The Boeing Company
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March 8, 2019
DAT-2019-009

Mr. Dean Yasuda
Environmental Engineer
Department of Ecology, NW Region Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

Subject: Boeing Response to Ecology's Questions Regarding the Supplemental Feasibility Study Cost Estimates

Dear Mr. Yasuda:

Thank you for your February 12, 2019 letter pertaining to the cost estimates provided in Appendix C of the Supplemental Feasibility Study (FS) report dated November 29, 2018. The following provides responses to each of Ecology's comments and questions provided in Attachment A of the letter.

1. General Comments

- **Response to Comment 1.a.** Please see attached revised Cost Estimate Tables C-1a through C-1f, which include the requested sources of unit costs and cost data for each line item cost for point of compliance Options 1 through 5 (Attachment 1).

- **Response Comment 1.b.** Please see attached estimated project schedule for point of compliance Options 1 through 5 (Attachment 2).

2. Alternative 5. Remedial Design, Planning, and General (Indirect Costs)

- **Response Comment 2.a.** Engineering/Remedial Design costs were assumed to be 8% of the capital/construction costs of the project based on the US Environmental Protection Agency (EPA) Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8, and an estimated total construction cost between $2M and $10M.

- **Response Comment 2.b.** Construction Management costs were assumed to be 6% of the capital/construction costs of the project based on the EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8, and an estimated total construction cost between $2M and $10M.

- **Response Comment 2.c.** Project Management costs were assumed to be 5% of the total project costs based on the EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8, and an estimated total construction cost greater than $2M.

- **Response Comment 2.d.** Ecology oversight costs were assumed to be similar to the project management costs (5% of the total project costs).

3. **Alternative 5. Dynamic Groundwater Recirculation and Source Area EISB – Remedial Action Construction – Dynamic Groundwater Recirculation and Source Area Electron Donor Injections (Direct Costs)**

   - **Response Comment 3a.** The unit costs for Line Items 7 and 8 (unit cost for shallow and deep DGR injection well installation) were inadvertently switched in the original Appendix C cost estimate tables. This has been corrected in the revised cost estimate tables in Attachment 1 (highlighted cells indicate where changes were made from original[1]).

   - **Response Comment 3b-3f.** Line Items 14 through 18 have been revised to include sources and design assumptions for each unit cost estimate (see Attachment 1).

4. **Alternative 5 Options 1 – 5. Annual Operation, Maintenance, Monitoring, and Reporting.**

   - **Response Comment 4a.** Unit costs for "Groundwater sampling (during DGR)" for Options 2a and 2b include sampling all the same monitoring wells as the other options, but also include additional sampling points based on the unique nature of the conditional points of compliance included in these options. Specifically, Option 2a also includes sampling of the creek pore water samplers or drive point wells that would be installed in or adjacent to the creek under this option (see line item #7); and Option 2b includes sampling the additional monitoring wells that would be installed upgradient of the creek under this option (see Remedial Action Construction line item #10).

   - **Response Comment 4b.** Requested details are provided in the revised cost estimate tables in Attachment 1.

5. **Alternative 5. Non-Routine Operation, Maintenance, Monitoring, and Reporting.**

   - **Response Comment 5a.** The non-routine equipment replacement costs assume an approximate lifespan of 15 to 20 years for major system equipment and components (e.g., blower, discharge pump, well pumps, GAC vessels, PLC and other electrical equipment). The $200,000 "unit cost" for this line item represents the potential cost to replace one or more of these pieces of equipment if they fail during this approximate lifespan estimate (i.e. it is not based on a specific planned replacement schedule for any given piece of equipment). Therefore, the number of replacement "events" is estimated based on the total estimated project lifecycle under each Option (i.e. 1 event for Options 1, 2a, 2b, 3 [approximate 15- to 24-year project lifecycles]; 2 events for Option 4 [approximate 34-year project lifecycle]; 2.5 events for Option 5 [approximate 44-year project life cycle), and also takes into consideration that some of the GET system equipment will have already been in operation for approximately 6 to 10 years prior to DGR system implementation).

   - **Response Comment 5b.** Presumed discount rate of 0.6% is per the Office of Management and Budget, Circular A-94 Appendix C, Revised February 2018 (real interest rates/discount rates for 30-year notes) consistent with Section 4.3 of the EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000).

   - **Response Comment 5c.** Requested details are provided in the revised cost estimate tables in Attachment 1.

[1] Note that other minor corrections/changes in the spreadsheets made from original are also identified by highlighting.

- **Response Comment 5d.** As explained in Section 4.3.3 of the SFS, Options 4 and 5 cost estimates assume that the downgradient cleanup of groundwater on the Boeing property to the Surface Water Quality Standards (SWQS) will directly depend on completion of source area cleanup. Therefore, in order to minimize migration of TCE that may still be originating from the source area at concentrations over the SWQS, portions of the DGR system (e.g., GET system extraction wells) may need to continue to be operated until, and potentially several years after, the source area cleanup is completed (even after DGR has functionally cleaned up the downgradient portion of the plume) to achieve cleanup at the points of compliance for Options 4 and 5. Whereas, Options 1, 2a, 2b, and 3 would not be dependent upon achieving the SWQS in or immediately downgradient of the source area to achieve compliance at their respective (substantially farther downgradient) points of compliance and, therefore, it would not be necessary to continue operation of the GET system extraction wells for these Options after achieving the cleanup levels.

We hope that this letter and associated attachments provides Ecology with sufficient information to complete its review of the cost estimates.

Please contact me if you have any questions.

Sincerely,

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Dr. Tong Li, Groundwater Solutions

ATTACHMENTS

Attachment A – Revised Cost Estimate Tables C-1a through C-1f
Attachment B – Estimated Project Schedule for Point of Compliance Options 1 through 5

REFERENCES

Ecology Questions Regarding the Supplemental Feasibility Study Report – Cost Estimate Tables. Letter from Dean Yasuda (Ecology) to Debbie Taege (Boeing), dated February 12, 2019.

Agency Review Draft, Supplemental Feasibility Study Report, BCA Everett Plant – Powder Mill Gulch, Everett, Washington, dated November 19, 2018.

ATTACHMENT A

Revised Cost Estimate Tables C-1a through C-1f

Table C-1a
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

ALTERNATIVE 5 **DYNAMIC GROUNDWATER RECIRUCLATION AND SOURCE AREA EISB**

POINT OF COMPLIANCE OPTION: **OPTION 1 - GROUNDWATER AND SURFACE WATER STANDARD POCS**

Explanation of POC Option: Drinking water standard (4 µg/L TCE) to be met in monitoring wells throughout the groundwater TCE plume and the SWQS (0.3 µg/L TCE) to be met in creek water sampling points immediately above the creek bed.

POC Option Specific Assumptions
1 Existing monitoring well network sufficient for monitoring groundwater POC
2 Existing surface water sampling locations will be used for monitoring surface water POC
3 DGR system will be operated for 15 years for downgradient plume cleanup
4 EISB in source area will require 23 years for source area cleanup (including 3 injection events over 3-year period)

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	Category	Item #	Description	Quantity	Unit	Unit Cost	Total	Source/Basis of Unit Costs and Cost Data	Assumptions, Comments, and/or Notes
			REMEDIAL DESIGN, PLANNING, AND GENERAL (Indirect Costs)						
		1	**Engineering/Proj Mgmt/Const Mgmt/Reporting**						
		2	Cleanup action plan	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		3	Permits	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	UIC permit, major modification to NPDES permit, access agreements, construction permits
		4	Negotiate and implement institutional controls	0	LS	$ 10,000	$ -		
		5	Contract documents and contractor bidding/procurement	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	
		6	Cleanup action construction report/O&M manual	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		7	Engineering/Remedial Design	8%	pct	$ 4,105,000	$ 328,400	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~8% of capital costs
		8	Construction management/oversight	6%	pct	$ 4,105,000	$ 246,300	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~6% of capital costs
		9	Project management	5%	pct	$ 12,595,700	$ 629,785	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~5% of project costs
		10	Ecology oversight	5%	pct	$ 12,595,700	$ 629,785	Assume similar to project management value	Assume ~5% of project costs
	Subtotal Remedial Design, Planning, and General Costs						*$ 1,944,300*		
	Indirect Contingency and Unlisted Engineering Services (%)			**15%**	pct	$1,944,300	$ 291,600		
	TOTAL INDIRECT COST						**$2,236,000**		
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
			REMEDIAL ACTION CONSTRUCTION - DGR SYSTEM AND ELECTRON DONOR INJECTIONS (Direct Costs)						
		1	Contractor mobilization/demobilization	1	LS	$ 30,000	$ 30,000	Glacier Environmental - approx. cost based on prior similar work	
		2	DGR pilot study	1	LS	$ 80,000	$ 80,000	Assumed level of effort for 1 year pilot study (construction costs included below)	Assume 1 full time field tech, 10 hour days, plus travel/field equip ($1,500/day), four days per month for 1 year, includes monitoring, system reconfigurations, sampling, plus lab costs and data evaluation and reporting
			Install injection and extraction wells/distribution system						
		3	Utility locate	1	LS	$ 2,500	$ 2,500	Local utility locator rates = $85 - $100/hr	Assume 3 days total for utility locates for drilling, trenching
		4	Site prep/clearing/grubbing	1	LS	$ 75,000	$ 75,000	Assumed level of effort based on prior experience; prep roads/trails to well	Prep roads/trails to well drilling and other construction locations
		5	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		6	Drilling - DGR extraction well installation	4	well	$ 20,000	$ 80,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 extraction wells, 6" stainless steel, to average 50 ft. (15 ft screens), includes start card, drilling, well construction materials
		7	Drilling - DGR injection well installation (shallow)	4	well	$ 15,000	$ 60,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 injection wells, 4" carbon steel, to average 55 ft. (30 ft screens), includes start card, drilling, well construction materials
		8	Drilling - DGR injection well installation (deep)	8	well	$ 26,000	$ 208,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	8 injection wells ,4" carbon steel, to avg 140 ft. (30 ft screens), includes start card, drilling, well construction materials
		9	Drilling - monitoring wells for DGR monitoring	4	well	$ 12,000	$ 48,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 monitoring wells, 2" pvc to average 55 ft (5 ft screens), includes start card, drilling, well construction materials
		10	IDW disposal	60	Drums	$ 200	$ 12,000	Stericycle - approx. cost based on prior similar disposal costs	Average per drum disposal cost plus labor
		11	Well vaults, pumps, air vac assemblies	1	LS	$ 210,000	$ 210,000	Glacier Environmental - approx. cost based on prior similar installations	4 submersible pumps w/controls, 16 well vaults, 12 air-vac assemblies
		12	Transfer tank, valving, and pump with controls	1	LS	$ 18,000	$ 18,000	Grainger (tank), Tsurumi (pump)	500-gallon double-walled poly tank; Tsurumi high volume/high head sump pump
		13	Directional drilling for pipe/conduit up to ridge	1	LS	$ 100,000	$ 100,000	Directed Technologies Drilling quote	Approx. 660 LF, elevation change of approx. 150 ft
		14	Water line, electrical, communications trenching	4200	LF	$ 16	$ 67,200	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Trenching, bedding, backfill, assumed trench length of 4200 ft
		15	Water piping	4200	LF	$ 60	$ 252,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	HDR 11, includes connection to existing conveyance system
		16	Electrical conduit and cable	2400	LF	$ 45	$ 108,000	Glacier Environmental - approx. cost based on prior similar installations	Electrical from power drops and connections to existing power near injection wells, and from existing panels to new extraction wells
		17	Communications conduit and cable	4200	LF	$ 65	$ 273,000	Systems Interface - estimate	Communications from control panel to injection wells and new extraction wells
		18	Trench repaving/restoration	20000	SF	$ 5	$ 100,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Assume approx. 4 ft width x 4200 LF, plus additional 3,000 SF around other subsurface infrastructure; 18 inch paving and base cours sections
		19	Electrical equipment upgrades/transformer/electrician	1	LS	$ 70,000	$ 70,000	Estimate based on original SnoPUD transformer installation	Install 1 new/replacement transformer
		20	Instrumentation and controls; control panels	1	LS	$ 150,000	$ 150,000	Automation & Control/System's Interface - estimates	Level meters, flow meters, pressure meters, controls instrumentation, drive(s), installation, programming and startup for new injection and extraction wells.
		21	GAC polishing vessels	2	each	$ 12,500	$ 25,000	Pacific Coast Carbon - estimate	2 x 2,000 lb liquid phase GAC vessels plus concrete pad and plumbing
		22	DGR system startup and testing	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	
			EISB injection well installation						
		23	Utility locate/clearing	1	LS	$ 1,000	$ 1,000	Local utility locator rates = $85 - $100/hr	
		24	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		25	Drilling - injection wells (detention basin hotspot)	24	wells	$ 4,000	$ 96,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	8 injection wells, 2" steel casing to 70 ft., 8 injection wells to 50 ft., 8 wells to 30 ft. (20 ft screens) Includes start card, drilling, well construction materials
		26	Wellhead preparation	24	wells	$ 1,000	$ 24,000	Assumed level of effort based on prior experience	Monuments/vaults, valves, fittings for injection well wellheads

IMPLEMENTATION

Table C-1a
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
IMPLEMENTATION		27	IDW disposal	70	Drums	$ 200	$ 14,000	Stericycle - average per drum disposal cost plus labor	
			Injection of Electron Donor						Assume 3 injection events
		28	Injection crew/labor	75	days	$ 3,000	$ 225,000	Assumed level of effort based on prior experience	Assume 2 to 3 FTE for 5 weeks (10 hrs/day) per injection event
		29	Purchase equipment/supplies for injection system setup	1	LS	$ 25,000	$ 25,000	Assumed level of effort based on prior experience	Pumps, mixing tanks, hoses, fittings, trailer
		30	Materials and rentals for injection events	3	event	$ 20,000	$ 60,000	Assumed level of effort based on prior experience	Water tank rental, other rental equipment and materials
		31	Water for injection events	285000	gal	$ 0.03	$ 8,550	Assumed level of effort based on prior experience	Assume 95K gal per event at $0.03/gal
		32	Donor for injection events	36000	lbs	$ 2	$ 54,000	Assumed level of effort based on prior experience	Assume 12K lbs per event at $1.50/lb
		33	Site Restoration - slope/buffer plantings, general cleanup	1	LS	$ 25,000	$ 25,000	Glacier Environmental - approx. cost based on prior similar work	
	Subtotal Remedial Action Construction Costs						*$ 2,527,300*		
	Direct Cost Contingency and Unlisted Engineering Services (%)			**25%**	pct	$2,527,300	$ 631,800	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid contingency (10% - low end) and scope contingency (15% low end groundwater treatmnet and soil excavation)
	Contractor Bond Fee, Overhead, and Profit (%)			**20%**	pct	$2,693,375	$ 538,700	Standard	Applied to contractor and driller costs only (not injection related costs)
	Washington State Sales Tax (%)			**9.2%**	pct	$ 3,232,075	$297,400	City of Everett/State sales tax rate	Applied to contractor and driller costs
	TOTAL DIRECT COST						**$3,995,000**		
OM&M	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	ANNUAL OPERATION, MAINTENANCE, MONITORING, AND REPORTING								
		1	Electrical usage	1	yr	$ 44,500	$ 44,500	SnoPUD commercial electrical rate	Approx. 98 hp of equip. (1743 kw*hr/day x $0.07/kw-hr x 365 days/yr)
		2	Cell phone/GET system remote access charges	12	mo	$ 369	$ 4,428	Frontier commercial rate	$369/month x 12 mo. service for autodialer, alarms, etc
		3	Carbon usage	1	yr	$ 9,600	$ 9,600	Evoqua - estimate; assumed usage rate based on prior consumption	assume 1 changeout (3,000 lbs GAC) every other year at $9600 per changeout, incl GAC profiling, plus disposal as haz waste
		4	System monitoring/NPDES reporting	1	yr	$ 20,000	$ 20,000		Includes monthly air and water influent/effluent sampling and NPDES DMR
		5	DGR system O&M labor and cost	1	yr	$ 95,000	$ 95,000	Assumed level of effort based on prior experience	Assume 1 FTE, 10 hour days, plus travel/field equip ($1,500/day), four days per month, includes general maintenance and monitoring, response to upset, minor equipment repair and replacement, annual bridge crane inspections,
		6	NPDES annual renewal fee	1	yr	$ 20,137	$ 20,137	Per WAC 173-224-040 fees - 2019 schedule	Per WAC 173-224-040 fee 2019 schedule (Non-LUST Hazardous Waste Cleanup Site; >2 contaminants)
		7	Groundwater sampling (during DGR)	1	yr	$ 65,000	$ 65,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (155 wells)
		8	Groundwater elevation monitoring (during DGR)	1	yr	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual water levels (155 wells)
		9	Surface water sampling (during DGR)	1	yr	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (17 surface water sampling points)
		10	Reporting	1	yr	$ 15,000	$ 15,000	Assumed level of effort based on prior experience	
	Subtotal Annual OM&M and Reporting Cost						$ 289,700		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$289,700	$ 57,900	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 &	Assumed bid and scope contingency (10% each)
			Years of Annual Monitoring	***15***	yrs	$347,600	$ 5,214,000		Total estimated operation timeframe to remediation level (based on restoration timeframe modeling and calculations)
	TOTAL ANNUAL OM&M AND REPORTING COST						***$5,214,000***		
	Present-Worth Annual OM&M and Reporting Cost		Presumed Discount Rate	***0.6%***	pct		**$4,972,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	NON-ROUTINE OPERATION, MAINTENANCE, MONITORING, AND REPORTING								
		1	Baseline groundwater/surface water sampling	1	event	$ 73,000	$ 73,000	Assumed level of effort based on prior experience	1 complete sampling event prior to remedy implementation for VOCs (155 wells, 17 sw points)
		2	DGR system replacement cost	1	event	$ 200,000	$ 200,000	Assumed major equipment replacement after typical lifespan.	Replace failed major equipment (blower, well pumps, labor) after 15 to 20 years of operation
		3	Quarterly groundwater sampling (EISB parameters)	3	yr	$ 95,000	$ 285,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		4	Quarterly groundwater sampling	12	event	$ 65,000	$ 780,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs after each injection event (155 wells)
		5	Quarterly groundwater elevation monitoring	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly groundwater level measurements (155 wells)
		6	Quarterly surface water sampling	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs (17 surface water sampling points)
		7	Annual groundwater sampling (EISB parameters post DGR	8	yrs	$ 65,000	$ 520,000	Assumed level of effort based on prior experience	8 yrs annual sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		8	Annual groundwater elevation monitoring (post DGR)	8	yrs	$ 8,000	$ 64,000	Assumed level of effort based on prior experience	8 yrs annual groundwater level measurements (155 wells)
		9	Annual surface water sampling (post DGR)	8	yrs	$ 8,000	$ 64,000	Assumed level of effort based on prior experience	8 yrs annual sampling for VOCs (17 surface water sampling points)
		10	1.5 years quarterly confirmation sampling	6	event	$ 73,000	$ 438,000	Assumed level of effort based on prior experience	6 qtrs sampling for VOCs (155 wells; 17 sw points)
		11	Cleanup completion report	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	Final remediation completion report (year 25)
	Subtotal Non-Routine OM&M and Reporting Cost						$ 2,636,000		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$2,636,000	$ 527,200	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 &	Assumed bid and scope contingency (10% each)
	TOTAL NON-ROUTINE OM&M AND REPORTING COST						***$3,163,000***		
	Present-Worth Non-Routine OM&M and Reporting Cost		Presumed Discount Rate	***0.6%***	pct		**$2,944,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note)
TOTAL	**ALTERNATIVE COST SUMMARY**								
	TOTAL PRESENT-WORTH REMEDIAL DESIGN, PLANNING, AND GENERAL COST (INDIRECT)						**$2,236,000**		
	TOTAL PRESENT-WORTH REMEDIATION IMPLEMENTATION COST (DIRECT)						**$3,995,000**		
	TOTAL PRESENT-WORTH OM&M COST (ANNUAL & NON-ROUTINE)						**$7,916,000**		
	TOTAL PRESENT-WORTH COST						**$14,150,000**		
	Appropriate Cost Range (-30% - +50%)				**TOTAL**	**$ 9,910,000**	**$ 21,230,000**	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 2-3	Accuracy range at Detailed Analysis of Alternatives/Conceptual Design

Table C-1b
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

ALTERNATIVE 5 **DYNAMIC GROUNDWATER RECIRUCLATION AND SOURCE AREA EISB**

POINT OF COMPLIANCE OPTION: **OPTION 2A - GROUNDWATER CPOC IN TRANSITION ZONE BENEATH THE CREEK**

Explanation of POC Option: SWQS (0.3 µg/L TCE) to be met in transition zone water sampling points below the creek bed or immediately adjacent to the creek (off property) and "within the surface water as close as technically possible to the point or points where groundwater flows into the surface water" (on Boeing property).
Drinking water standard (4 µg/L TCE) to be met in monitoring wells throughout the groundwater TCE plume.

POC Option Specific Assumptions

1. Pore water samplers or drive point wells will be installed at approximately 100-ft intervals in or adjacent to creek for groundwater CPOC (assume 23 locations). Existing monitoring well network sufficient for monitoring groundwater throughout plume.
2. Existing surface water sampling locations will be used for monitoring surface water POC
3. Pore water samplers or drive point wells must be replaced every 3 years due to damage from storms/creek meander
4. DGR system will be operated for 16 years for downgradient plume cleanup
5. EISB in source area will require 23 years for source area cleanup (including 3 injection events over 3-year period)

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	Category	Item #	Description	Quantity	Unit	Unit Cost	Total	Source/Basis of Unit Costs and Cost Data	Assumptions, Comments, and/or Notes
	REMEDIAL DESIGN, PLANNING, AND GENERAL (Indirect Costs)								
		1	**Engineering/Proj Mgmt/Const Mgmt/Reporting**						
		2	Cleanup action plan	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		3	Permits	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	UIC permit, major modification to NPDES permit, access agreements, construction permits
		4	Negotiate and implement institutional controls	0	LS	$ 10,000	$ -		
		5	Contract documents and contractor bidding/procurement	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	
		6	Cleanup action construction report/O&M manual	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		7	Engineering/Remedial Design	8%	pct	$ 4,105,000	$ 328,400	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~8% of capital costs
		8	Construction management/oversight	6%	pct	$ 4,105,000	$ 246,300	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~6% of capital costs
		9	Project management	5%	pct	$ 13,088,700	$ 654,435	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~5% of project costs
		10	Ecology oversight	5%	pct	$ 13,088,700	$ 654,435	Assume similar to project management value	Assume ~5% of project costs
	Subtotal Remedial Design, Planning, and General Costs						*$ 1,993,600*		
	Indirect Contingency and Unlisted Engineering Services (%)			**15%**	pct	$1,993,600	$ 299,000		
	TOTAL INDIRECT COST						**$2,293,000**		
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	REMEDIAL ACTION CONSTRUCTION - DGR SYSTEM AND ELECTRON DONOR INJECTIONS (Direct Costs)								
		1	Contractor mobilization/demobilization	1	LS	$ 30,000	$ 30,000	Glacier Environmental - approx. cost based on prior similar work	
		2	DGR pilot study	1	LS	$ 80,000	$ 80,000	Assumed level of effort for 1 year pilot study (construction costs included below)	Assume 1 full time field tech, 10 hour days, plus travel/field equip ($1,500/day), four days per month for 1 year, includes monitoring, system reconfigurations, sampling, plus lab costs and data evaluation and reporting
			Install injection and extraction wells/distribution system						
		3	Utility locate	1	LS	$ 2,500	$ 2,500	Local utility locator rates = $85 - $100/hr	Assume 3 days total for utility locates for drilling, trenching
		4	Site prep/clearing/grubbing	1	LS	$ 75,000	$ 75,000	Assumed level of effort based on prior experience; prep roads/trails to well	Prep roads/trails to well drilling and other construction locations
		5	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		6	Drilling - DGR extraction well installation	4	well	$ 20,000	$ 80,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 extraction wells, 6" stainless steel, to average 50 ft. (15 ft screens), includes start card, drilling, well construction materials
		7	Drilling - DGR injection well installation (shallow)	4	well	$ 15,000	$ 60,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 injection wells, 4" carbon steel, to average 55 ft. (30 ft screens), includes start card, drilling, well construction materials
		8	Drilling - DGR injection well installation (deep)	8	well	$ 26,000	$ 208,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	8 injection wells ,4" carbon steel, to avg 140 ft. (30 ft screens), includes start card, drilling, well construction materials
		9	Drilling - monitoring wells for DGR monitoring	4	well	$ 12,000	$ 48,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 monitoring wells, 2" pvc to average 55 ft (5 ft screens), includes start card, drilling, well construction materials
		10	IDW disposal	60	Drums	$ 200	$ 12,000	Stericycle - approx. cost based on prior similar disposal costs	Average per drum disposal cost plus labor
		11	Well vaults, pumps, air vac assemblies	1	LS	$ 210,000	$ 210,000	Glacier Environmental - approx. cost based on prior similar installations	4 submersible pumps w/controls, 16 well vaults, 12 air-vac assemblies
		12	Transfer tank, valving, and pump with controls	1	LS	$ 18,000	$ 18,000	Grainger (tank), Tsurumi (pump)	500-gallon double-walled poly tank; Tsurumi high volume/high head sump
		13	Directional drilling for pipe/conduit up to ridge	1	LS	$ 100,000	$ 100,000	Directed Technologies Drilling quote	Approx. 660 LF, elevation change of approx. 150 ft
		14	Water line, electrical, communications trenching	4200	LF	$ 16	$ 67,200	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Trenching, bedding, backfill, assumed trench length of 4200 ft
		15	Water piping	4200	LF	$ 60	$ 252,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	HDR 11, includes connection to existing conveyance system
		16	Electrical conduit and cable	2400	LF	$ 45	$ 108,000	Glacier Environmental - approx. cost based on prior similar installations	Electrical from power drops and connections to existing power near injection
		17	Communications conduit and cable	4200	LF	$ 65	$ 273,000	Systems Interface - estimate	Communications from control panel to injection wells and new extraction wells
		18	Trench repaving/restoration	20000	SF	$ 5	$ 100,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Assume approx. 4 ft width x 4200 LF, plus additional 3,000 SF around other subsurface infrastructure; 18 inch paving and base cours sections
		19	Electrical equipment upgrades/transformer/electrician	1	LS	$ 70,000	$ 70,000	Estimate based on original SnoPUD transformer installation	Install 1 new/replacement transformer
		20	Instrumentation and controls; control panels	1	LS	$ 150,000	$ 150,000	Automation & Control/System's Interface - estimates	Level meters, flow meters, pressure meters, controls instrumentation, drive(s), installation, programming and startup for new injection and extraction wells.
		21	GAC polishing vessels	2	each	$ 12,500	$ 25,000	Pacific Coast Carbon - estimate	2 x 2,000 lb liquid phase GAC vessels plus concrete pad and plumbing
		22	DGR system startup and testing	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	
			EISB Injection Well Installation						
		23	Utility locate/clearing	1	LS	$ 1,000	$ 1,000	Local utility locator rates = $85 - $100/hr	
		24	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		25	Drilling - injection wells (detention basin hotspot)	24	wells	$ 4,000	$ 96,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	8 injection wells, 2" steel casing to 70 ft., 8 injection wells to 50 ft., 8 wells to 30 ft. (20 ft screens), includes start card, drilling, well construction materials

IMPLEMENTATION

Table C-1b
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
IMPLEMENTATION		26	Wellhead preparation	24	wells	$ 1,000	$ 24,000	Assumed level of effort based on prior experience	Monuments/vaults, valves, fittings for injection well wellheads
		27	IDW disposal	70	Drums	$ 200	$ 14,000	Stericycle - average per drum disposal cost plus labor	
			Injection of Electron Donor						Assume 3 injection events
		28	Injection crew/labor	75	days	$ 3,000	$ 225,000	Assumed level of effort based on prior experience	Assume 2 to 3 FTE for 5 weeks (10 hrs/day) per injection event
		29	Purchase equipment/supplies for injection system setup	1	LS	$ 25,000	$ 25,000	Assumed level of effort based on prior experience	Pumps, mixing tanks, hoses, fittings, trailer
		30	Materials and rentals for injection events	3	event	$ 20,000	$ 60,000	Assumed level of effort based on prior experience	Water tank rental, other rental equipment and materials
		31	Water for injection events	285,000	gal	$ 0.03	$ 8,550	Assumed level of effort based on prior experience	Assume 95K gal per event at $0.03/gal
		32	Donor for injection events	36000	lbs	$ 2	$ 54,000	Assumed level of effort based on prior experience	Assume 12K lbs per event at $1.50/lb
		33	Site Restoration - slope/buffer plantings, general cleanup	1	LS	$ 25,000	$ 25,000	Glacier Environmental - approx. cost based on prior similar work	
	Subtotal Remedial Action Construction Costs						*$ 2,527,300*		
	Direct Cost Contingency and Unlisted Engineering Services (%)			**25%**	pct	$2,527,300	$ 631,800	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid contingency (10% - low end) and scope contingency (15% low end groundwater treatmnet and soil excavation)
	Contractor Bond Fee, Overhead, and Profit (%)			**20%**	pct	$2,693,375	$ 538,700	Standard	Applied to contractor and driller costs only (not injection related costs)
	Washington State Sales Tax (%)			**9.2%**	pct	$ 3,232,075	$297,400	City of Everett/State sales tax rate	Applied to contractor and driller costs
	TOTAL DIRECT COST						**$3,995,000**		
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	ANNUAL OPERATION, MAINTENANCE, MONITORING, AND REPORTING								
		1	Electrical usage	1	yr	$ 44,500	$ 44,500	SnoPUD commercial electrical rate	Approx. 98 hp of equip. (1743 kw*hr/day x $0.07/kw-hr x 365 days/yr)
		2	Cell phone/GET system remote access charges	12	mo	$ 369	$ 4,428	Frontier commercial rate	$369/month x 12 mo. service for autodialer, alarms, etc
		3	Carbon usage	1	yr	$ 9,600	$ 9,600	Evoqua - estimate; assumed usage rate based on prior consumption	Assume 1 changeout (3,000 lbs GAC) every other year at $9600 per changeout, incl GAC profiling, plus disposal as haz waste
		4	System monitoring/NPDES reporting	1	yr	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	Includes monthly air and water influent/effluent sampling and NPDES DMR
		5	DGR system O&M labor and cost	1	yr	$ 95,000	$ 95,000	Assumed level of effort based on prior experience	Assume 1 FTE, 10 hour days, plus travel/field equip ($1,500/day), four days per month, includes general maintenance and monitoring, response to upset, minor equipment repair and replacement, annual bridge crane inspections, plus
		6	NPDES annual renewal fee	1	yr	$ 20,137	$ 20,137	Per WAC 173-224-040 fees - 2019 schedule	Per WAC 173-224-040 fee 2019 schedule (Non-LUST Hazardous Waste Cleanup Site; >2 contaminants)
		7	Install pore water samplers or drive point wells	23	unit	$ 250	$ 5,750	Approximate drive point well cost base on online vendors and assumed level of effort for installation.	Assume $100/pore water sampler or drive point well approx every 100 ft of creek within plume limits and 1 hour labor for installation
		8	Groundwater sampling (during DGR)	1	yr	$ 70,000	$ 70,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (155 wells + 23 pore water samples)
		9	Groundwater elevation monitoring (during DGR)	1	yr	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual water levels (155 wells)
		10	Surface water sampling (during DGR)	1	yr	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (17 surface water sampling points)
		11	Reporting	1	yr	$ 15,000	$ 15,000	Assumed level of effort based on prior experience	
	Subtotal Annual OM&M and Reporting Cost						$ 300,400		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$300,400	$ 60,100	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-	Assumed bid and scope contingency (10% each)
	Years of Annual Monitoring			***16***	yrs	$360,500	$ 5,768,000		Total estimated operation timeframe to remediation level (based on restoration timeframe modeling and calculations)
	TOTAL ANNUAL OM&M AND REPORTING COST						***$5,768,000***		
	Present-Worth Annual OM&M and Reporting Cost Presumed Discount Rate			***0.6%***	pct		**$5,484,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note
OM&M	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	NON-ROUTINE OPERATION, MAINTENANCE, MONITORING, AND REPORTING								
		1	Baseline groundwater/surface water sampling	1	event	$ 75,000	$ 75,000	Assumed level of effort based on prior experience	1 complete sampling event prior to remedy implementation for VOCs (155 wells, 17 sw points)
		2	DGR system replacement cost	1	event	$ 200,000	$ 200,000	Assumed major equipment replacement after typical lifespan.	Replace failed major equipment (blower, well pumps, labor) after 15 to 20 years of operation
		3	Replace pore water samplers or drive point wells	5	event	$ 5,750	$ 28,750	Approximate drive point well cost base on online vendors and assumed level of effort for installation.	Assume drive points/pore water samplers or drive point wells must all be replaced every 3 years due to damage from storms, creek meander, etc.
		4	Quarterly groundwater sampling (EISB parameters)	3	yr	$ 95,000	$ 285,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		5	Quarterly groundwater sampling	12	event	$ 70,000	$ 840,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs after each injection event (155 wells + 23 pore water samplers or drive point wells)
		6	Quarterly groundwater elevation monitoring	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly groundwater level measurements (155 wells)
		7	Quarterly surface water sampling	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs (17 surface water sampling points)
		8	Annual groundwater sampling (EISB parameters post DGR	7	yrs	$ 65,000	$ 455,000	Assumed level of effort based on prior experience	7 yrs annual sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		9	Annual groundwater elevation monitoring (post DGR)	7	yrs	$ 8,000	$ 56,000	Assumed level of effort based on prior experience	7 yrs annual groundwater level measurements (155 wells)
		10	Annual surface water sampling (post DGR)	7	yrs	$ 8,000	$ 56,000	Assumed level of effort based on prior experience	7 yrs annual sampling for VOCs (17 surface water sampling points)
		11	1.5 years quarterly confirmation sampling	6	event	$ 75,000	$ 450,000	Assumed level of effort based on prior experience	6 qtrs sampling for VOCs (155 wells; 17 sw points)
		12	Cleanup completion report	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	Final remediation completion report (year 25)
	Subtotal Non-Routine OM&M and Reporting Cost						$ 2,657,800		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$2,657,800	$ 531,600	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-	Assumed bid and scope contingency (10% each)
	TOTAL NON-ROUTINE OM&M AND REPORTING COST						***$3,189,000***		
	Present-Worth Non-Routine OM&M and Reporting Cost Presumed Discount Rate			***0.6%***	pct		**$2,925,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note)
TOTAL	**ALTERNATIVE COST SUMMARY**								
	TOTAL PRESENT-WORTH REMEDIAL DESIGN, PLANNING, AND GENERAL COST (INDIRECT)						**$2,293,000**		
	TOTAL PRESENT-WORTH REMEDIATION IMPLEMENTATION COST (DIRECT)						**$3,995,000**		
	TOTAL PRESENT-WORTH OM&M COST (ANNUAL & NON-ROUTINE)						**$8,409,000**		
	TOTAL PRESENT-WORTH COST						**$14,700,000**		
	Appropriate Cost Range (-30% - +50%)			**TOTAL**		**$ 10,290,000**	**$ 22,050,000**	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 2-3	Accuracy range at Detailed Analysis of Alternatives/Conceptual Design

Table C-1c
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

ALTERNATIVE 5 **DYNAMIC GROUNDWATER RECIRUCLATION AND SOURCE AREA EISB**

POINT OF COMPLIANCE OPTION: OPTION 2B - GROUNDWATER CPOC IN MONITORING WELLS UPGRADIENT OF CREEK

Explanation of POC Option: SWQS (0.3 µg/L TCE) to be met in monitoring wells in "buffer zone" upgradient of the creek. Drinking water standard (4 µg/L TCE) to be met in monitoring wells throughout the groundwater TCE plume.

POC Option Specific Assumptions

1 Existing monitoring wells adjacent to creek, plus additional 7 wells requested by Ecology, sufficient for monitoring groundwater CPOC; existing monitoring well network sufficient for monitoring groundwater throughout plume.
2 Existing surface water sampling locations will be used for monitoring surface water POC
3 DGR system will be operated for 20 years for downgradient plume cleanup
4 EISB in source area will require 23 years for source area cleanup (including 3 injection events over 3-year period)
5 Major equipment replacement for DGR system will be required during 20-year operational time frame

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	REMEDIAL DESIGN, PLANNING, AND GENERAL (Indirect Costs)								
		1	**Engineering/Proj Mgmt/Const Mgmt/Reporting**						
		2	Cleanup action plan	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		3	Permits	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	UIC permit, major modification to NPDES permit, access agreements, construction permits
		4	Negotiate and implement institutional controls	0	LS	$ 10,000	$ -		
		5	Contract documents and contractor bidding/procurement	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	
		6	Cleanup action construction report/O&M manual	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		7	Engineering/Remedial Design	8%	pct	$ 4,220,000	$ 337,600	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~8% of capital costs
		8	Construction management/oversight	6%	pct	$ 4,220,000	$ 253,200	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~6% of capital costs
		9	Project management	5%	pct	$ 13,952,800	$ 697,640	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~5% of project costs
		10	Ecology oversight	5%	pct	$ 13,952,800	$ 697,640	Assume similar to project management value	Assume ~5% of project costs
	Subtotal Remedial Design, Planning, and General Costs						*$ 2,096,100*		
	Indirect Contingency and Unlisted Engineering Services (%)			**15%**	pct	$2,096,100	$ 314,400		
	TOTAL INDIRECT COST						**$2,411,000**		
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	REMEDIAL ACTION CONSTRUCTION - DGR SYSTEM AND ELECTRON DONOR INJECTIONS (Direct Costs)								
		1	Contractor mobilization/demobilization	1	LS	$ 30,000	$ 30,000	Glacier Environmental - approx. cost based on prior similar work	
		2	DGR pilot study	1	LS	$ 80,000	$ 80,000	Assumed level of effort for 1 year pilot study (construction costs included below)	Assume 1 full time field tech, 10 hour days, plus travel/field equip ($1,500/day), four days per month for 1 year, includes monitoring, system reconfigurations, sampling, plus lab costs and data evaluation and reporting
			Install injection and extraction wells/distribution system						
		3	Utility locate	1	LS	$ 2,500	$ 2,500	Local utility locator rates = $85 - $100/hr	Assume 3 days total for utility locates for drilling, trenching
		4	Site prep/clearing/grubbing	1	LS	$ 75,000	$ 75,000	Assumed level of effort based on prior experience; prep roads/trails to well	Prep roads/trails to well drilling and other construction locations
		5	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		6	Drilling - DGR extraction well installation	4	well	$ 20,000	$ 80,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 extraction wells, 6" stainless steel, to average 50 ft. (15 ft screens), includes start card, drilling, well construction materials
		7	Drilling - DGR injection well installation (shallow)	4	well	$ 15,000	$ 60,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 injection wells, 4" carbon steel, to average 55 ft. (30 ft screens), includes start card, drilling, well construction materials
		8	Drilling - DGR injection well installation (deep)	8	well	$ 26,000	$ 208,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	8 injection wells ,4" carbon steel, to avg 140 ft. (30 ft screens), includes start card, drilling, well construction materials
		9	Drilling - Monitoring wells for DGR monitoring	4	well	$ 12,000	$ 48,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 monitoring wells, 2" pvc to average 55 ft (5 ft screens), includes start card, drilling, well construction materials
		10	Drilling - Monitoring wells for CPOC monitoring	7	well	$ 10,000	$ 70,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	7 monitoring wells, 2" pvc to average 20 ft (5 ft screens), includes start card, drilling, well construction materials; and pre-drilling profiling
		11	IDW disposal	60	Drums	$ 200	$ 12,000	Stericycle - approx. cost based on prior similar disposal costs	Average per drum disposal cost plus labor
		12	Well vaults, pumps, air vac assemblies	1	LS	$ 210,000	$ 210,000	Glacier Environmental - approx. cost based on prior similar installations	4 submersible pumps w/controls, 16 well vaults, 12 air-vac assemblies
		13	Transfer tank, valving, and pump with controls	1	LS	$ 18,000	$ 18,000	Grainger (tank), Tsurumi (pump)	500-gallon double-walled poly tank; Tsurumi high volume/high head sump
		14	Directional drilling for pipe/conduit up to ridge	1	LS	$ 100,000	$ 100,000	Directed Technologies Drilling quote	Approx. 660 LF, elevation change of approx. 150 ft
		15	Water line, electrical, communications trenching	4200	LF	$ 16	$ 67,200	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Trenching, bedding, backfill, assumed trench length of 4200 ft
		16	Water piping	4200	LF	$ 60	$ 252,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	HDR 11, includes connection to existing conveyance system
		17	Electrical conduit and cable	2400	LF	$ 45	$ 108,000	Glacier Environmental - approx. cost based on prior similar installations	Electrical from power drops and connections to existing power near injection wells, and from existing panels to new extraction wells
		18	Communications conduit and cable	4200	LF	$ 65	$ 273,000	Systems Interface - estimate	Communications from control panel to injection wells and new extraction wells
		19	Trench repaving/restoration	20000	SF	$ 5	$ 100,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Assume approx. 4 ft width x 4200 LF, plus additional 3,000 SF around other subsurface infrastructure; 18 inch paving and base cours sections
		20	Electrical equipment upgrades/transformer/electrician	1	LS	$ 70,000	$ 70,000	Estimate based on original SnoPUD transformer installation	Install 1 new/replacement transformer
		21	Instrumentation and controls; control panels	1	LS	$ 150,000	$ 150,000	Automation & Control/System's Interface - estimates	Level meters, flow meters, pressure meters, controls instrumentation, drive(s),
		22	GAC polishing vessels	2	each	$ 12,500	$ 25,000	Pacific Coast Carbon - estimate	2 x 2,000 lb liquid phase GAC vessels plus concrete pad and plumbing
		23	DGR system startup and testing	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	

IMPLEMENTATION

Table C-1c
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
IMPLEMENTATION			**EISB Injection Well Installation**						
		24	Utility locate/clearing	1	LS	$ 1,000	$ 1,000	Local utility locator rates = $85 - $100/hr	
		25	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		26	Drilling - injection wells (detention basin hotspot)	24	wells	$ 4,000	$ 96,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar	8 injection wells, 2" steel casing to 70 ft., 8 injection wells to 50 ft., 8 wells to
		17	Wellhead preparation	24	wells	$ 1,000	$ 24,000	Assumed level of effort based on prior experience	Monuments/vaults, valves, fittings for injection well wellheads
		28	IDW disposal	70	Drums	$ 200	$ 14,000	Stericycle - average per drum disposal cost plus labor	
			Injection of Electron Donor						Assume 3 injection events
		30	Injection crew/labor	75	days	$ 3,000	$ 225,000	Assumed level of effort based on prior experience	Assume 2 to 3 FTE for 5 weeks (10 hrs/day) per injection event
		31	Purchase equipment/supplies for injection system setup	1	LS	$ 25,000	$ 25,000	Assumed level of effort based on prior experience	Pumps, mixing tanks, hoses, fittings, trailer
		32	Materials and rentals for injection events	3	event	$ 20,000	$ 60,000	Assumed level of effort based on prior experience	Water tank rental, other rental equipment and materials
		32	Water for injection events	285,000	gal	$ 0.03	$ 8,550	Assumed level of effort based on prior experience	Assume 95K gal per event at $0.03/gal
		33	Donor for injection events	36000	lbs	$ 2	$ 54,000	Assumed level of effort based on prior experience	Assume 12K lbs per event at $1.50/lb
		34	Site Restoration - slope/buffer plantings, general cleanup	1	LS	$ 25,000	$ 25,000	Glacier Environmental - approx. cost based on prior similar work	
	Subtotal Remedial Action Construction Costs						*$ 2,597,300*		
	Direct Cost Contingency and Unlisted Engineering Services (%)			**25%**	pct	$2,597,300	$ 649,300	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid contingency (10% - low end) and scope contingency (15% low end groundwater treatmnet and soil excavation)
	Contractor Bond Fee, Overhead, and Profit (%)			**20%**	pct	$2,780,875	$ 556,200	Standard	Applied to contractor and driller costs only (not injection related costs)
	Washington State Sales Tax (%)			**9.2%**	pct	$ 3,337,075	$307,000	City of Everett/State sales tax rate	Applied to contractor and driller costs
	TOTAL DIRECT COST						**$4,110,000**		
OM&M	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
			ANNUAL OPERATION, MAINTENANCE, MONITORING, AND REPORTING						
		1	Electrical usage	1	yr	$ 44,500	$ 44,500	SnoPUD commercial electrical rate	Approx. 98 hp of equip. (1743 kw*hr/day x $0.07/kw-hr x 365 days/yr)
		2	Cell phone/GET system remote access charges	12	mo	$ 369	$ 4,428	Frontier commercial rate	$369/month x 12 mo. service for autodialer, alarms, etc
		3	Carbon usage	1	yr	$ 9,600	$ 9,600	Evoqua - estimate; assumed usage rate based on prior consumption	Assume 1 changeout (3,000 lbs GAC) every other year at $9600 per changeout, incl GAC profiling, plus disposal as haz waste
		4	System monitoring/NPDES reporting	1	yr	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	Includes monthly air and water influent/effluent sampling and NPDES DMR
		5	DGR system O&M labor and cost	1	yr	$ 95,000	$ 95,000	Assumed level of effort based on prior experience	Assume 1 FTE, 10 hour days, plus travel/field equip ($1,500/day), four days per month, includes general maintenance and monitoring, response to upset, minor equipment repair and replacement, annual bridge crane inspections, plus
		6	NPDES annual renewal fee	1	yr	$ 20,137	$ 20,137	Per WAC 173-224-040 fees - 2019 schedule	Per WAC 173-224-040 fee 2019 schedule (Non-LUST Hazardous Waste Cleanup Site; >2 contaminants)
		7	Groundwater sampling (during DGR)	1	yr	$ 67,000	$ 67,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (162 wells)
		8	Groundwater elevation monitoring (during DGR)	1	yr	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual water levels (162 wells)
		9	Surface water sampling (during DGR)	1	yr	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (17 surface water sampling points)
		10	Reporting	1	yr	$ 15,000	$ 15,000	Assumed level of effort based on prior experience	
	Subtotal Annual OM&M and Reporting Cost						$ 291,700		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$291,700	$ 58,300	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid and scope contingency (10% each)
	Years of Annual Monitoring			***20***	yrs	$350,000	$ 7,000,000		Total estimated operation timeframe to remediation level (based on restoration timeframe modeling and calculations)
	TOTAL ANNUAL OM&M AND REPORTING COST						***$7,000,000***		
	Present-Worth Annual OM&M and Reporting Cost Presumed Discount Rate			***0.6%***	pct		**$6,578,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
			NON-ROUTINE OPERATION, MAINTENANCE, MONITORING, AND REPORTING						
		1	Baseline groundwater/surface water sampling	1	event	$ 75,000	$ 75,000	Assumed level of effort based on prior experience	1 complete sampling event prior to remedy implementation for VOCs (162 wells, 17 sw points)
		2	DGR system equipment replacement cost	1	event	$ 200,000	$ 200,000	Assumed major equipment replacement after typical lifespan.	Replace failed major equipment (blower, well pumps, labor) after 15 to 20
		3	Quarterly groundwater sampling (EISB parameters)	3	yr	$ 95,000	$ 285,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		4	Quarterly groundwater sampling	12	event	$ 67,000	$ 804,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs after each injection event (162 wells)
		5	Quarterly groundwater elevation monitoring	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly groundwater level measurements (162 wells)
		6	Quarterly surface water sampling	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs (17 surface water sampling points)
		7	Annual groundwater sampling (EISB parameters post DGR)	3	yrs	$ 65,000	$ 195,000	Assumed level of effort based on prior experience	3 yrs annual sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		8	Annual groundwater elevation monitoring (post DGR)	3	yrs	$ 8,000	$ 24,000	Assumed level of effort based on prior experience	3 yrs annual groundwater level measurements (168 wells)
		9	Annual surface water sampling (post DGR)	3	yrs	$ 8,000	$ 24,000	Assumed level of effort based on prior experience	3 yrs annual sampling for VOCs (17 surface water sampling points)
		10	1.5 years quarterly confirmation sampling	6	event	$ 75,000	$ 450,000	Assumed level of effort based on prior experience	6 qtrs sampling for VOCs (162 wells; 17 sw points)
		11	Cleanup completion report	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	Final remediation completion report (year 25)
	Subtotal Non-Routine OM&M and Reporting Cost						$ 2,269,000		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$2,269,000	$ 453,800	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid and scope contingency (10% each)
	TOTAL NON-ROUTINE OM&M AND REPORTING COST						***$2,723,000***		
	Present-Worth Non-Routine OM&M and Reporting Cost Presumed Discount Rate			***0.6%***	pct		**$2,564,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note)
TOTAL			**ALTERNATIVE COST SUMMARY**						
	TOTAL PRESENT-WORTH REMEDIAL DESIGN, PLANNING, AND GENERAL COST (INDIRECT)						**$2,411,000**		
	TOTAL PRESENT-WORTH REMEDIATION IMPLEMENTATION COST (DIRECT)						**$4,110,000**		
	TOTAL PRESENT-WORTH OM&M COST (ANNUAL & NON-ROUTINE)						**$9,142,000**		
	TOTAL PRESENT-WORTH COST						**$15,660,000**		
	Appropriate Cost Range (-30% - +50%)			**TOTAL**		**$ 10,960,000**	**$ 23,490,000**	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 2-3	Accuracy range at Detailed Analysis of Alternatives/Conceptual Design

Table C-1d
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

ALTERNATIVE 5 **DYNAMIC GROUNDWATER RECIRUCLATION AND SOURCE AREA EISB**

POINT OF COMPLIANCE OPTION: **OPTION 3 - GROUNDWATER CPOC AT PROPERTY LINE/UPGRADIENT OF CREEK ON BOEING PROPERTY**

Explanation of POC Option: SWQS (0.3 µg/L TCE) to be met in monitoring wells along Boeing Property Line (and all points downgradient) and in "buffer zone" upgradient (or in transition zone as allowable by MTCA for properties abutting surface water) of the creek on Boeing property. Drinking water standard (4 µg/L TCE) to be met in monitoring wells throughout the groundwater TCE plume on Boeing property.

POC Option Specific Assumptions

1. Existing monitoring wells along property line and adjacent to creek sufficient for monitoring groundwater CPOC; existing monitoring well network sufficient for monitoring groundwater throughout plume.
2. Existing surface water sampling locations will be used for monitoring surface water POC
3. DGR system will be operated for 24 years for downgradient plume cleanup
4. EISB in source area will require 23 years for source area cleanup (including 3 injection events over 3-year period)
5. Major and minor equipment replacements for DGR system will be required during 24-year operational time frame

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
IMPLEMENTATION	**REMEDIAL DESIGN, PLANNING, AND GENERAL (Indirect Costs)**								
		1	Engineering/Proj Mgmt/Const Mgmt/Reporting						
		2	Cleanup action plan	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		3	Permits	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	UIC permit, major modification to NPDES permit, access agreements, construction permits
		4	Negotiate and implement institutional controls	0	LS	$ 10,000	$ -		
		5	Contract documents and contractor bidding/procurement	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	
		6	Cleanup action construction report/O&M manual	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		7	Engineering/Remedial Design	8%	pct	$ 4,105,000	$ 328,400	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~8% of capital costs
		8	Construction management/oversight	6%	pct	$ 4,105,000	$ 246,300	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~6% of capital costs
		9	Project management	5%	pct	$ 15,004,700	$ 750,235	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~5% of project costs
		10	Ecology oversight	5%	pct	$ 15,004,700	$ 750,235	Assume similar to project management value	Assume ~5% of project costs
	Subtotal Remedial Design, Planning, and General Costs						*$ 2,185,200*		
	Indirect Contingency and Unlisted Engineering Services (%)			**15%**	pct	$2,185,200	$ 327,800		
	TOTAL INDIRECT COST						**$2,513,000**		
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	REMEDIAL ACTION CONSTRUCTION - DGR SYSTEM AND ELECTRON DONOR INJECTIONS (Direct Costs)								
		1	Contractor mobilization/demobilization	1	LS	$ 30,000	$ 30,000	Glacier Environmental - approx. cost based on prior similar work	
		2	DGR pilot study	1	LS	$ 80,000	$ 80,000	Assumed level of effort for 1 year pilot study (construction costs included below)	Assume 1 full time field tech, 10 hour days, plus travel/field equip ($1,500/day), four days per month for 1 year, includes monitoring, system reconfigurations, sampling, plus lab costs and data evaluation and reporting
			Install injection and extraction wells/distribution system						
		3	Utility locate	1	LS	$ 2,500	$ 2,500	Local utility locator rates = $85 - $100/hr	Assume 3 days total for utility locates for drilling, trenching
		4	Site prep/clearing/grubbing	1	LS	$ 75,000	$ 75,000	Assumed level of effort based on prior experience; prep roads/trails to well	Prep roads/trails to well drilling and other construction locations
		5	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		6	Drilling - DGR extraction well installation	4	well	$ 20,000	$ 80,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 extraction wells, 6" stainless steel, to average 50 ft. (15 ft screens), includes start card, drilling, well construction materials
		7	Drilling - DGR injection well installation (shallow)	4	well	$ 15,000	$ 60,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 injection wells, 4" carbon steel, to average 55 ft. (30 ft screens), includes start card, drilling, well construction materials
		8	Drilling - DGR injection well installation (deep)	8	well	$ 26,000	$ 208,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	8 injection wells ,4" carbon steel, to avg 140 ft. (30 ft screens), includes start card, drilling, well construction materials
		9	Drilling - monitoring wells for DGR monitoring	4	well	$ 12,000	$ 48,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 monitoring wells, 2" pvc to average 55 ft (5 ft screens), includes start card, drilling, well construction materials
		10	IDW disposal	60	Drums	$ 200	$ 12,000	Stericycle - approx. cost based on prior similar disposal costs	Average per drum disposal cost plus labor
		11	Well vaults, pumps, air vac assemblies	1	LS	$ 210,000	$ 210,000	Glacier Environmental - approx. cost based on prior similar installations	4 submersible pumps w/controls, 16 well vaults, 12 air-vac assemblies
		12	Transfer tank, valving, and pump with controls	1	LS	$ 18,000	$ 18,000	Grainger (tank), Tsurumi (pump)	500-gallon double-walled poly tank; Tsurumi high volume/high head sump
		13	Directional drilling for pipe/conduit up to ridge	1	LS	$ 100,000	$ 100,000	Directed Technologies Drilling quote	Approx. 660 LF, elevation change of approx. 150 ft
		14	Water line, electrical, communications trenching	4200	LF	$ 16	$ 67,200	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Trenching, bedding, backfill, assumed trench length of 4200 ft
		15	Water piping	4200	LF	$ 60	$ 252,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	HDR 11, includes connection to existing conveyance system
		16	Electrical conduit and cable	2400	LF	$ 45	$ 108,000	Glacier Environmental - approx. cost based on prior similar installations	Electrical from power drops and connections to existing power near injection wells, and from existing panels to new extraction wells
		17	Communications conduit and cable	4200	LF	$ 65	$ 273,000	Systems Interface - estimate	Communications from control panel to injection wells and new extraction wells
		18	Trench repaving/restoration	20000	SF	$ 5	$ 100,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Assume approx. 4 ft width x 4200 LF, plus additional 3,000 SF around other subsurface infrastructure; 18 inch paving and base cours sections
		19	Electrical equipment upgrades/transformer/electrician	1	LS	$ 70,000	$ 70,000	Estimate based on original SnoPUD transformer installation	Install 1 new/replacement transformer
		20	Instrumentation and controls; control panels	1	LS	$ 150,000	$ 150,000	Automation & Control/System's Interface - estimates	Level meters, flow meters, pressure meters, controls instrumentation, drive(s),
		21	GAC polishing vessels	2	each	$ 12,500	$ 25,000	Pacific Coast Carbon - estimate	2 x 2,000 lb liquid phase GAC vessels plus concrete pad and plumbing
		22	DGR system startup and testing	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	
			EISB Injection Well Installation						
		23	Utility locate/clearing	1	LS	$ 1,000	$ 1,000	Local utility locator rates = $85 - $100/hr	
		24	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		25	Drilling - injection wells (detention basin hotspot)	24	wells	$ 4,000	$ 96,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar	8 injection wells, 2" steel casing to 70 ft., 8 injection wells to 50 ft., 8 wells to

Table C-1d
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	Category	Item #	Description	Quantity	Unit	Unit Cost	Total	Source/Basis of Unit Costs and Cost Data	Assumptions, Comments, and/or Notes
IMPLEMENTATION		26	Wellhead preparation	24	wells	$ 1,000	$ 24,000	Assumed level of effort based on prior experience	Monuments/vaults, valves, fittings for injection well wellheads
		27	IDW disposal	70	Drums	$ 200	$ 14,000	Stericycle - average per drum disposal cost plus labor	
			Injection of Electron Donor						Assume 3 injection events
		28	Injection crew/labor	75	days	$ 3,000	$ 225,000	Assumed level of effort based on prior experience	Assume 2 to 3 FTE for 5 weeks (10 hrs/day) per injection event
		29	Purchase equipment/supplies for injection system setup	1	LS	$ 25,000	$ 25,000	Assumed level of effort based on prior experience	Pumps, mixing tanks, hoses, fittings, trailer
		30	Materials and rentals for injection events	3	event	$ 20,000	$ 60,000	Assumed level of effort based on prior experience	Water tank rental, other rental equipment and materials
		31	Water for injection events	285,000	gal	$ 0.03	$ 8,550	Assumed level of effort based on prior experience	Assume 95K gal per event at $0.03/gal
		32	Donor for injection events	36000	lbs	$ 2	$ 54,000	Assumed level of effort based on prior experience	Assume 12K lbs per event at $1.50/lb
		33	Site Restoration - slope/buffer plantings, general cleanup	1	LS	$ 25,000	$ 25,000	Glacier Environmental - approx. cost based on prior similar work	
	Subtotal Remedial Action Construction Costs						*$ 2,527,300*		
	Direct Cost Contingency and Unlisted Engineering Services (%)			**25%**	pct	$2,527,300	$ 631,800	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid contingency (10% - low end) and scope contingency (15% low end groundwater treatmnet and soil excavation)
	Contractor Bond Fee, Overhead, and Profit (%)			**20%**	pct	$2,693,375	$ 538,700	Standard	Applied to contractor and driller costs only (not injection related costs)
	Washington State Sales Tax (%)			**9.2%**	pct	$ 3,232,075	$297,400	City of Everett/State sales tax rate	Applied to contractor and driller costs
	TOTAL DIRECT COST						**$3,995,000**		
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
OM&M	**ANNUAL OPERATION, MAINTENANCE, MONITORING, AND REPORTING**								
		1	Electrical usage	1	yr	$ 44,500	$ 44,500	SnoPUD commercial electrical rate	Approx. 98 hp of equip. (1743 kw*hr/day x $0.07/kw-hr x 365 days/yr)
		2	Cell phone/GET system remote access charges	12	mo	$ 369	$ 4,428	Frontier commercial rate	$369/month x 12 mo. service for autodialer, alarms, etc
		3	Carbon usage	1	yr	$ 9,600	$ 9,600	Evoqua - estimate; assumed usage rate based on prior consumption	assume 1 changeout (3,000 lbs GAC) every other year at $9600 per changeout, incl GAC profiling, plus disposal as haz waste
		4	System monitoring/NPDES reporting	1	yr	$ 20,000	$ 20,000		Includes monthly air and water influent/effluent sampling and NPDES DMR
		5	DGR system O&M labor and cost	1	yr	$ 95,000	$ 95,000	Assumed level of effort based on prior experience	Assume 1 FTE, 10 hour days, plus travel/field equip ($1,500/day), four days per month, includes general maintenance and monitoring, response to upset, minor equipment repair and replacement, annual bridge crane inspections, plus
		6	NPDES annual renewal fee	1	yr	$ 20,137	$ 20,137	Per WAC 173-224-040 fees - 2019 schedule	Per WAC 173-224-040 fee 2019 schedule (Non-LUST Hazardous Waste Cleanup Site; >2 contaminants)
		7	Groundwater sampling (during DGR)	1	yrs	$ 65,000	$ 65,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (155 wells)
		8	Groundwater elevation monitoring (during DGR)	1	yrs	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual water levels (155 wells)
		9	Surface water sampling (during DGR)	1	yrs	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (17 surface water sampling points)
		10	Reporting	1	yr	$ 15,000	$ 15,000	Assumed level of effort based on prior experience	
	Subtotal Annual OM&M and Reporting Cost						$ 289,700		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$289,700	$ 57,900	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 &	Assumed bid and scope contingency (10% each)
	Years of Annual Monitoring			***24***	yrs	$347,600	$ 8,342,400		Total estimated operation timeframe to remediation level (based on restoration timeframe modeling and calculations)
	TOTAL ANNUAL OM&M AND REPORTING COST						***$8,342,000***		
	Present-Worth Annual OM&M and Reporting Cost Presumed Discount Rate			***0.6%***	pct		**$7,748,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	NON-ROUTINE OPERATION, MAINTENANCE, MONITORING, AND REPORTING								
		1	Baseline groundwater/surface water sampling	1	event	$ 73,000	$ 73,000	Assumed level of effort based on prior experience	1 complete sampling event prior to remedy implementation for VOCs (155 wells, 17 sw points)
		2	DGR system equipment replacement cost	1.5	event	$ 200,000	$ 300,000	Assumed major equipment replacement after typical lifespan.	Replace failed major equipment (blower, well pumps, labor) after 15 to 20 years of operation
		3	Quarterly groundwater sampling (EISB parameters)	3	yr	$ 95,000	$ 285,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		4	Quarterly groundwater sampling	12	event	$ 65,000	$ 780,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs after each injection event (155 wells)
		5	Quarterly groundwater elevation monitoring	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly groundwater level measurements (155 wells)
		6	Quarterly surface water sampling	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs (17 surface water sampling points)
		7	Annual groundwater sampling (EISB parameters post DGR	0	yrs	$ 65,000	$ -		
		8	Annual groundwater elevation monitoring (post DGR)	0	yrs	$ 8,000	$ -		
		9	Annual surface water sampling (post DGR)	0	yrs	$ 8,000	$ -		
		10	1.5 years quarterly confirmation sampling	6	event	$ 73,000	$ 438,000	Assumed level of effort based on prior experience	6 qtrs sampling for VOCs (155 wells; 17 sw points)
		11	Cleanup completion report	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	Final remediation completion report (year 26)
	Subtotal Non-Routine OM&M and Reporting Cost						$ 2,088,000		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$2,088,000	$ 417,600	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 &	Assumed bid and scope contingency (10% each)
	TOTAL NON-ROUTINE OM&M AND REPORTING COST						***$2,506,000***		
	Present-Worth Non-Routine OM&M and Reporting Cost Presumed Discount Rate			***0.6%***	pct		**$2,577,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note)
TOTAL	**ALTERNATIVE COST SUMMARY**								
	TOTAL PRESENT-WORTH REMEDIAL DESIGN, PLANNING, AND GENERAL COST (INDIRECT)						**$2,513,000**		
	TOTAL PRESENT-WORTH REMEDIATION IMPLEMENTATION COST (DIRECT)						**$3,995,000**		
	TOTAL PRESENT-WORTH OM&M COST (ANNUAL & NON-ROUTINE)						**$10,325,000**		
	TOTAL PRESENT-WORTH COST						**$16,830,000**		
	Appropriate Cost Range (-30% - +50%)				**TOTAL**	**$ 11,780,000**	**$ 25,250,000**	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 2-3	Accuracy range at Detailed Analysis of Alternatives/Conceptual Design

Table C-1e
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

ALTERNATIVE 5 **DYNAMIC GROUNDWATER RECIRUCLATION AND SOURCE AREA EISB**

POINT OF COMPLIANCE OPTION: **OPTION 4 - GROUNDWATER CPOC IMMEDIATELY DOWNGRADIENT OF SOURCE AREA**

Explanation of POC Option: SWQS (0.3 µg/L TCE) to be met in monitoring wells downgradient of source area/detention basin (and all points downgradient). Drinking water standard (4 µg/L TCE) to be met in monitoring wells throughout the groundwater TCE plume on Boeing property.

POC Option Specific Assumptions

1. New monitoring wells (assume 3) will be necessary downgradient of detention basin to monitor groundwater CPOC; monitoring well network sufficient for monitoring groundwater throughout plume.
2. Existing surface water sampling locations will be used for monitoring surface water POC
3. DGR system will be operated for 24 years for downgradient plume cleanup
4. EISB in source area will require 30 years for source area cleanup (including 3 injection events over 3-year period)
5. Phase 1 area GET system will continue to be operated until compliance at groundwater CPOC (10 years after DGR)
6. Major and minor equipment replacements for DGR/GET system will be required during 24-year operational time frame

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	REMEDIAL DESIGN, PLANNING, AND GENERAL (Indirect Costs)								
		1	**Engineering/Proj Mgmt/Const Mgmt/Reporting**						
		2	Cleanup action plan	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		3	Permits	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	UIC permit, major modification to NPDES permit, access agreements, construction permits
		4	Negotiate and implement institutional controls	0	LS	$ 10,000	$ -		
		5	Contract documents and contractor bidding/procurement	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	
		6	Cleanup action construction report/O&M manual	1	LS	$ 30,000	$ 30,000	Assumed level of effort based on prior experience	
		7	Engineering/Remedial Design	8%	pct	$ 4,167,000	$ 333,360	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~8% of capital costs
		8	Construction management/oversight	6%	pct	$ 4,167,000	$ 250,020	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~6% of capital costs
		9	Project management	5%	pct	$ 17,369,380	$ 868,469	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~5% of project costs
		10	Ecology oversight	5%	pct	$ 17,369,380	$ 868,469	Assume similar to project management value	Assume ~5% of project costs
	Subtotal Remedial Design, Planning, and General Costs						*$ 2,430,300*		
	Indirect Contingency and Unlisted Engineering Services (%)			**15%**	pct	$2,430,300	$ 364,500		
	TOTAL INDIRECT COST						**$2,795,000**		
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	REMEDIAL ACTION CONSTRUCTION - DGR SYSTEM AND ELECTRON DONOR INJECTIONS (Direct Costs)								
		1	Contractor mobilization/demobilization	1	LS	$ 30,000	$ 30,000	Glacier Environmental - approx. cost based on prior similar work	
		2	DGR pilot study	1	LS	$ 80,000	$ 80,000	Assumed level of effort for 1 year pilot study (construction costs included below)	Assume 1 full time field tech, 10 hour days, plus travel/field equip ($1,500/day), four days per month for 1 year, includes monitoring, system reconfigurations, sampling, plus lab costs and data evaluation and reporting
			Install injection and extraction wells/distribution system						
		3	Utility locate	1	LS	$ 2,500	$ 2,500	Local utility locator rates = $85 - $100/hr	Assume 3 days total for utility locates for drilling, trenching
		4	Site prep/clearing/grubbing	1	LS	$ 75,000	$ 75,000	Assumed level of effort based on prior experience; prep roads/trails to well	Prep roads/trails to well drilling and other construction locations
		5	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		6	Drilling - DGR extraction well installation	4	well	$ 20,000	$ 80,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 extraction wells, 6" stainless steel, to average 50 ft. (15 ft screens), includes start card, drilling, well construction materials
		7	Drilling - DGR injection well installation (shallow)	4	well	$ 15,000	$ 60,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 injection wells, 4" carbon steel, to average 55 ft. (30 ft screens), includes start card, drilling, well construction materials
		8	Drilling - DGR injection well installation (deep)	8	well	$ 26,000	$ 208,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar	8 injection wells ,4" carbon steel, to avg 140 ft. (30 ft screens), includes start
		9	Drilling - monitoring wells for DGR and CPOC monitoring	7	well	$ 12,000	$ 84,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 wells for DGR monitoring, 3 wells for CPOC monitoring, 2" pvc to average 55 ft (5 ft screens), includes start card, drilling, well construction materials
		10	IDW disposal	70	Drums	$ 200	$ 14,000	Stericycle - approx. cost based on prior similar disposal costs	Average per drum disposal cost plus labor
		11	Well vaults, pumps, air vac assemblies	1	LS	$ 210,000	$ 210,000	Glacier Environmental - approx. cost based on prior similar installations	4 submersible pumps w/controls, 16 well vaults, 12 air-vac assemblies
		12	Transfer tank, valving, and pump with controls	1	LS	$ 18,000	$ 18,000	Grainger (tank), Tsurumi (pump)	500-gallon double-walled poly tank; Tsurumi high volume/high head sump
		13	Directional drilling for pipe/conduit up to ridge	1	LS	$ 100,000	$ 100,000	Directed Technologies Drilling quote	Approx. 660 LF, elevation change of approx. 150 ft
		14	Water line, electrical, communications trenching	4200	LF	$ 16	$ 67,200	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Trenching, bedding, backfill, assumed trench length of 4200 ft
		15	Water piping	4200	LF	$ 60	$ 252,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	HDR 11, includes connection to existing conveyance system
		16	Electrical conduit and cable	2400	LF	$ 45	$ 108,000	Glacier Environmental - approx. cost based on prior similar installations	Electrical from power drops and connections to existing power near injection wells, and from existing panels to new extraction wells
		17	Communications conduit and cable	4200	LF	$ 65	$ 273,000	Systems Interface - estimate	Communications from control panel to injection wells and new extraction wells
		18	Trench repaving/restoration	20000	SF	$ 5	$ 100,000	WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Assume approx. 4 ft width x 4200 LF, plus additional 3,000 SF around other subsurface infrastructure; 18 inch paving and base cours sections
		19	Electrical equipment upgrades/transformer/electrician	1	LS	$ 70,000	$ 70,000	Estimate based on original SnoPUD transformer installation	Install 1 new/replacement transformer
		20	Instrumentation and controls; control panels	1	LS	$ 150,000	$ 150,000	Automation & Control/System's Interface - estimates	Level meters, flow meters, pressure meters, controls instrumentation, drive(s),
		21	GAC polishing vessels	2	each	$ 12,500	$ 25,000	Pacific Coast Carbon - estimate	2 x 2,000 lb liquid phase GAC vessels plus concrete pad and plumbing
		22	DGR system startup and testing	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	

IMPLEMENTATION

Table C-1e
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

DETAILED COST ESTIMATE								COST BASIS	
Cost Type	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
IMPLEMENTATION			**EISB Injection Well Installation**						
		23	Utility locate/clearing	1	LS	$ 1,000	$ 1,000	Local utility locator rates = $85 - $100/hr	
		24	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000	Typical mobilization rate for local drillers	
		25	Drilling - injection wells (detention basin hotspot)	24	wells	$ 4,000	$ 96,000	Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	8 injection wells, 2" steel casing to 70 ft., 8 injection wells to 50 ft., 8 wells to 30 ft. (20 ft screens) Includes start card, drilling, well construction materials
		26	Wellhead preparation	24	wells	$ 1,000	$ 24,000	Assumed level of effort based on prior experience	Monuments/vaults, valves, fittings for injection well wellheads
		27	IDW disposal	70	Drums	$ 200	$ 14,000	Stericycle - average per drum disposal cost plus labor	
			Injection of Electron Donor						Assume 3 injection events
		28	Injection crew/labor	75	days	$ 3,000	$ 225,000	Assumed level of effort based on prior experience	Assume 2 to 3 FTE for 5 weeks (10 hrs/day) per injection event
		29	Purchase equipment/supplies for injection system setup	1	LS	$ 25,000	$ 25,000	Assumed level of effort based on prior experience	Pumps, mixing tanks, hoses, fittings, trailer
		30	Materials and rentals for injection events	3	event	$ 20,000	$ 60,000	Assumed level of effort based on prior experience	Water tank rental, other rental equipment and materials
		31	Water for injection events	285,000	gal	$ 0.03	$ 8,550	Assumed level of effort based on prior experience	Assume 95K gal per event at $0.03/gal
		32	Donor for injection events	36000	lbs	$ 2	$ 54,000	Assumed level of effort based on prior experience	Assume 12K lbs per event at $1.50/lb
		33	Site Restoration - slope/buffer plantings, general cleanup	1	LS	$ 25,000	$ 25,000	Glacier Environmental - approx. cost based on prior similar work	
	Subtotal Remedial Action Construction Costs						*$ 2,565,300*		
	Direct Cost Contingency and Unlisted Engineering Services (%)			**25%**	pct	$2,565,300	$ 641,300	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid contingency (10% - low end) and scope contingency (15% low end groundwater treatmnet and soil excavation)
	Contractor Bond Fee, Overhead, and Profit (%)			**20%**	pct	$2,740,875	$ 548,200	Standard	Applied to contractor and driller costs only (not injection related costs)
	Washington State Sales Tax (%)			**9.2%**	pct	$ 3,289,075	$302,600	City of Everett/State sales tax rate	Applied to contractor and driller costs
	TOTAL DIRECT COST						**$4,057,000**		
OM&M	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
			ANNUAL OPERATION, MAINTENANCE, MONITORING, AND REPORTING						
		1	Electrical usage	1	yr	$ 44,500	$ 44,500	SnoPUD commercial electrical rate	Approx. 98 hp of equip. (1743 kw*hr/day x $0.07/kw-hr x 365 days/yr)
		2	Cell phone/GET system remote access charges	12	mo	$ 369	$ 4,428	Frontier commercial rate	$369/month x 12 mo. service for autodialer, alarms, etc
		3	Carbon usage	1	yr	$ 9,600	$ 9,600	Evoqua - estimate; assumed usage rate based on prior consumption	Assume 1 changeout (3,000 lbs GAC) every other year at $9600 per changeout, incl GAC profiling, plus disposal as haz waste
		4	System monitoring/NPDES reporting	1	yr	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	Includes monthly air and water influent/effluent sampling and NPDES DMR
		5	DGR system O&M labor and cost	1	yr	$ 95,000	$ 95,000	Assumed level of effort based on prior experience	Assume 1 FTE, 10 hour days, plus travel/field equip ($1,500/day), four days per month, includes general maintenance and monitoring, response to upset, minor equipment repair and replacement, annual bridge crane inspections,
		6	NPDES annual renewal fee	1	yr	$ 20,137	$ 20,137	Per WAC 173-224-040 fees - 2019 schedule	Per WAC 173-224-040 fee 2019 schedule (Non-LUST Hazardous Waste Cleanup Site: >2 contaminants)
		7	Groundwater sampling (during DGR)	1	yrs	$ 65,000	$ 65,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (158 wells)
		8	Groundwater elevation monitoring (during DGR)	1	yrs	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual water levels (158 wells)
		9	Surface water sampling (during DGR)	1	yrs	$ 8,000	$ 8,000	Assumed level of effort based on prior experience	Annual sampling for VOCs (17 surface water sampling points)
		10	Reporting	1	yr	$ 15,000	$ 15,000	Assumed level of effort based on prior experience	
	Subtotal Annual OM&M and Reporting Cost						$ 289,700		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$289,700	$ 57,900	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid and scope contingency (10% each)
			Years of Annual Monitoring	***24***	yrs	$347,600	$ 8,342,400		Total estimated operation timeframe to remediation level (based on restoration timeframe modeling and calculations)
	TOTAL ANNUAL OM&M AND REPORTING COST						***$8,342,000***		
	Present-Worth Annual OM&M and Reporting Cost		Presumed Discount Rate	***0.6%***	pct		**$7,748,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
			NON-ROUTINE OPERATION, MAINTENANCE, MONITORING, AND REPORTING						
		1	Baseline groundwater/surface water sampling	1	event	$ 73,000	$ 73,000	Assumed level of effort based on prior experience	1 complete sampling event prior to remedy implementation for VOCs (158 wells, 17 sw points)
		2	DGR/GET system equipment replacement cost	2	event	$ 200,000	$ 400,000	Assumed major equipment replacement after typical lifespan.	Replace failed major equipment (blower, well pumps, labor) after 15 to 20 years of operation
		3	Quarterly groundwater sampling (EISB parameters)	3	yr	$ 95,000	$ 285,000	Approximate drive point well cost base on online vendors and assumed level of effort for installation.	3 yrs qtrly sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		4	Quarterly groundwater sampling	12	event	$ 65,000	$ 780,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs after each injection event (158 wells)
		5	Quarterly groundwater elevation monitoring	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly groundwater level measurements (158 wells)
		6	Quarterly surface water sampling	12	event	$ 8,000	$ 96,000	Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs (17 surface water sampling points)
		7	Annual groundwater sampling (EISB parameters post DGR)	6	yrs	$ 65,000	$ 390,000	Assumed level of effort based on prior experience	6 yrs annual sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		8	Annual groundwater elevation monitoring (post DGR)	10	yrs	$ 8,000	$ 80,000	Assumed level of effort based on prior experience	10 yrs annual groundwater level measurements (158 wells)
		9	Annual surface water sampling (post DGR)	10	yrs	$ 8,000	$ 80,000	Assumed level of effort based on prior experience	10 yrs annual sampling for VOCs (17 surface water sampling points)
		10	Annual operation of Phase 1 area GET system (post DGR)	10	yrs	$ 185,000	$ 1,850,000	Assume annual operational costs for GET system same as FS Alternative 1 annual	10 yrs O&M, NPDES compliance sampling, permit renewal fees, GAC usage
		11	1.5 years quarterly confirmation sampling	6	event	$ 73,000	$ 438,000	Assumed level of effort based on prior experience	6 qtrs sampling for VOCs (158 wells; 17 sw points)
		12	Cleanup completion report	1	LS	$ 20,000	$ 20,000	Assumed level of effort based on prior experience	Final remediation completion report (year 36)
	Subtotal Non-Routine OM&M and Reporting Cost						$ 4,588,000		
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$4,588,000	$ 917,600	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid and scope contingency (10% each)
	TOTAL NON-ROUTINE OM&M AND REPORTING COST						***$5,506,000***		
	Present-Worth Non-Routine OM&M and Reporting Cost		Presumed Discount Rate	***0.6%***	pct		**$4,871,000**	Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note)
TOTAL			**ALTERNATIVE COST SUMMARY**						
	TOTAL PRESENT-WORTH REMEDIAL DESIGN, PLANNING, AND GENERAL COST (INDIRECT)						**$2,795,000**		
	TOTAL PRESENT-WORTH REMEDIATION IMPLEMENTATION COST (DIRECT)						**$4,057,000**		
	TOTAL PRESENT-WORTH OM&M COST (ANNUAL & NON-ROUTINE)						**$12,619,000**		
	TOTAL PRESENT-WORTH COST						**$19,470,000**		
			Appropriate Cost Range (-30% - +50%)		**TOTAL**	**$ 13,630,000**	**$ 29,210,000**	EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 2-3	Accuracy range at Detailed Analysis of Alternatives/Conceptual Design

Table C-1f
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

ALTERNATIVE 5 **DYNAMIC GROUNDWATER RECIRUCLATION AND SOURCE AREA EISB**

POINT OF COMPLIANCE OPTION: OPTION 5 - GROUNDWATER STANDARD POC USING SWQS

Explanation of POC Option: SWQS (0.3 µg/L TCE) to be met in monitoring wells throughout the groundwater TCE plume (and surface water).

POC Option Specific Assumptions

1 Existing monitoring well network sufficient for monitoring groundwater POC; however, new monitoring wells (assume 3) will be necessary to monitor EISB performance downgradient of detention basin.
2 Existing surface water sampling locations will be used for monitoring surface water POC
3 DGR system will be operated for 24 years for downgradient plume cleanup
4 EISB in source area will require 38 years for source area cleanup (including 3 injection events over 3-year period)
5 Phase 1 area GET system extraction wells will continue to be operated until compliance at groundwater CPOC (20 years after DGR)
6 Major and minor equipment replacements for DGR/GET system will be required during 24-year operational time frame

DETAILED COST ESTIMATE									COST BASIS	
Cost Type	Category	Item #	Description	Quantity	Unit	Unit Cost	Total		Source/Basis of Unit Costs and Cost Data	Assumptions, Comments, and/or Notes
	REMEDIAL DESIGN, PLANNING, AND GENERAL (Indirect Costs)									
		1	Engineering/Proj Mgmt/Const Mgmt/Reporting							
		2	Cleanup action plan	1	LS	$ 30,000	$ 30,000		Assumed level of effort based on prior experience	
		3	Permits	1	LS	$ 30,000	$ 30,000		Assumed level of effort based on prior experience	UIC permit, major modification to NPDES permit, access agreements, construction permits
		4	Negotiate and implement institutional controls	0	LS	$ 10,000	$ -			
		5	Contract documents and contractor bidding/procurement	1	LS	$ 20,000	$ 20,000		Assumed level of effort based on prior experience	
		6	Cleanup action construction report/O&M manual	1	LS	$ 30,000	$ 30,000		Assumed level of effort based on prior experience	
		7	Engineering/Remedial Design	8%	pct	$ 4,167,000	$ 333,360		EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~8% of capital costs
		8	Construction management/oversight	6%	pct	$ 4,167,000	$ 250,020		EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~6% of capital costs
		9	Project management	5%	pct	$ 19,935,380	$ 996,769		EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-8	Assume ~5% of project costs
		10	Ecology oversight	5%	pct	$ 19,935,380	$ 996,769		Assume similar to project management value	Assume ~5% of project costs
	Subtotal Remedial Design, Planning, and General Costs						*$ 2,686,900*			
	Indirect Contingency and Unlisted Engineering Services (%)			**15%**	pct	$2,686,900	$ 403,000			
	TOTAL INDIRECT COST						**$3,090,000**			
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**		**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	REMEDIAL ACTION CONSTRUCTION - DGR SYSTEM AND ELECTRON DONOR INJECTIONS (Direct Costs)									
		1	Contractor mobilization/demobilization	1	LS	$ 30,000	$ 30,000		Glacier Environmental - approx. cost based on prior similar work	
		2	DGR pilot study	1	LS	$ 80,000	$ 80,000		Assumed level of effort for 1 year pilot study (construction costs included below)	Assume 1 full time field tech, 10 hour days, plus travel/field equip ($1,500/day), four days per month for 1 year, includes monitoring, system reconfigurations, sampling, plus lab costs and data evaluation and reporting
			Install injection and extraction wells/distribution system							
		3	Utility locate	1	LS	$ 2,500	$ 2,500		Local utility locator rates = $85 - $100/hr	Assume 3 days total for utility locates for drilling, trenching
		4	Site prep/clearing/grubbing	1	LS	$ 75,000	$ 75,000		Assumed level of effort based on prior experience; prep roads/trails to well	Prep roads/trails to well drilling and other construction locations
		5	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000		Typical mobilization rate for local drillers	
		6	Drilling - DGR extraction well installation	4	well	$ 20,000	$ 80,000		Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 extraction wells, 6" stainless steel, to average 50 ft. (15 ft screens), includes start card, drilling, well construction materials
		7	Drilling - DGR injection well installation (shallow)	4	well	$ 15,000	$ 60,000		Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 injection wells, 4" carbon steel, to average 55 ft. (30 ft screens), includes start card, drilling, well construction materials
		8	Drilling - DGR injection well installation (deep)	8	well	$ 26,000	$ 208,000		Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	8 injection wells ,4" carbon steel, to avg 140 ft. (30 ft screens), includes start card, drilling, well construction materials
		9	Drilling - monitoring wells for DGR and CPOC monitorin	7	well	$ 12,000	$ 84,000		Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	4 wells for DGR monitoring, 3 wells for CPOC monitoring, 2" pvc to average 55 ft (5 ft screens), includes start card, drilling, well construction materials
		10	IDW disposal	70	Drums	$ 200	$ 14,000		Stericycle - approx. cost based on prior similar disposal costs	Average per drum disposal cost plus labor
		11	Well vaults, pumps, air vac assemblies	1	LS	$ 210,000	$ 210,000		Glacier Environmental - approx. cost based on prior similar installations	4 submersible pumps w/controls, 16 well vaults, 12 air-vac assemblies
		12	Transfer tank, valving, and pump with controls	1	LS	$ 18,000	$ 18,000		Grainger (tank), Tsurumi (pump)	500-gallon double-walled poly tank; Tsurumi high volume/high head sump pump
		13	Directional drilling for pipe/conduit up to ridge	1	LS	$ 100,000	$ 100,000		Directed Technologies Drilling quote	Approx. 660 LF, elevation change of approx. 150 ft
		14	Water line, electrical, communications trenching	4200	LF	$ 16	$ 67,200		WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Trenching, bedding, backfill, assumed trench length of 4200 ft
		15	Water piping	4200	LF	$ 60	$ 252,000		WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	HDR 11, includes connection to existing conveyance system
		16	Electrical conduit and cable	2400	LF	$ 45	$ 108,000		Glacier Environmental - approx. cost based on prior similar installations	Electrical from power drops and connections to existing power near injection wells, and from existing panels to new extraction wells
		17	Communications conduit and cable	4200	LF	$ 65	$ 273,000		Systems Interface - estimate	Communications from control panel to injection wells and new extraction wells
		18	Trench repaving/restoration	20000	SF	$ 5	$ 100,000		WSDOT Unit Bid Analysis - http://www.wsdot.wa.gov/biz/contaa/uba/; approx. median cost for similar scope of work	Assume approx. 4 ft width x 4200 LF, plus additional 3,000 SF around other subsurface infrastructure; 18 inch paving and base cours sections
		19	Electrical equipment upgrades/transformer/electrician	1	LS	$ 70,000	$ 70,000		Estimate based on original SnoPUD transformer installation	Install 1 new/replacement transformer
		20	Instrumentation and controls; control panels	1	LS	$ 150,000	$ 150,000		Automation & Control/System's Interface - estimates	Level meters, flow meters, pressure meters, controls instrumentation, drive(s), installation, programming and startup for new injection and extraction wells.
		21	GAC polishing vessels	2	each	$ 12,500	$ 25,000		Pacific Coast Carbon - estimate	2 x 2,000 lb liquid phase GAC vessels plus concrete pad and plumbing
		22	DGR system startup and testing	1	LS	$ 20,000	$ 20,000		Assumed level of effort based on prior experience	
			EISB Injection Well Installation							
		23	Utility locate/clearing	1	LS	$ 1,000	$ 1,000		Local utility locator rates = $85 - $100/hr	
		24	Driller mobilization/demobilization	1	LS	$ 3,000	$ 3,000		Typical mobilization rate for local drillers	

IMPLEMENTATION

Table C-1f
Comparison of Point of Compliance Costs
Boeing Everett - PMG SWMU

DETAILED COST ESTIMATE									COST BASIS	
Cost Type	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**		**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
IMPLEMENTATION		25	Drilling - injection wells (detention basin hotspot)	24	wells	$ 4,000	$ 96,000		Cascade Drilling - built up per well cost based on quoted unit rates for similar wells	8 injection wells, 2" steel casing to 70 ft., 8 injection wells to 50 ft., 8 wells to 30 ft. (20 ft screens) Includes start card, drilling, well construction materials
		26	Wellhead preparation	24	wells	$ 1,000	$ 24,000		Assumed level of effort based on prior experience	Monuments/vaults, valves, fittings for injection well wellheads
		27	IDW disposal	70	Drums	$ 200	$ 14,000		Stericycle - average per drum disposal cost plus labor	
			Injection of Electron Donor							Assume 3 injection events
		28	Injection crew/labor	75	days	$ 3,000	$ 225,000		Assumed level of effort based on prior experience	Assume 2 to 3 FTE for 5 weeks (10 hrs/day) per injection event
		29	Purchase equipment/supplies for injection system setup	1	LS	$ 25,000	$ 25,000		Assumed level of effort based on prior experience	Pumps, mixing tanks, hoses, fittings, trailer
		30	Materials and rentals for injection events	3	event	$ 20,000	$ 60,000		Assumed level of effort based on prior experience	Water tank rental, other rental equipment and materials
		31	Water for injection events	285,000	gal	$ 0.03	$ 8,550		Assumed level of effort based on prior experience	Assume 95K gal per event at $0.03/gal
		32	Donor for injection events	36000	lbs	$ 2	$ 54,000		Assumed level of effort based on prior experience	Assume 12K lbs per event at $1.50/lb
		33	Site Restoration - slope/buffer plantings, general cleanup	1	LS	$ 25,000	$ 25,000		Glacier Environmental - approx. cost based on prior similar work	
	Subtotal Remedial Action Construction Costs						*$ 2,565,300*			
	Direct Cost Contingency and Unlisted Engineering Services (%)			**25%**	pct	$2,565,300	$ 641,300		EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 & 5-7	Assumed bid contingency (10% - low end) and scope contingency (15% low end groundwater treatmnet and soil excavation)
	Contractor Bond Fee, Overhead, and Profit (%)			**20%**	pct	$2,740,875	$ 548,200		Standard	Applied to contractor and driller costs only (not injection related costs)
	Washington State Sales Tax (%)			**9.2%**	pct	$ 3,289,075	$302,600		City of Everett/State sales tax rate	Applied to contractor and driller costs
	TOTAL DIRECT COST						**$4,057,000**			
OM&M	**Category**	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**			
	ANNUAL OPERATION, MAINTENANCE, MONITORING, AND REPORTING									
		1	Electrical usage	1	yr	$ 44,500	$ 44,500		SnoPUD commercial electrical rate	Approx. 98 hp of equip. (1743 kw*hr/day x $0.07/kw-hr x 365 days/yr)
		2	Cell phone/GET system remote access charges	12	mo	$ 369	$ 4,428		Frontier commercial rate	$369/month x 12 mo. service for autodialer, alarms, etc
		3	Carbon usage	1	yr	$ 9,600	$ 9,600		Evoqua - estimate; assumed usage rate based on prior consumption	Assume 1 changeout (3,000 lbs GAC) every other year at $9600 per changeout, incl GAC profiling, plus disposal as haz waste
		4	System monitoring/NPDES reporting	1	yr	$ 20,000	$ 20,000		Assumed level of effort based on prior experience	Includes monthly air and water influent/effluent sampling and NPDES DMR
		5	DGR system O&M labor and cost	1	yr	$ 95,000	$ 95,000		Assumed level of effort based on prior experience	Assume 1 FTE, 10 hour days, plus travel/field equip ($1,500/day), four days per month, includes general maintenance and monitoring, response to upset, minor equipment repair and replacement, annual bridge crane inspections,
		6	NPDES annual renewal fee	1	yr	$ 20,137	$ 20,137		Per WAC 173-224-040 fees - 2019 schedule	Per WAC 173-224-040 fee 2019 schedule (Non-LUST Hazardous Waste Cleanup Site; >2 contaminants)
		7	Groundwater sampling (during DGR)	1	yrs	$ 65,000	$ 65,000		Assumed level of effort based on prior experience	Annual sampling for VOCs (158 wells)
		8	Groundwater elevation monitoring (during DGR)	1	yrs	$ 8,000	$ 8,000		Assumed level of effort based on prior experience	Annual water levels (158 wells)
		9	Surface water sampling (during DGR)	1	yrs	$ 8,000	$ 8,000		Assumed level of effort based on prior experience	Annual sampling for VOCs (17 surface water sampling points)
		10	Reporting	1	yr	$ 15,000	$ 15,000		Assumed level of effort based on prior experience	
	Subtotal Annual OM&M and Reporting Cost						$ 289,700			
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$289,700	$ 57,900		EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 &	Assumed bid and scope contingency (10% each)
			Years of Annual Monitoring	***24***	yrs	$347,600	$ 8,342,400			Total estimated operation timeframe to remediation level (based on restoration
	TOTAL ANNUAL OM&M AND REPORTING COST						***$8,342,000***			
	Present-Worth Annual OM&M and Reporting Cost		Presumed Discount Rate	***0.6%***	pct		**$7,748,000**		Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note
	Category	**Item #**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**		**Source/Basis of Unit Costs and Cost Data**	**Assumptions, Comments, and/or Notes**
	NON-ROUTINE OPERATION, MAINTENANCE, MONITORING, AND REPORTING									
		1	Baseline groundwater/surface water sampling	1	event	$ 73,000	$ 73,000		Assumed level of effort based on prior experience	1 complete sampling event prior to remedy implementation for VOCs (155 wells, 17 sw points)
		2	DGR/GET system equipment replacement cost	2.5	event	$ 200,000	$ 500,000		Assumed major equipment replacement after typical lifespan.	Replace failed major equipment (blower, well pumps, labor) after 15 to 20 years of operation
		3	Quarterly groundwater sampling (EISB parameters)	3	yr	$ 95,000	$ 285,000		Approximate drive point well cost base on online vendors and assumed level of effort for installation.	3 yrs qtrly sampling for Metals, Dissolved Gases, TOC following EISB (45 wells)
		4	Quarterly groundwater sampling	12	event	$ 65,000	$ 780,000		Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs after each injection event (158 wells)
		5	Quarterly groundwater elevation monitoring	12	event	$ 8,000	$ 96,000		Assumed level of effort based on prior experience	3 yrs qtrly groundwater level measurements (158 wells)
		6	Quarterly surface water sampling	12	event	$ 8,000	$ 96,000		Assumed level of effort based on prior experience	3 yrs qtrly sampling for VOCs (17 surface water sampling points)
		7	Annual groundwater sampling (EISB parameters post DGR)	14	yrs	$ 65,000	$ 910,000		Assumed level of effort based on prior experience	14 yrs annual sampling in source area for Metals, Dissolved Gases, TOC following EISB (45 wells)
		8	Annual groundwater elevation monitoring (post DGR)	20	yrs	$ 8,000	$ 160,000		Assumed level of effort based on prior experience	20 yrs annual groundwater level measurements (158 wells)
		9	Annual surface water sampling (post DGR)	20	yrs	$ 8,000	$ 160,000		Assumed level of effort based on prior experience	20 yrs annual sampling for VOCs (17 surface water sampling points)
		10	Annual operation of Phase 1 area GET system (post DGR)	20	yrs	$ 185,000	$ 3,700,000		Assume annual operational costs for GET system same as FS Alternative 1 annual	20 yrs O&M, NPDES compliance sampling, permit renewal fees, GAC usage
		11	1.5 years quarterly confirmation sampling	6	event	$ 73,000	$ 438,000		Assumed level of effort based on prior experience	6 qtrs sampling for VOCs (158 wells; 17 sw points)
		12	Cleanup completion report	1	LS	$ 20,000	$ 20,000		Assumed level of effort based on prior experience	Final remediation completion report (year 46)
	Subtotal Non-Routine OM&M and Reporting Cost						$ 7,218,000			
	Annual Monitoring Cost Contingency and Unlisted Items (%)			**20%**	pct	$7,218,000	$ 1,443,600		EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 5-6 &	Assumed bid and scope contingency (10% each)
	TOTAL NON-ROUTINE OM&M AND REPORTING COST						***$8,662,000***			
	Present-Worth Non-Routine OM&M and Reporting Cost		Presumed Discount Rate	***0.6%***	pct		**$7,437,000**		Per Office of Management and Budget, Circular A-94 Appendix C, Revised Feb.	Discount Rate is 0.6% percent (real discount rate - 30 year note)
TOTAL	**ALTERNATIVE COST SUMMARY**									
	TOTAL PRESENT-WORTH REMEDIAL DESIGN, PLANNING, AND GENERAL COST (INDIRECT)						**$3,090,000**			
	TOTAL PRESENT-WORTH REMEDIATION IMPLEMENTATION COST (DIRECT)						**$4,057,000**			
	TOTAL PRESENT-WORTH OM&M COST (ANNUAL & NON-ROUTINE)						**$15,185,000**			
	TOTAL PRESENT-WORTH COST						**$22,330,000**			
	Appropriate Cost Range (-30% - +50%)				**TOTAL**	**$ 15,630,000**	**$ 33,500,000**		EPA Guide to FS Cost Estimates (EPA 540-R-00-002, July 2000), Exhibit 2-3	Accuracy range at Detailed Analysis of Alternatives/Conceptual Design

ATTACHMENT B

Estimated Project Schedule for Point of Compliance Options 1 through 5

Attachmen 2
Estimated Project Schedule
Point of Compliance Options 1 thorugh 5
Boeing Everett - PMG SWMU

	YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061
	REMEDIATION YEAR			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
	TASK																																										
	Cleanup Action Plan/Engineering Design																																										
	Final Cleanup Action Plan Issued																																										
	Prepare Engineering Design Report																																										
	Bidding and Procurement																																										
	Downgradient Plume DGR Remediation																																										
	DGR Pilot Test Construction																																										
	DGR Pilot Test Implementation																																										
	Full Scale DGR System Construction																																										
	Full Scale DGR System Operation																																										
	Source Area Bioremediation																																										
	Injection Well Installation																																										
	Donor Injection Event #1																																										
	Donor Injection Event #2																																										
	Donor Injection Event #3																																										
Option	**Compliance Monitoring Schedule**																																										
Opt 1	DGR Operations/ Monitoring for POC #1				mo/qtr	mo/qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr																								
	Source Area Monitoring for POC #1				qtr	qtr	qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr															
	Final Compliance Sampling for POC #1																											qtr(4)	qtr (2)															
Opt 2a	DGR Operations/ Monitoring for CPOC #2a				mo/qtr	mo/qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr																								
	Source Area Monitoring for CPOC #2a				qtr	qtr	qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr															
	Final Compliance Sampling for CPOC #2a																											qtr(4)	qtr (2)															
Opt 2b	DGR Operations/ Monitoring for CPOC #2b				mo/qtr	mo/qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr																			
	Source Area Monitoring for CPOC #2b				qtr	qtr	qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr															
	Final Compliance Sampling for CPOC #2a																											qtr(4)	qtr (2)															
Opt 3	DGR Operations/ Monitoring for CPOC #3				mo/qtr	mo/qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr															
	Source Area Monitoring for CPOC #3				qtr	qtr	qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr														
	Final Compliance Sampling for CPOC #3																												qtr(4)	qtr (2)														
Opt 4	DGR Operations/ Monitoring for CPOC #4				mo/qtr	mo/qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr															
	GETS Operations/Monitoring for CPOC #4																												yr	yr	yr	yr	yr	yr									
	Source Area Monitoring for CPOC #4				qtr	qtr	qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr									
	Final Compliance Sampling for CPOC #4																																	qtr(4)	qtr (2)								
Opt 5	DGR Operations/ Monitoring for POC #5				mo/qtr	mo/qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr															
	GETS Operations/Monitoring for POC #5																												yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr
	Source Area Monitoring for POC #5				qtr	qtr	qtr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr	yr
	Final Compliance Sampling for POC #5																																									qtr(4)	qtr (2)