\$2,383	\$12,372	\$2,383	\$12,372	\$2,383	\$12,372	\$2,383
\$1,060	\$11,664	\$12,724	\$1,750	\$1,166	\$14,679	\$1,254	\$15,933	\$2,375	\$1,583	\$19,792	\$990	\$1,187	\$1,187	\$23,158	\$4,460	\$23,158	\$4,460	\$23,158	\$4,460	\$23,158	\$4,460	\$23,158	\$4,460
\$829	\$9,118	\$9,947	\$1,268	\$829	\$11,397	\$980	\$12,377	\$1,857	\$1,238	\$15,472	\$774	\$928	\$928	\$18,102	\$3,486	\$18,102	\$3,486	\$18,102	\$3,486	\$18,102	\$3,486	\$18,102	\$3,486
\$326	\$3,591	\$3,917	\$539	\$359	\$4,489	\$386	\$4,875	\$731	\$487	\$5,693	\$305	\$366	\$366	\$7,129	\$1,373	\$7,129	\$1,373	\$7,129	\$1,373	\$7,129	\$1,373	\$7,129	\$1,373
\$299	\$3,289	\$3,588	\$493	\$329	\$4,111	\$354	\$4,464	\$670	\$446	\$5,580	\$279	\$335	\$335	\$6,529	\$1,257	\$6,529	\$1,257	\$6,529	\$1,257	\$6,529	\$1,257	\$6,529	\$1,257
\$9,000	\$99,000	\$108,000	\$14,850	\$9,900	\$123,750	\$10,643	\$134,393	\$20,159	\$13,439	\$167,991	\$8,400	\$10,079	\$10,079	\$196,549	\$37,855	\$196,549	\$37,855	\$196,549	\$37,855	\$196,549	\$37,855	\$196,549	\$37,855
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$240,000	\$2,640,000	\$2,880,000	\$396,000	\$264,000	\$3,300,000	\$283,800	\$3,583,800	\$537,570	\$358,380	\$4,479,750	\$223,988	\$268,785	\$268,785	\$5,241,308	\$1,009,476	\$5,241,308	\$1,009,476	\$5,241,308	\$1,009,476	\$5,241,308	\$1,009,476	\$5,241,308	\$1,009,476
\$9,000	\$99,000	\$108,000	\$14,850	\$9,900	\$123,750	\$10,643	\$134,393	\$20,159	\$13,439	\$167,991	\$8,400	\$10,079	\$10,079	\$196,549	\$37,855	\$196,549	\$37,855	\$196,549	\$37,855	\$196,549	\$37,855	\$196,549	\$37,855
\$6,900	\$75,900	\$82,800	\$11,385	\$7,590	\$94,875	\$8,159	\$103,034	\$15,455	\$10,303	\$128,793	\$6,440	\$7,728	\$7,728	\$150,688	\$29,022	\$150,688	\$29,022	\$150,688	\$29,022	\$150,688	\$29,022	\$150,688	\$29,022
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$52,000	\$572,000	\$624,000	\$85,600	\$57,200	\$715,000	\$61,490	\$776,490	\$116,474	\$77,649	\$970,613	\$48,531	\$58,237	\$58,237	\$1,135,617	\$218,720	\$1,135,617	\$218,720	\$1,135,617	\$218,720	\$1,135,617	\$218,720	\$1,135,617	\$218,720
\$48,169	\$529,861	\$578,030	\$79,479	\$52,986	\$662,327	\$56,960	\$719,287	\$107,893	\$71,929	\$899,106	\$44,955	\$53,945	\$53,945	\$1,051,957	\$202,607	\$1,051,957	\$202,607	\$1,051,957	\$202,607	\$1,051,957	\$202,607	\$1,051,957	\$202,607
\$14,950,000	\$16,445,000	\$17,935,000	\$2,466,750	\$1,644,500	\$20,556,250	\$1,767,838	\$22,324,088	\$3,348,613	\$2,232,409	\$27,905,109	\$1,395,255	\$1,674,307	\$1,674,307	\$32,648,978	\$6,28								

ANNUAL O&M COST												
SITE	SITE NAME	WBS Top Tier	DESCRIPTION	QTY	UNIT	UNIT COST	SUBTOTAL	SOURCE	START YEAR	END YEAR	INTERVAL	NOTES
4	Operations and Maintenance	GW Monitoring, Extraction, Injection or Containment	388 P&T influent 2700 gpm site specific	26280000	\$/gal	\$0.0039	\$101,307	0	7	11		
4	Operations and Maintenance	GW Monitoring, Extraction, Injection or Containment	388 P&T influent 2700 gpm site specific	1419120000	\$/gal	\$0.0039	\$5,470,600	0	7	31		Assumes 12 wells per year for 120 years
4	Operations and Maintenance	Well Maintenance	375 Monitoring Well Maintenance	12	EA	\$1,700	\$20,400	OTHER	7	31		Assumes 12 wells per year for 120 years
4	Operations and Maintenance	Well Maintenance	383 AWLN Monitoring System Maintenance	12	EA	\$500	\$6,000	0	7	31		Assumes 12 wells per year for 120 years
4	Operations and Maintenance	Well Maintenance	389 Extraction Well Maintenance	27	EA	\$5,500	\$148,500	0	7	31		27 dispersed plume wells plus 2 source wells
4	Operations and Maintenance	Well Maintenance	390 Injection Well Maintenance	26	EA	\$3,300	\$85,800	0	7	31		
4	Operations and Maintenance	Monitoring, Testing, Sampling & Analysis	376 Groundwater Sampling and Analysis	12	EA	\$1,000	\$12,000	OTHER	7	31		Assumes 12 wells per year for 25 years
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	952 Environmental Engineers	140	hr	\$124	\$17,332	OTHER	1	31		1 report per year for 25 years
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	954 Managers & Executives	40	hr	\$142	\$5,665	OTHER	1	31		
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	955 Geologists/Geophysicists/Hydro	80	hr	\$133	\$10,603	OTHER	1	31		
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	80	hr	\$104	\$8,289	OTHER	1	31		
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	957 Technical Writers & Editors	40	hr	\$82	\$3,264	OTHER	1	31		
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	953 Administrative Assistants	40	hr	\$75	\$2,990	OTHER	1	31		
5	Remedy Performance Monitoring/Reporting	Progress Reviews and Reports	956 Environmental Scientists	240	hr	\$104	\$24,866	OTHER	1	31		Annual data evaluation for 31 years (20 hours per month)
4	Operations and Maintenance	Well Maintenance	389 Extraction Well Maintenance	2	EA	\$5,500	\$11,000	0	7	11		2 extraction wells for source control

ANNUAL O&M MARKUPS											
MDBI	Overhead	Profit	WA States Sales Tax	Scope Contingency	Bid Contingency	CHPRC G&A	Institutional Controls	SUBTOTAL			COST PER YEAR
0%	15%	10%	8.6%	15%	10%	19.26%					
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$101,307	\$15,196	\$10,131	\$126,634	\$10,891	\$137,525	\$20,629	\$13,752	\$171,906	\$171,906	\$33,109
\$0	\$5,470,600	\$820,590	\$547,060	\$6,838,250	\$588,089	\$7,426,339	\$1,113,951	\$742,634	\$9,282,924	\$9,282,924	\$1,787,891
\$0	\$20,400	\$3,060	\$2,040	\$25,500	\$2,193	\$27,693	\$4,154	\$2,769	\$34,616	\$34,616	\$6,667
\$0	\$6,000	\$900	\$600	\$7,500	\$645	\$8,145	\$1,222	\$815	\$10,181	\$10,181	\$1,961
\$0	\$148,500	\$22,275	\$14,850	\$185,625	\$15,964	\$201,589	\$30,238	\$20,159	\$251,986	\$251,986	\$48,532
\$0	\$85,800	\$12,870	\$8,580	\$107,250	\$9,224	\$116,474	\$17,471	\$11,647	\$145,592	\$145,592	\$28,041
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$12,000	\$1,800	\$1,200	\$15,000	\$1,290	\$16,290	\$2,444	\$1,629	\$20,363	\$20,363	\$3,922
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$17,332	\$0	\$0	\$17,332	\$1,491	\$18,823	\$2,823	\$1,882	\$23,528	\$23,528	\$4,532
\$0	\$5,665	\$850	\$567	\$7,082	\$609	\$7,691	\$1,154	\$769	\$9,613	\$9,613	\$1,851
\$0	\$10,603	\$1,590	\$1,060	\$13,254	\$1,140	\$14,394	\$2,159	\$1,439	\$17,992	\$17,992	\$3,465
\$0	\$8,289	\$1,243	\$829	\$10,361	\$891	\$11,252	\$1,688	\$1,125	\$14,065	\$14,065	\$2,709
\$0	\$3,264	\$490	\$326	\$4,081	\$351	\$4,431	\$665	\$443	\$5,539	\$5,539	\$1,067
\$0	\$2,990	\$448	\$299	\$3,737	\$321	\$4,058	\$609	\$406	\$5,073	\$5,073	\$977
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$24,866	\$3,730	\$2,487	\$31,083	\$2,673	\$33,756	\$5,063	\$3,376	\$42,195	\$42,195	\$8,127
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
\$0	\$11,000	\$1,650	\$1,100	\$13,750	\$1,183	\$14,933	\$2,240	\$1,493	\$18,666	\$18,666	\$3,595
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0



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**Appendix C**  
**Line Item Detail**

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## **C Line Item Detail**

This appendix provides the capital and operations and maintenance groups used in the estimate.

**Table C-1. Capital Unit Cost Summary**

<b>Location:</b>		200-UP-1									
<b>Phase:</b>		SE Chromium Plume									
<b>Base Year:</b>		2019									
<b>Date:</b>		1/1/2019									
	Item	Qty	Unit Cost	Units	Total	Source	Institutional Control?	Add OH and Profit?	Labor Only?	% of non-labor item to be taxed	Notes/References
<b>GW MONITORING, EXTRACTION, INJECTION OR CONTAINMENT: #250 - 349</b>											
266	Injection Well Installation	57	\$575,000	EA	\$ 32,775,000	HISTORICAL	NO	YES	NO	100%	Assume well depth of 400 ft. Includes direct drilling cost and CHPRC field and oversight labor. Includes \$50,000 additional allowance for extraction well pump installation and other activities.
267	Monitoring Well Installation	36	\$400,000	EA	\$ 14,400,000	HISTORICAL	NO	YES	NO	100%	Assume well depth of 400 ft. Includes direct drilling cost and CHPRC field and oversight labor.
268	Extraction Well Installation	61	\$625,000	EA	\$ 38,125,000	HISTORICAL	NO	YES	NO	100%	Assume 6 new wells needed for MNA monitoring, and well depth of 425 ft.
269	Well Pads	154	\$15,000	EA	\$ 2,310,000	HISTORICAL	NO	YES	NO	100%	Unit Cost based on project experience
270	Access Roads	42.1	\$115,000	Mile	\$ 4,841,500	OTHER	NO	YES	NO	100%	Unit cost based on linear foot cost for gravel road for Well 199-K-224.
271	Well Sampling	3,140	\$1,000	Sample	\$ 3,140,000	HISTORICAL	NO	YES	NO	100%	
272	Well Sampling Crew	6,280	\$463	Hr	\$ 2,908,679	OTHER	NO	YES	NO	100%	
273	AWLN Monitoring System	60	\$9,000	EA	\$ 540,000	OTHER	NO	YES	NO	100%	Unit Cost based on project experience
<b>GROUNDWATER PUMP AND TREAT SYSTEMS: #350 - 449</b>											
351	Misc. Modifications	5	\$50,000	ea	\$ 250,000	OTHER	NO	YES	NO	100%	
352	150 GPM Cr Treatment Train	1	\$800,000	ea	\$ 800,000	OTHER	NO	YES	NO	100%	
353	Fluidized Bed Reactor (FBR)	1	\$4,900,000	ea	\$ 4,900,000	OTHER	NO	YES	NO	100%	Unit cost from 200 West P&T Expansion ROM
354	Membrane Bioreactor (MBR)	1	\$15,200,000	ea	\$ 15,200,000	OTHER	NO	YES	NO	100%	Unit cost from 200 West P&T Expansion ROM
355	Air Stripper	1	\$7,550,000	ea	\$ 7,550,000	OTHER	NO	YES	NO	100%	Unit cost from 200 West P&T Expansion ROM minus 1,000,000 for GAC
356	Granular Activated Carbon (GAC)	2	\$1,000,000	ea	\$ 2,000,000	OTHER	NO	YES	NO	100%	Unit cost based on \$877,000 unit cost for Fixed bed reactor vapor phase GAC Roll-off units for 200W in 2011. Costs escalated 2% per year to 2018.
357	3" Single Wall HDPE Pipe	170,386	\$10	ft	\$ 1,703,860	OTHER	NO	YES	NO	100%	Unit Cost includes \$4/ft materials, and \$6/ft labor.
358	4" X 8" Dual Wall HDPE Pipeline	708,994	\$33	ft	\$ 23,396,802	OTHER	NO	YES	NO	100%	Unit Cost includes \$20/ft materials (for 4-inch dual-wall HDPE), and \$13/ft labor.
359	Paved Road Crossing	115	\$60,000	ea	\$ 6,900,000	OTHER	NO	YES	NO	100%	Unit cost from 200-UP-1 RD/RAWP in 2013 and based on invoice that averaged ~\$60K per crossing
360	Gravel Road Crossing	121	\$16,000	ea	\$ 1,936,000	OTHER	NO	YES	NO	100%	Unit Cost based on project experience
361	Mechanical Rack	119	\$25,000	ea	\$ 2,975,000	OTHER	NO	YES	NO	100%	From 200-BP-5 FS cost estimate. Assumes 1 rack per well
362	Electrical Rack	119	\$40,000	ea	\$ 4,760,000	OTHER	NO	YES	NO	100%	Unit cost from 200-UP-1 RD/RAWP in 2013 which used KX as basis. Assumes 1 rack per well
363	On Ground electric cable	148,057	\$8	ft	\$ 1,184,456	OTHER	NO	YES	NO	100%	Unit Cost based on project experience
364	Instrument Cable	383,308	\$5	ft	\$ 1,916,540	OTHER	NO	YES	NO	100%	Unit Cost based on project experience
365	Power Service Transformers	10.5	\$2,000,000	ea	\$ 21,000,000	OTHER	NO	YES	NO	100%	Transmission line installation charges from 10th & Beloit to plant site (assuming cost of \$155 per ft).
366	New Treatment Building	4.5	\$1,200,000	ea	\$ 5,400,000	OTHER	NO	YES	NO	100%	Building cost for 25 year system about 3.5 times cost of other systems.
367	750 GPM Cr Treatment Train	2	\$1,200,000	ea	\$ 2,400,000	OTHER	NO	YES	NO	100%	Unit Cost based on project experience
368	3,000 GPM Cr Treatment Train	1	\$4,500,000	ea	\$ 4,500,000	OTHER	NO	YES	NO	100%	Unit Cost based on project experience
371	200W Cr Only Modifications	1	\$6,200,000	ea	\$ 6,200,000	OTHER	NO	YES	NO	100%	Unit Cost based on project experience
<b>CAT/ATP/OTP: #950 - 999</b>											
951	CAT/ATP/OTP	2,186,253	\$1	ea	\$ 2,186,253		NO	YES	NO	100%	Cost based on 2 percent of capital cost construction.

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**Table C-1. Capital Unit Cost Summary**

<b>Location:</b>		200-UP-1									
<b>Phase:</b>		SE Chromium Plume									
<b>Base Year:</b>		2019									
<b>Date:</b>		1/1/2019									
<b>LABOR RATES: #1050 - 1549</b>											
	Item	Qty	Unit Cost	Units	Total	Source	Institutional Control?	Add OH and Profit?	Labor Only?	% of non-labor item to be taxed	Notes/References
1051	Environmental Engineers	760	\$124	hr	\$ 94,088		NO	YES	NO	100%	
1052	Administrative Assistants	410	\$75	hr	\$ 30,643		NO	YES	NO	100%	
1053	Managers & Executives	230	\$142	hr	\$ 32,575		NO	YES	NO	100%	
1054	Geologists/Geophysicists/Hydro	580	\$133	hr	\$ 76,873		NO	YES	NO	100%	
1055	Environmental Scientists	760	\$104	hr	\$ 78,744		NO	YES	NO	100%	
1056	Technical Writers & Editors	440	\$82	hr	\$ 35,908		NO	YES	NO	100%	
1057	MSA Labor for Permtting	6	\$5,000	ea	\$ 30,000		NO	YES	NO	100%	
1058	Modeling Subcontractor	5	\$90,000	ea	\$ 450,000		NO	YES	NO	100%	

**Table C-2. O&M Unit Cost Summary**

Location:		200-UP-1									
Phase:		SE Chromium Plume									
Base Year:		2019									
Date:		1/1/2019									
	Item	Qty	Unit Cost	Units	Total	Source	Institutional Control?	Add OH and Profit?	Labor Only?	% of non-labor item to be taxed	Notes/References
<b>GW MONITORING, EXTRACTION, INJECTION OR CONTAINMENT: #350 - 549</b>											
375	Monitoring Well Maintenance	126	\$1,700	EA	\$ 214,200	OTHER	NO	YES	NO	100%	Cost based on project experience
376	Groundwater Sampling and Analysis	3,022	\$1,000	EA	\$ 3,022,000	OTHER	NO	YES	NO	100%	Includes labor crew and laboratory analytical
377	Injection Well Installation	51	\$575,000	EA	\$ 29,325,000	OTHER	NO	YES	NO	100%	Assume well depth of 400 ft. Includes direct drilling cost and CHPRC field and oversight labor. Includes \$50,000 additional allowance for Extraction well pump installation and other activities.
378	Monitoring Well Installation	48	\$400,000	EA	\$ 19,200,000	OTHER	NO	YES	NO	100%	Assume well depth of 400 ft. Includes direct drilling cost and CHPRC field and oversight labor.
379	Extraction Well Installation	46	\$675,000	EA	\$ 31,050,000	OTHER	NO	YES	NO	100%	Assume 6 new wells needed for MNA monitoring, and well depth of 425 ft.
380	Well Sampling Crew	5,800	\$463	HR	\$ 2,686,359	OTHER	NO	YES	NO	100%	
381	Well Pads	145	\$15,000	EA	\$ 2,175,000	OTHER	NO	YES	NO	100%	Cost based on project experience
382	Access Roads	14.5	\$115,000	Mile	\$ 1,667,500	OTHER	NO	YES	NO	100%	Unit cost based on linear foot cost for gravel road for Well 199-K-224.
383	AWLN Monitoring System Maintenance	140	\$500	EA	\$ 70,000		NO	YES	NO	100%	
384	Well Decommissioning	305	\$7,500	EA	\$ 2,287,500	OTHER	NO	YES	NO	100%	Unit cost based on \$3,500 per 150 ft well from 100-BC cost estimate
385	P&T influent - 100 gpm	26,280,000	\$0.0055	\$/gal	\$ 144,388		NO	YES	NO	100%	Ave KX, DX & HX 2016 unit costs
386	P&T influent - 500 gpm site specific	551,880,000	\$0.0055	\$/gal	\$ 3,032,152		NO	YES	NO	100%	Ave KX, DX & HX 2016 unit costs
387	P&T influent 500 gpm 2WP&T	315,360,000	\$0.0231	\$/gal	\$ 7,271,944		NO	YES	NO	100%	200WP&T 2016 unit costs from annual P&T report
388	P&T influent 2700 gpm site specific	1,445,400,000	\$0.0039	\$/gal	\$ 5,571,907		NO	YES	NO	100%	DX 2016 unit costs
389	Extraction Well Maintenance	61	\$5,500	EA	\$ 335,500		NO	YES	NO	100%	Cost based on project experience
390	Injection Well Maintenance	57	\$3,300	EA	\$ 188,100		NO	YES	NO	100%	Cost based on project experience
391	P&T Facility Decommissioning	2	\$800,000	EA	\$ 1,600,000		NO	YES	NO	100%	Cost based on 2016 D&D cost for 100-NR-2 P&T facility
<b>INSTITUTIONAL CONTROLS: #850 - 899</b>											
853	OU institutional controls	2	\$23,000	EA	\$ 46,000		NO	YES	NO	100%	From ECF-HANFORD-12-0067 Rev. 1.
<b>SITE CLOSEOUT AND FINAL REPORTS: #950 - 999</b>											
952	Environmental Engineers	1,820	\$124	hr	\$ 225,316	OTHER	NO	NO	NO	100%	
953	Administrative Assistants	520	\$75	hr	\$ 38,865	OTHER	NO	YES	NO	100%	
954	Managers & Executives	520	\$142	hr	\$ 73,648	OTHER	NO	YES	NO	100%	
955	Geologists/Geophysicists/Hydro	1,040	\$133	hr	\$ 137,842	OTHER	NO	YES	NO	100%	
956	Environmental Scientists	4,160	\$104	hr	\$ 431,018	OTHER	NO	YES	NO	100%	
957	Technical Writers & Editors	520	\$82	hr	\$ 42,437	OTHER	NO	YES	NO	100%	

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