

**APPENDIX F**  
**DETAILED COST EVALUATION TABLES**

**Table F1-1: Cost Estimate For B104 Groundwater Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** General site maintenance will be completed for a period of 30 years. Routine monitoring and reporting will be completed on an annual basis to confirm site conditions.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 10,000	\$ 10,000
Project Management	% design	\$ 17,500	8%	\$ 1,400
<b>Total Design and Reporting Cost</b>				\$ <b>18,900</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual Monitoring - Sample Collection, Analysis, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
<b>Subtotal - Annual OM&amp;M</b>				\$ <b>21,125</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ <b>324,743</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ <b>343,643</b>
<b>Contingency (15%)</b>				\$ <b>51,546</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ <b>395,189</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes no additional well installation required to supplement existing monitoring network.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F1-2: Cost Estimate For B104 Groundwater Alternative 2 - Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** MNA will be used to confirm that the groundwater plume from the B104 area is stable or shrinking. Two new wells will be installed to support the MNA program. The number of monitoring locations for the MNA program will decrease over the remedy duration, based on anticipated decreases in the plume magnitude and extent. General site maintenance will also be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Monitoring Well - Zone EF with Geophysics, Packer Testing, Install, Develop, Waste, Survey	Well	2	\$ 56,000	\$ 112,000
<b>Total Capital Cost</b>				<b>\$ 112,000</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 10,000	\$ 10,000
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 5,000	\$ 5,000
Project Management	% design	\$ 15,000	8%	\$ 1,200
<b>Total Design and Reporting Cost</b>				<b>\$ 16,200</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	2	\$ 357	\$ 714
Groundwater Performance Monitoring - MNA Suite	Sample	9	\$ 167	\$ 1,503
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	16	\$ 356	\$ 5,696
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 37,426</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 499,542</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 627,742</b>
<b>Contingency (15%)</b>				<b>\$ 94,161</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 721,903</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes minimal additional well installation required to supplement existing monitoring network.
- Assumes initial MNA performance monitoring program (PMP) will consist of 6 wells (i.e., 6 Zone EF wells) and 2 surface water locations. This MNA program is intended to represent about 25% of the total annual MNA program for the Front Valley based on four AOIs requiring source MFR. The program for B139 is somewhat less than the other three AOIs as the groundwater plume is limited to Zone EF.
- Assumes number of wells in the MNA PMP decreases by 30% every five years.
- Assumes each sample is analyzed for volatile organic compounds (VOCs), nitroaromatics, and perchlorate. Assumes 60% of locations are analyzed for MNA parameters (i.e., dissolved hydrocarbon gases [DHGs], total organic carbon [TOC], and select anions) and 15% of locations for select dissolved metals.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F1-3: Cost Estimate For B104 Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Pump and treat will be used to capture the COC plume from the B104 Area, with one new Zone CD extraction well and one existing Zone EF well used for extraction. In addition, one new shallow Zone EF monitoring well will be installed to support remedy evaluation, including the MNA program. The total flow rate is anticipated to be 6 gpm. Prior to implementation, a pre-design investigation will be used to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include installation of one monitoring well, which would also be used to support the MNA program. The treatment system will be housed in the existing FV P&T system building, however the existing air stripper will be replaced to allow sufficient capacity for extracted groundwater from B104 and other P&T areas in the FV. Conduits from B104 will be trenched to tie into the existing subsurface conduits from the B116 area. It is expected that the extraction wells will be replaced in Years 10, 20 and 30, and the treatment system will be replaced in Year 20. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, remedy performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	0.5	\$ 7,000	\$ 3,500
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 40,000	\$ 40,000
Monitoring Well - Zone EF with Geophysics, Packer Testing, Install, Develop, Waste, Survey	Well	1	\$ 56,000	\$ 56,000
Extraction Well - Zone CD Installation, Development, Waste Management, Survey	Well	1	\$ 30,600	\$ 30,600
Extraction Pump/Install + Wellhead Piping: Grundfos Redi-Flo3 w/Controller interface, Teflon cabling pkg.	Well	2	\$ 4,940	\$ 9,880
Utility Clearance Pipeline	SF	600	\$ 2.00	\$ 1,200
Trenching, Piping, Wiring, Electrical to Treatment System	LF	200	\$ 40	\$ 8,000
Roll-Off for Waste Containerization	LS	2	\$ 2,600	\$ 5,200
Off-Site Disposal - Non-hazardous	ton	70	\$ 40	\$ 2,800
Clean Fill Placement, Compaction & Grading	CY	60	\$ 15	\$ 900
Extraction Well Housing/Protection	LS	2	\$ 5,000	\$ 10,000
Air Stripper	LS	0.25	\$ 30,000	\$ 7,500
Filtration	LS	0.25	\$ 3,000	\$ 750
Controls, Piping and Instrumentation	LS	0.25	\$ 10,000	\$ 2,500
Mechanical and Electrical Installation - 75% of System Materials and Equipment	%	\$ 48,730	75%	\$ 36,548
<b>Total Capital Cost</b>				<b>\$ 216,878</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 216,878	12%	\$ 26,025
Construction Management & As Built Report	% capital	\$ 216,878	8%	\$ 17,350
Health and Safety	% capital	\$ 216,878	2%	\$ 4,338
Project Management	% capital	\$ 216,878	6%	\$ 13,013
System Startup	% capital	\$ 216,878	4%	\$ 8,675
Mark-up on Subcontract Services	% Subs	\$ 171,878	5%	\$ 8,594
<b>Total Design and Reporting Cost</b>				<b>\$ 77,995</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - P&T System Maintenance and Part Replacement	% capital	\$ 66,498	5%	\$ 3,325
Annual O&M - Semi-Annual MSD Sample Collection, Analysis, Report Preparation	LS	1	\$ 5,000	\$ 5,000
Annual O&M - MSD Discharge Fees	MGAL	3154	\$ 4.00	\$ 12,614
Annual O&M - Electrical	kWh	39200	\$ 0.11	\$ 4,312
Consumables - Water	LS	1	\$ 2,000	\$ 2,000
Well Rehabilitation	well	2	\$ 1,500	\$ 3,000
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	2	\$ 357	\$ 714
Groundwater Performance Monitoring - MNA Suite	Sample	9	\$ 167	\$ 1,503
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	16	\$ 356	\$ 5,696
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 67,677</b>
<b>SYSTEM REPLACEMENT - WELLS YEARS 10, 20, 30, COMPLETE SYSTEM YEAR 20</b>				
Capital Costs of Initial Installation + Well Decommissioning + 20% for Planning, Project Management, Construction Management and Health and Safety	LS	1	\$ 127,920	\$ 127,920
Construction, design and reporting costs associated with replacement of the treatment system and wells in Year 20	LS	1	\$ 294,872	\$ 294,872
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 1,183,842</b>

**Table F1-3: Cost Estimate For B104 Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>	<b>\$ 1,478,714</b>
<b>Contingency (15%)</b>	<b>\$ 221,807</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>	<b>\$ 1,700,521</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes minimal additional well installation required to supplement existing monitoring network.
- Assumes that P&T + MNA is the selected remedy for the entire Front Valley, with 25% of capital, construction and O&M costs assigned to B104.
- Assumes no UXO is identified during UXO clearance.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F1-4: Cost Estimate For B104 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation (Anaerobic) and Monitored Natural Attenuation (MNA)**  
**Chemtronics Site, Swannanoa, North Carolina**

**Description:** EISB will be used to treat COC source area in the B104 Area using a semi-passive recirculation approach. A pre-design investigation will be completed to confirm COC distribution to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include installation of one monitoring well, which will also be used to support the MNA program. The existing pilot test system will be expanded to provide recirculation to three new injection wells and one new extraction well to provide treatment in Zone CD and shallow Zone EF (80 to 140 ft bgs). Recirculation will be completed periodically to deliver electron donor, and potentially buffer and bioaugmentation culture, to the target interval for up to two years. At the end of each recirculation cycle a long term electron donor will be amended to extend EISB between injection events. At Year 3, the program is expected to transition to MNA, for a total remedy duration of 30 years. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 40,000	\$ 40,000
Injection/Extraction Well - Zone CD Installation, Development, Waste Management, Survey	well	2	\$ 30,600	\$ 61,200
Injection/Extraction Well - Zone EF Geophysics, Packer Testing, Install, Develop, Waste, Survey	well	2	\$ 56,000	\$ 112,000
Misc Equipment, Supplies, Sampling Equipment	week	3	\$ 1,000	\$ 3,000
Skid Steer	week	3	\$ 860	\$ 2,580
Recirculation System Upgrade (conduit to wells, panel upgrade, controls)	LS	1	\$ 30,000	\$ 30,000
<b>Total Capital Cost</b>				<b>\$ 257,280</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 257,280	12%	\$ 30,874
Construction Management & As Built Report	% capital	\$ 257,280	8%	\$ 20,582
Health and Safety	% capital	\$ 257,280	2%	\$ 5,146
Project Management	% capital	\$ 257,280	6%	\$ 15,437
Mark-up on Subcontract Services	% subs.	\$ 208,780	5%	\$ 10,439
<b>Total Design and Reporting Cost</b>				<b>\$ 82,477</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEARS 1 TO 2</b>				
Annual Monitoring - Sample Collection, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - Recirculation System Maintenance and Part Replacement. Cost Based on Cost to Maintain the Existing System (Capital Cost of \$40,000) and Upgrades Listed Above	% capital		\$ 72,580	10% \$ 7,258
Annual O&M - Operator Oversight, 2 hr/day During Recirc	day		\$ 640	34 \$ 21,600
Annual O&M - Electrical	kWh	39,200	\$ 0.11	\$ 4,312
Well Rehabilitation	well	6	\$ 1,500	\$ 9,000
EVO Electron Donor	lb	6,500	\$ 1.70	\$ 11,050
Sodium Lactate Electron Donor	lb	6,500	\$ 2.00	\$ 13,000
pH Buffer, Sodium Bicarbonate	lb	200	\$ 0.60	\$ 120
KB-1 Culture - Low pH	lb	30	\$ 300	\$ 9,000
Recirculation Performance Monitoring - VOCs only (Analytical and Sample)	Sample	24	\$ 446	\$ 10,704
Sample Collection Labor and Equipment	Well	10	\$ 356	\$ 3,560
Groundwater Performance Monitoring - MNA Suite	Sample	10	\$ 167	\$ 1,670
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	10	\$ 357	\$ 3,570
Groundwater Performance Monitoring - Molecular	Sample	4	\$ 200	\$ 800
Remedy Performance Data Analysis & Reporting	year	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEARS 1 TO 2</b>				<b>\$ 131,769</b>
<b>ANNUAL OM&amp;M - YEARS 3 TO 30</b>				
MNA Monitoring & Reporting Program and General Site Maintenance (see Table F1-2)	LS	1	\$ 37,426	\$ 37,426
<b>Subtotal - Annual OM&amp;M - YEARS 3 TO 30</b>				<b>\$ 37,426</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 678,259</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,018,016</b>
<b>Contingency (15%)</b>				<b>\$ 152,702</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 1,170,718</b>

**Table F1-4: Cost Estimate For B104 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation (Anaerobic) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

Notes:

1. Costs are estimated within -30% / +50%.
2. Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
3. General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
4. Assumes minimal additional monitoring well installation required to supplement existing monitoring network.
5. Bioaugmentation is not included after Year 1 as it is assumed that the previous bioaugmentation event will be sufficient.
6. Assumes no UXO is identified during UXO clearance.
7. O&M maintenance costs include capital costs of \$40,000 for the existing recirculation equipment components.
8. Assumes number of wells in the MNA PMP decreases by 30% every five years.
9. Decommissioning costs, after remedy completion, are not included.
10. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F2-1: Cost Estimate For B105 and B147 Groundwater Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** General site maintenance will be completed for a period of 30 years. Routine monitoring and reporting will be completed on an annual basis to confirm site conditions.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 5,000	\$ 5,000
Project Management	% design	\$ 12,500	8%	\$ 1,000
<b>Total Design and Reporting Cost</b>				\$ <b>13,500</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual Monitoring - Sample Collection, Analysis, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
<b>Subtotal - Annual OM&amp;M</b>				\$ <b>21,125</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ <b>324,743</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ <b>338,243</b>
<b>Contingency (15%)</b>				\$ <b>50,736</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ <b>388,979</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes no additional well installation required to supplement existing monitoring network.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F2-2: Cost Estimate For B105 and B147 Groundwater Alternative 2 - Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** MNA will be used to confirm that the groundwater plume from the B105 and B147 areas is stable or shrinking. Two new monitoring wells will be installed to support the MNA program. The number of monitoring locations for the MNA program will decrease over the remedy duration, based on anticipated decreases in the plume magnitude and extent. General site maintenance will also be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, remedy performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Monitoring Well - Zone AB Installation, Development, Waste Management, Survey	Well	2	\$ 8,350	\$ 16,700
<b>Total Capital Cost</b>				<b>\$ 16,700</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 10,000	\$ 10,000
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 5,000	\$ 5,000
Project Management	% design	\$ 15,000	8%	\$ 1,200
<b>Total Design and Reporting Cost</b>				<b>\$ 16,200</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	2	\$ 357	\$ 714
Groundwater Performance Monitoring - MNA Suite	Sample	9	\$ 167	\$ 1,503
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	16	\$ 356	\$ 5,696
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 37,426</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 499,542</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 532,442</b>
<b>Contingency (15%)</b>				<b>\$ 79,866</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 612,308</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes minimal additional well installation required to supplement existing monitoring network.
- Assumes initial MNA performance monitoring program (PMP) will consist of 6 wells (i.e., 6 Zone EF wells) and 2 surface water locations. This MNA program is intended to represent about 25% of the total annual MNA program for the Front Valley based on four AOIs requiring source MFR. The program for B139 is somewhat less than the other three AOIs as the groundwater plume is limited to Zone EF.
- Assumes number of wells in the MNA PMP decreases by 30% every five years.
- Assumes each sample is analyzed for volatile organic compounds (VOCs), nitroaromatics, and perchlorate. Assumes 60% of locations are analyzed for MNA parameters (i.e., dissolved hydrocarbon gases [DHGs], total organic carbon [TOC], and select anions) and 15% of locations for select dissolved metals.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F2-3: Cost Estimate For B105 and B147 Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Pump and treat will be used to capture the COC plume from the B105 and B147 Areas, with three new Zone AB extraction wells installed in each area for a total estimated flow of 6 gpm. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include installation of 2 monitoring wells between and adjacent to the existing pilot test areas and associated soil and groundwater sampling. The treatment system will be housed in the existing FV P&T system building, however the existing air stripper will be replaced to allow sufficient capacity for extracted groundwater from B105 and B147 and other P&T areas in the FV. Conduits from B105 and B147 will be trenched to tie into the existing subsurface conduits in the B116 area. It is expected that the extraction wells will be replaced in Years 10, 20 and 30, and the treatment system will be replaced in Year 20. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, remedy performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Site Preparation	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 30,000	\$ 30,000
Extraction Well Installation, Development, Waste Management, Survey	Well	6	\$ 11,500	\$ 69,000
Extraction Pump/Install + Wellhead Piping: Grundfos Redi-Flo3 w/Controller interface, Teflon cabling pkg.	Well	6	\$ 4,940	\$ 29,640
Utility Clearance Pipeline	SF	2700	\$ 2.00	\$ 5,400
Trenching, Piping, Wiring, Electrical to Treatment System	LF	900	\$ 40	\$ 36,000
Roll-Off for Waste Containerization	LS	7	\$ 2,600	\$ 18,200
Off-Site Disposal - Non-hazardous	ton	310	\$ 40	\$ 12,400
Clean Fill Placement, Compaction & Grading	CY	270	\$ 15	\$ 4,050
Extraction Well Housing/Protection	LS	6	\$ 5,000	\$ 30,000
Air Stripper	LS	0.25	\$ 30,000	\$ 7,500
Filtration	LS	0.25	\$ 3,000	\$ 750
Controls, Piping and Instrumentation	LS	0.25	\$ 10,000	\$ 2,500
Mechanical and Electrical Installation - 75% of System Materials and Equipment	%	\$ 146,440	75%	\$ 109,830
<b>Total Capital Cost</b>				<b>\$ 363,770</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 363,770	12%	\$ 43,652
Construction Management & As Built Report	% capital	\$ 363,770	8%	\$ 29,102
Health and Safety	% capital	\$ 363,770	2%	\$ 7,275
Project Management	% capital	\$ 363,770	6%	\$ 21,826
System Startup	% capital	\$ 363,770	4%	\$ 14,551
Mark-up on Subcontract Services	% Subs	\$ 325,270	5%	\$ 16,264
<b>Total Design and Reporting Cost</b>				<b>\$ 132,670</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - P&T System Maintenance and Part Replacement	% capital	\$ 198,420	5%	\$ 9,921
Annual O&M - Semi-Annual MSD Sample Collection, Analysis, Report Preparation	LS	1	\$ 5,000	\$ 5,000
Annual O&M - MSD Discharge Fees	MGAL	3154	\$ 4.00	\$ 12,614
Annual O&M - Electrical	kWh	65400	\$ 0.11	\$ 7,194
Consumables - Water	LS	1	\$ 2,000	\$ 2,000
Well Rehabilitation	well	3	\$ 1,500	\$ 4,500
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	2	\$ 357	\$ 714
Groundwater Performance Monitoring - MNA Suite	Sample	9	\$ 167	\$ 1,503
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	16	\$ 356	\$ 5,696
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 78,655</b>
<b>SYSTEM REPLACEMENT - WELLS YEARS 10, 20, 30, COMPLETE SYSTEM YEAR 20</b>				
Capital Costs of Initial Installation + Well Decommissioning + 20% for Planning, Project Management, Construction Management and Health and Safety	LS	1	\$ 118,800	\$ 118,800
Construction, design and reporting costs associated with replacement of the treatment system and wells in Year 20	LS	1	\$ 496,440	\$ 496,440
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 1,420,862</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,917,302</b>
<b>Contingency (15%)</b>				<b>\$ 287,595</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 2,204,898</b>

**Table F2-3: Cost Estimate For B105 and B147 Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

## Notes:

1. Costs are estimated within -30% / +50%.
2. General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
3. Assumes no UXO is identified during UXO clearance.
4. Assumes minimal additional well installation required to supplement existing monitoring network.
5. Assumes that P&T + MNA is the selected remedy for the entire Front Valley, with 25% of capital, construction and O&M costs assigned to B105 and B147.
6. Decommissioning costs, after remedy completion, are not included.
7. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F2-4: Cost Estimate For B105 and B147 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation Using Passive Approach and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** EISB will be used to treat the COC source area in the B105 and B147 Areas. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include installation of 3 monitoring wells between the existing pilot test areas and associated soil and groundwater sampling. The berm between B105 and B147 will be cleared, graded and compacted to allow treatment between the two areas. An additional 19 injection points will be installed around and between the pilot test areas. Electron donor, buffers, and bioaugmentation culture will be injected into the new wells and within the pilot test areas where COCs meet the threshold for MFR. A second injection event will be completed at Year 3 if necessary. At Year 6 the program is expected to transition to MNA. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 45,000	\$ 45,000
Grading Berm	CY	1485	\$ 10	\$ 14,850
Injection Well - Zone AB Installation, Development, Waste Management, Survey	Well	19	\$ 8,350	\$ 158,650
EVO Electron Donor	lb	36,300	\$ 1.70	\$ 61,710
Sodium Lactate Electron Donor	lb	7,700	\$ 2.00	\$ 15,400
pH Buffer, Sodium Bicarbonate	lb	32,100	\$ 0.60	\$ 19,260
pH Buffer, Neutral Zone	lb	22,900	\$ 2.25	\$ 51,525
KB-1 Culture - Low pH	L	57	\$ 300	\$ 17,100
Injection Preparation & Demobilization Activities	Day	5	\$ 1,440	\$ 7,200
Injection Field Activities	Day	50	\$ 2,600	\$ 130,000
Generator - Diesel 56 kW and Fuel	week	10	\$ 1,400	\$ 14,000
Misc Equipment, Supplies, Sampling Equipment	week	10	\$ 1,000	\$ 10,000
Water Supply	Day	50	\$ 150	\$ 7,500
Skid Steer	Week	10	\$ 860	\$ 8,600
Site Injection Trailer - O&M Cost	Day	50	\$ 50	\$ 2,500
<b>Total Capital Cost</b>				<b>\$ 571,795</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 571,795	12%	\$ 68,615
Construction Management & As Built Report	% capital	\$ 571,795	8%	\$ 45,744
Health and Safety	% capital	\$ 571,795	2%	\$ 11,436
Project Management	% capital	\$ 571,795	6%	\$ 34,308
Mark-up on Subcontract Services	% subs.	\$ 388,095	5%	\$ 19,405
<b>Total Design and Reporting Cost</b>				<b>\$ 179,507</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEARS 1 TO 6</b>				
Annual Monitoring - Sample Collection, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Groundwater Performance Monitoring - MNA Suite	Sample	10	\$ 167	\$ 1,670
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	10	\$ 357	\$ 3,570
Groundwater Performance Monitoring - Molecular	Sample	3	\$ 200	\$ 600
Sample Collection Labor and Equipment	Well	10	\$ 356	\$ 3,560
Remedy Performance Data Analysis & Reporting	year	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEARS 1 TO 6</b>				<b>\$ 45,525</b>
<b>ANNUAL OM&amp;M - YEARS 7 TO 30</b>				
MNA Monitoring & Reporting Program and General Site Maintenance (see Table F2-2)	LS	1	\$ 37,426	\$ 37,426
<b>Subtotal - Annual OM&amp;M - YEARS 7 TO 30</b>				<b>\$ 37,426</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>REINJECTION EVENT - YEAR 3</b>				
Injection Capital Costs of Initial Event + 20% for Planning, Project Management, Construction Management and Health and Safety				<b>\$ 400,102</b>
<b>Estimated Total OM&amp;M</b>				<b>\$ 889,056</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,640,358</b>
<b>Contingency (15%)</b>				<b>\$ 246,054</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 1,886,412</b>

**Table F2-4: Cost Estimate For B105 and B147 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation Using Passive Approach and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

Notes:

1. Costs are estimated within -30% / +50%.
2. Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
3. General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
4. Assumes minimal additional well installation required to supplement existing monitoring network.
5. Bioaugmentation is not included in the reinjection event as it is assumed that the previous bioaugmentation event will be sufficient.
6. Assumes no UXO is identified during UXO clearance.
7. Graded berm materials will remain on-site.
8. Assumes number of wells in the MNA PMP decreases by 30% every five years.
9. Decommissioning costs, after remedy completion, are not included.
10. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F2-5: Cost Estimate For B105 and B147 Groundwater Alternative 5 - In Situ Chemical Reduction (ZVI PRB) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** A ZVI PRB will be installed in Zone AB downgradient of B105 and B147 to treat VOCs transporting downgradient of these areas. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction and support the PRB design. This is expected to include installation of up to 4 monitoring wells along the proposed alignment of the ZVI PRB and associated groundwater sampling. The PRB will be 1.3 feet wide to provide sufficient residence time for COC treatment. The PRB will be installed to a total depth of about 30 feet below ground surface to intersect the groundwater plume and will be installed using a biopolymer slurry. The PRB will be reinstalled at Year 15 to maintain treatment effectiveness. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 50,000	\$ 50,000
Monitoring Well - Zone AB Installation, Development, Waste Management, Survey	Well	4	\$ 8,350	\$ 33,400
ZVI	ton	308	\$ 1,400	\$ 430,920
Sand-ZVI Mixing	LS	1	\$ 80,000	\$ 80,000
PRB Installation	LS	1	\$ 293,000	\$ 293,000
Off-Site Disposal - Non-hazardous	CY	600	\$ 40	\$ 24,000
Roll-Off for Waste Containerization	LS	15	\$ 2,600	\$ 39,000
Generator - Diesel 56 kW and Fuel	week	2	\$ 1,400	\$ 2,800
Misc Equipment, Supplies, Sampling Equipment	week	2	\$ 1,000	\$ 2,000
Water Supply	Day	10	\$ 150	\$ 1,500
Construction supervision/oversight (Technician and Staff Professional)	Day	10	\$ 2,600	\$ 26,000
<b>Total Capital Cost</b>				<b>\$ 991,120</b>
<b>DESIGN AND REPORTING COSTS</b>				
Bench Scale ZVI Column Test + GW collection	LS	1	\$ 30,000	\$ 30,000
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 991,120	12%	\$ 118,934
Construction Management & As Built Report	% capital	\$ 991,120	8%	\$ 79,290
Health and Safety	% capital	\$ 991,120	2%	\$ 19,822
Project Management	% capital	\$ 991,120	6%	\$ 59,467
Mark-up on Subcontract Services	% subs.	\$ 837,320	5%	\$ 41,866
<b>Total Design and Reporting Cost</b>				<b>\$ 319,380</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEARS 1 TO 30</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	2	\$ 357	\$ 714
Groundwater Performance Monitoring - MNA Suite	Sample	9	\$ 167	\$ 1,503
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	16	\$ 356.00	\$ 5,696
Remedy Performance Data Analysis & Reporting	year	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEARS 1 TO 30</b>				<b>\$ 37,426</b>
<b>RE-INSTALLATION EVENT - YEAR 15</b>				
PRB Installation Capital Costs + 20% for Planning, Project Management, Construction Management and Health and Safety				<b>\$ 963,096</b>
<b>Estimated Total OM&amp;M</b>				<b>\$ 962,807</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 2,273,307</b>
<b>Contingency (15%)</b>				<b>\$ 340,996</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 2,614,303</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes no UXO is identified during UXO clearance.
- Assumes number of wells in the MNA PMP decreases by 30% every five years.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F3-1 Cost Estimate For B139 Groundwater Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** General site maintenance will be completed for a period of 30 years. Routine monitoring and reporting will be completed on an annual basis to confirm site conditions.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 5,000	\$ 5,000
Project Management	% design	\$ 12,500	8%	\$ 1,000
<b>Total Design and Reporting Cost</b>				\$ <b>13,500</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual Monitoring - Sample Collection, Analysis, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
<b>Subtotal - Annual OM&amp;M</b>				\$ <b>21,125</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ <b>324,743</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ <b>338,243</b>
<b>Contingency (15%)</b>				\$ <b>48,711</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ <b>386,954</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes no additional well installation required to supplement existing monitoring network.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F3-2 Cost Estimate For B139 Groundwater Alternative 2 - Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** MNA will be used to confirm that the groundwater plume from the B139 Area is stable or shrinking. Two new monitoring wells will be installed to support the MNA program. The number of monitoring locations for the MNA program will decrease over the remedy duration, based on anticipated decreases in the plume magnitude and extent. General site maintenance will also be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Monitoring Well - Zone EF with Geophysics, Packer Testing, Install, Develop, Waste, Survey	Well	2	\$ 56,000	\$ 112,000
<b>Total Capital Cost</b>				<b>\$ 112,000</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 10,000	\$ 10,000
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 5,000	\$ 5,000
Project Management	% design	\$ 15,000	8%	\$ 1,200
<b>Total Design and Reporting Cost</b>				<b>\$ 16,200</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	6	\$ 357	\$ 2,142
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	2	\$ 357	\$ 714
Groundwater Performance Monitoring - MNA Suite	Sample	4	\$ 167	\$ 668
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	1	\$ 70	\$ 70
Sample Collection Labor and Equipment	Well	8	\$ 356	\$ 2,848
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 30,817</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 448,301</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 576,501</b>
<b>Contingency (15%)</b>				<b>\$ 86,475</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 662,977</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes minimal additional well installation required to supplement existing monitoring network.
- Assumes initial MNA performance monitoring program (PMP) will consist of 6 wells (i.e., 6 Zone EF wells) and 2 surface water locations. This MNA program is intended to represent about 25% of the total annual MNA program for the Front Valley based on four AOIs requiring source MFR. The program for B139 is somewhat less than the other three AOIs as the groundwater plume is limited to Zone EF.
- Assumes number of wells in the MNA PMP decreases by 30% every five years.
- Assumes each sample is analyzed for volatile organic compounds (VOCs), nitroaromatics, and perchlorate. Assumes 60% of locations are analyzed for MNA parameters (i.e., dissolved hydrocarbon gases [DHGs], total organic carbon [TOC], and select anions) and 15% of locations for select dissolved metals.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F3-3 Cost Estimate For B139 Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Pump and treat will be used to capture the COC plume from the B139 Area, with one new Zone EF extraction well installed in the area for a total estimated flow of 3 gpm. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction, including installation of at least one new Zone EF monitoring well and bedrock characterization. This well would also be used to support the MNA program. The treatment system will be housed in the existing FV P&T system building, however the existing air stripper will be replaced to allow sufficient capacity for extracted groundwater from B139 and other P&T areas in the FV. Conduits from B139 will be trenched to tie into the existing subsurface conduits in the B116 area. It is expected that the extraction wells will be replaced in Years 10, 20 and 30, and the treatment system will be replaced in Year 20. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, remedy performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Site Preparation	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 80,000	\$ 80,000
Extraction Well Installation, Development, Waste Management, Survey, Includes Geophysics and Packer Testing	Well	1	\$ 56,000	\$ 56,000
Extraction Pump/Install + Wellhead Piping: Grundfos Redi-Flo3 w/Controller interface, Teflon cabling pkg.	Well	1	\$ 4,940	\$ 4,940
Utility Clearance Pipeline	SF	1800	\$ 2.00	\$ 3,600
Trenching, Piping, Wiring, Electrical to Treatment System	LF	600	\$ 40	\$ 24,000
Roll-Off for Waste Characterization	LS	5	\$ 2,600	\$ 13,000
Off-Site Disposal - Non-hazardous	ton	210	\$ 40	\$ 8,400
Clean Fill Placement, Compaction & Grading	CY	180	\$ 15	\$ 2,700
Extraction Well Housing/Protection	LS	1	\$ 5,000	\$ 5,000
Air Stripper	LS	0.25	\$ 30,000	\$ 7,500
Filtration	LS	0.25	\$ 3,000	\$ 750
Controls, Piping and Instrumentation	LS	0.25	\$ 10,000	\$ 2,500
Mechanical and Electrical Installation - 75% of System Materials and Equipment	%	\$ 61,640	75%	\$ 46,230
<b>Total Capital Cost</b>				<b>\$ 263,120</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 263,120	12%	\$ 31,574
Construction Management & As Built Report	% capital	\$ 263,120	8%	\$ 21,050
Health and Safety	% capital	\$ 263,120	2%	\$ 5,262
Project Management	% capital	\$ 263,120	6%	\$ 15,787
System Startup	% capital	\$ 263,120	4%	\$ 10,525
Mark-up on Subcontract Services	% Subs	\$ 174,620	5%	\$ 8,731
<b>Total Design and Reporting Cost</b>				<b>\$ 92,929</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - P&T System Maintenance and Part Replacement	% capital	\$ 124,520	5%	\$ 6,226
Annual O&M - Semi-Annual MSD Sample Collection, Analysis, Report Preparation	LS	1	\$ 5,000	\$ 5,000
Annual O&M - MSD Discharge Fees	MGAL	1577	\$ 4.00	\$ 6,307
Annual O&M - Electrical	kWh	32700	\$ 0.11	\$ 3,597
Well Rehabilitation	well	1	\$ 1,500	\$ 1,500
Consumables - Water	LS	1	\$ 2,000	\$ 2,000
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	6	\$ 357	\$ 2,142
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	2	\$ 357	\$ 714
Groundwater Performance Monitoring - MNA Suite	Sample	4	\$ 167	\$ 668
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	1	\$ 70	\$ 70
Sample Collection Labor and Equipment	Well	8	\$ 356	\$ 2,848
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 55,447</b>
<b>SYSTEM REPLACEMENT - WELLS YEARS 10, 20, 30, COMPLETE SYSTEM YEAR 20</b>				
Capital Costs of Initial Installation + Well Decommissioning + 20% for Planning, Project Management, Construction Management and Health and Safety	LS	1	\$ 79,200	\$ 79,200
Construction, design and reporting costs associated with replacement of the treatment system and wells in Year 20	LS	1	\$ 356,049	\$ 356,049
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 997,321</b>

**Table F3-3 Cost Estimate For B139 Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>	<b>\$ 1,353,371</b>
<b>Contingency (15%)</b>	<b>\$ 203,006</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>	<b>\$ 1,556,376</b>

---

## Notes:

1. Costs are estimated within -30% / +50%.
2. General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
3. System O&M costs assume capital value of \$30,000 for the existing air stripper and associated equipment.
4. Decommissioning costs, after remedy completion, are not included.
5. Assumes minimal additional well installation required to supplement existing monitoring network.
6. Assumes that P&T + MNA is the selected remedy for the entire Front Valley, with 25% of capital, construction and O&M costs assigned to B139.
7. Assumes no UXO is identified during UXO clearance.
8. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F3-4 Cost Estimate For B139 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation (Anaerobic) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Anaerobic EISB will be used to treat the COC source area in the B139 Area. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include installation of a new Zone EF well which would also be used to support the MNA program. A recirculation system will be constructed using two new injection wells and one new extraction well in shallow Zone EF. Recirculation will be completed periodically to deliver electron donor, and potentially buffer and bioaugmentation culture, to the target interval for up to two years. At the end of each recirculation cycle, a long-term electron donor will be amended to extend EISB between injection events. At Year 3, the program is expected to transition to MNA. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Site Preparation	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Road Construction	SY	400	\$ 26	\$ 10,400
Pre-Design Investigation	LS	1	\$ 80,000	\$ 80,000
Injection/Extraction Well - Zone EF Installation, Development, Waste Management, Survey	Well	3	\$ 56,200	\$ 168,600
Electrical Service Installation (poles, transformer, extension from B104)	LS	1	\$ 15,000	\$ 15,000
Recirculation System Components (connex box, tanks, pumps, conduit, well head components, conduit to wells, winterization)	LS	1	\$ 30,000	\$ 30,000
Mechanical and Electrical Installation - 75% of System Materials and Equipment	%	\$ 30,000	75%	\$ 22,500
<b>Total Capital Cost</b>				<b>\$ 335,000</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 335,000	12%	\$ 40,200
Construction Management & As Built Report	% capital	\$ 335,000	8%	\$ 26,800
Health and Safety	% capital	\$ 335,000	2%	\$ 6,700
Project Management	% capital	\$ 335,000	6%	\$ 20,100
Mark-up on Subcontract Services	% subs.	\$ 243,100	5%	\$ 12,155
<b>Total Design and Reporting Cost</b>				<b>\$ 105,955</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEARS 1 TO 2</b>				
Annual Monitoring - Sample Collection, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - Recirculation System Maintenance and Part Replacement	% capital	\$ 52,500	5%	\$ 2,625
Annual O&M - Operator Oversight, 1 hr/day During Recirc	day	\$ 1,100	17	\$ 18,563
Annual O&M - Electrical	kWh	26,200	\$ 0.11	\$ 2,882
EVO Electron Donor	lb	3,300	\$ 1.70	\$ 5,610
Sodium Lactate Electron Donor	lb	4,400	\$ 2.00	\$ 8,800
KB-1 Culture	L	40	\$ 200	\$ 8,000
Recirculation Performance Monitoring - VOCs only (Analytical and Sample)	Sample	12	\$ 446	\$ 5,352
Sample Collection Labor and Equipment	Well	6	\$ 356	\$ 2,136
Groundwater Performance Monitoring - MNA Suite	Sample	6	\$ 167	\$ 1,002
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	6	\$ 357	\$ 2,142
Groundwater Performance Monitoring - Molecular	Sample	2	\$ 200	\$ 400
Well Rehabilitation	well	2	\$ 1,500	\$ 3,000
Remedy Performance Data Analysis & Reporting	year	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEARS 1 TO 2</b>				<b>\$ 96,637</b>
<b>ANNUAL OM&amp;M - YEARS 3 TO 30</b>				
MNA Monitoring & Reporting Program and General Site Maintenance (see Table F3-2)	LS	1	\$ 30,817	\$ 30,817
<b>Subtotal - Annual OM&amp;M - YEARS 3 TO 30</b>				<b>\$ 30,817</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 559,057</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,000,012</b>
<b>Contingency (15%)</b>				<b>\$ 150,002</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 1,150,014</b>

**Table F3-4 Cost Estimate For B139 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation (Anaerobic) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

Notes:

1. Costs are estimated within -30% / +50%.
2. Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
3. General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
4. Assumes minimal additional well installation required to supplement existing monitoring network.
5. Bioaugmentation is not included in the reinjection event as it is assumed that the previous bioaugmentation event will be sufficient.
6. Assumes no UXO is identified during UXO clearance.
7. Assumes number of wells in the MNA PMP decreases by 30% every five years.
8. Decommissioning costs, after remedy completion, are not included.
9. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F3-5 Cost Estimate For B139 Groundwater Alternative 5A - Enhanced In-Situ Bioremediation (Aerobic - Hydrogen Peroxide) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Aerobic EISB will be used to treat the COC source area in the B139 Area. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include installation of a new Zone EF well which would also be used to support the MNA program. Two new injection wells and one new extraction well will be constructed in shallow Zone EF. The existing on-site injection equipment will be used to support injection of hydrogen peroxide. Groundwater extraction will also be employed to enhance transport of hydrogen peroxide within the TTA, and the extracted groundwater will be amended with hydrogen peroxide peroxide and reinjected with new equipment for this purpose. Injections will be completed every other month to maintain oxygen concentrations for up to two years. At Year 3, the program is expected to transition to MNA. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Road Construction	SY	400	\$ 26	\$ 10,400
Pre-Design Investigation	LS	1	\$ 80,000	\$ 80,000
Injection Well - Zone EF Installation, Development, Waste Management, Survey	Well	3	\$ 56,200	\$ 168,600
Electrical Service Installation (poles, transformer, extension from B104)	LS	1	\$ 15,000	\$ 15,000
Recirculation System Components (connex box, conduit, well head components, conduit to wells, winterization)	LS	1	\$ 25,000	\$ 25,000
Mechanical and Electrical Installation - 75% of System Materials and Equipment	%	\$ 25,000	75%	\$ 18,750
<b>Total Capital Cost</b>				<b>\$ 326,250</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 326,250	12%	\$ 39,150
Construction Management & As Built Report	% capital	\$ 326,250	8%	\$ 26,100
Health and Safety	% capital	\$ 326,250	2%	\$ 6,525
Project Management	% capital	\$ 326,250	6%	\$ 19,575
Mark-up on Subcontract Services	% subs.	\$ 219,350	5%	\$ 10,968
<b>Total Design and Reporting Cost</b>				<b>\$ 102,318</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEARS 1 TO 2</b>				
Annual Monitoring - Sample Collection, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - Peroxide System Maintenance and Part Replacement	% capital	\$ 43,750	5%	\$ 2,188
Injection Activities - Average of 4 days/month	day	48	\$ 1,100	\$ 52,800
Hydrogen Peroxide	lb	1,200	\$ 1.50	\$ 1,800
Gas for Generator	day	48	\$ 10.00	\$ 480
Quarterly Performance Monitoring - VOCs only (Analytical and Sample)	Sample	12	\$ 446	\$ 5,352
Sample Collection Labor and Equipment	Well	6	\$ 356	\$ 2,136
Groundwater Performance Monitoring - MNA Suite	Sample	6	\$ 167	\$ 1,002
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	6	\$ 357	\$ 2,142
Remedy Performance Data Analysis & Reporting	year	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEARS 1 TO 2</b>				<b>\$ 104,025</b>
<b>ANNUAL OM&amp;M - YEARS 3 TO 30</b>				
MNA Monitoring & Reporting Program and General Site Maintenance (see Table F3-2)	LS	1	\$ 30,817	\$ 30,817
<b>Subtotal - Annual OM&amp;M - YEARS 3 TO 30</b>				<b>\$ 30,817</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 580,051</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,008,618</b>
<b>Contingency (15%)</b>				<b>\$ 151,293</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 1,159,911</b>

**Table F3-5 Cost Estimate For B139 Groundwater Alternative 5A - Enhanced In-Situ Bioremediation (Aerobic - Hydrogen Peroxide) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

---

Notes:

1. Costs are estimated within -30% / +50%.
2. Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
3. General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
4. Assumes minimal additional well installation required to supplement existing monitoring network.
5. Assumes no UXO is identified during UXO clearance.
6. Assumes number of wells in the MNA PMP decreases by 30% every five years.
7. Decommissioning costs, after remedy completion, are not included.
8. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F3-6 Cost Estimate For B139 Groundwater Alternative 5B - Enhanced In-Situ Bioremediation (Aerobic - Biosparging) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Aerobic EISB will be used to treat the COC source area in the B139 Area. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include installation of a new Zone EF well which would also be used to support the MNA program. Two new injection wells and one new extraction well will be constructed in shallow Zone EF. An air sparging trailer will be purchased to provide injection to two new injection wells, which will be completed one day per week to maintain oxygen concentrations. Groundwater extraction will be employed to enhance transport of amendments within the TTA; this extracted groundwater would be treated on-site before discharge to the MSD. Sparging will be completed in the target interval for up to two years. At Year 3, the program is expected to transition to MNA. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	1	\$ 7,000	\$ 7,000
Road Construction	SY	400	\$ 26	\$ 10,400
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 80,000	\$ 80,000
Injection Well - Zone EF Installation, Development, Waste Management, Survey	Well	3	\$ 56,200	\$ 168,600
Electrical Service Installation (poles, transformer, extension from B104)	LS	1	\$ 20,000	\$ 20,000
Utility Clearance Pipeline	SF	1800	\$ 2.00	\$ 3,600
Trenching, Piping, Wiring, Electrical to Treatment System	LF	600	\$ 40	\$ 24,000
Air Sparging Trailer Purchase (trailer, compressor, heat exchanger, manifold, controls)	LS	1	\$ 80,000	\$ 80,000
Air Sparge Hosing, Manifold, Switches, Well Heads and Installation	LS	1	\$ 5,000	\$ 5,000
Treatment Equipment for Extracted Water (Air Stripper, Controls, Installation)	LS	1	\$ 30,000	\$ 30,000
<b>Total Capital Cost</b>				<b>\$ 400,100</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 400,100	12%	\$ 48,012
Construction Management & As Built Report	% capital	\$ 400,100	8%	\$ 32,008
Health and Safety	% capital	\$ 400,100	2%	\$ 8,002
Project Management	% capital	\$ 400,100	6%	\$ 24,006
Mark-up on Subcontract Services	% subs.	\$ 280,600	5%	\$ 14,030
<b>Total Design and Reporting Cost</b>				<b>\$ 126,058</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEARS 1 TO 2</b>				
Annual Monitoring - Sample Collection, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - Sparging System Maintenance and Part Replacement	% capital	\$ 85,000	5%	\$ 4,250
Annual O&M - Operator Oversight, 4 hr/day During Sparging	day	27	\$ 640	\$ 17,280
Annual O&M - Electrical	kWh	26,200	\$ 0.11	\$ 2,882
Annual O&M - Treatment and Discharge of Extracted Water (50% of costs from P&T alternative)	% P&T	0.5	\$ 27,437	\$ 13,719
Quarterly Performance Monitoring - VOCs only (Analytical and Sample)	Sample	12	\$ 446	\$ 5,352
Sample Collection Labor and Equipment	Well	6	\$ 356	\$ 2,136
Groundwater Performance Monitoring - MNA Suite	Sample	6	\$ 167	\$ 1,002
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	6	\$ 357	\$ 2,142
Remedy Performance Data Analysis & Reporting	year	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEARS 1 TO 2</b>				<b>\$ 84,888</b>
<b>ANNUAL OM&amp;M - YEARS 3 TO 30</b>				
MNA Monitoring & Reporting Program and General Site Maintenance (see Table F3-2)	LS	1	\$ 30,817	\$ 30,817
<b>Subtotal - Annual OM&amp;M - YEARS 3 TO 30</b>				<b>\$ 30,817</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 544,468</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,070,626</b>
<b>Contingency (15%)</b>				<b>\$ 160,594</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 1,231,220</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.

**Table F3-6 Cost Estimate For B139 Groundwater Alternative 5B - Enhanced In-Situ Bioremediation (Aerobic - Biosparging) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

4. Assumes minimal additional well installation required to supplement existing monitoring network.
5. Assumes no UXO is identified during UXO clearance.
6. Assumes number of wells in the MNA PMP decreases by 30% every five years.
7. Decommissioning costs, after remedy completion, are not included.
8. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F4-1 Cost Estimate For DA 23/B116 Groundwater Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** General site maintenance will be completed for a period of 30 years. Routine monitoring and reporting will be completed on an annual basis to confirm site conditions.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 5,000	\$ 5,000
Project Management	% design	\$ 12,500	8%	\$ 1,000
<b>Total Design and Reporting Cost</b>				\$ <b>13,500</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual Monitoring - Sample Collection, Analysis, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
<b>Subtotal - Annual OM&amp;M</b>				\$ <b>21,125</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ <b>324,743</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ <b>338,243</b>
<b>Contingency (15%)</b>				\$ <b>48,711</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ <b>386,954</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes no additional well installation required to supplement existing monitoring network.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F4-2 Cost Estimate For DA 23/B116 Groundwater Alternative 2 - Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** MNA will be used to confirm that the groundwater plume from the DA 23/B116 area is stable or shrinking. Two new wells will be installed to support the MNA program. The number of monitoring locations for the MNA program will decrease over the remedy duration, based on anticipated decreases in the plume magnitude and extent. General site maintenance will also be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Monitoring Well - Zone AB Installation, Development, Waste Management, Survey	Well	2	\$ 8,350	\$ 16,700
<b>Total Capital Cost</b>				<b>\$ 16,700</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 10,000	\$ 10,000
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 5,000	\$ 5,000
Project Management	% design	\$ 15,000	8%	\$ 1,200
<b>Total Design and Reporting Cost</b>				<b>\$ 16,200</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	2	\$ 357	\$ 714
Groundwater Performance Monitoring - MNA Suite	Sample	9	\$ 167	\$ 1,503
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	16	\$ 356	\$ 5,696
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 37,426</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 499,542</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 532,442</b>
<b>Contingency (15%)</b>				<b>\$ 79,866</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 612,308</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes minimal additional well installation required to supplement existing monitoring network.
- Assumes initial MNA performance monitoring program (PMP) will consist of 6 wells (i.e., 6 Zone EF wells) and 2 surface water locations. This MNA program is intended to represent about 25% of the total annual MNA program for the Front Valley based on four AOIs requiring source MFR. The program for B139 is somewhat less than the other three AOIs as the groundwater plume is limited to Zone EF.
- Assumes number of wells in the MNA PMP decreases by 30% every five years.
- Assumes each sample is analyzed for volatile organic compounds (VOCs), nitroaromatics, and perchlorate. Assumes 60% of locations are analyzed for MNA parameters (i.e., dissolved hydrocarbon gases [DHGs], total organic carbon [TOC], and select anions) and 15% of locations for select dissolved metals.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F4-3 Cost Estimate For DA 23/B116 Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Pump and treat will be used to capture the COC plume from the DA 23/B116 Area, with one new Zone CD extraction well installed in the area and the existing shallower extraction wells used for a total estimated flow of 4 gpm. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include installation of two permanent Zone AB monitoring wells near former temporary probe locations which will also be used to support the MNA program. The treatment system will be housed in the existing FV P&T system building, however the existing air stripper will be replaced to allow sufficient capacity for extracted groundwater from DA 23/B116 and other P&T areas in the FV. LGAC will be used for removal of BZ from the extracted groundwater. Conduits from the new extraction well will be trenched to tie into the existing subsurface conduits in the B116 area. It is expected that the extraction wells will be replaced in Years 10, 20 and 30, and the treatment system will be replaced in Year 20. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, remedy performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Pre-Design Investigation	LS	1	\$ 20,000	\$ 20,000
Extraction Well Install - Zone CD, Development, Waste Mgt. Survey	Well	1	\$ 30,600	\$ 30,600
Extraction Pump/Install + Wellhead Piping: Grundfos Redi-Flo3 w/Controller interface, Teflon cabling pkg.	Well	1	\$ 4,940	\$ 4,940
Utility Clearance Pipeline	SF	150	\$ 2.00	\$ 300
Trenching, Piping, Wiring, Electrical to Treatment System	LF	50	\$ 40	\$ 2,000
Roll-Off for Waste Management	LS	1	\$ 2,600	\$ 2,600
Off-Site Disposal - Non-hazardous	ton	20	\$ 40	\$ 800
Clean Fill Placement, Compaction & Grading	CY	20	\$ 15	\$ 300
Extraction Well Housing/Protection	LS	1	\$ 5,000	\$ 5,000
Air Stripper	LS	0.25	\$ 30,000	\$ 7,500
Filtration	LS	0.25	\$ 3,000	\$ 750
Controls, Piping and Instrumentation	LS	0.25	\$ 10,000	\$ 2,500
Mechanical and Electrical Installation - 75% of System Materials and Equipment	%	\$ 15,940	75%	\$ 11,955
<b>Total Capital Cost</b>				<b>\$ 89,245</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 89,245	12%	\$ 10,709
Construction Management & As Built Report	% capital	\$ 89,245	8%	\$ 7,140
Health and Safety	% capital	\$ 89,245	2%	\$ 1,785
Project Management	% capital	\$ 89,245	6%	\$ 5,355
System Startup	% capital	\$ 89,245	4%	\$ 3,570
Mark-up on Subcontract Services	% Subs	\$ 69,245	5%	\$ 3,462
<b>Total Design and Reporting Cost</b>				<b>\$ 32,021</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - P&T System Maintenance and Part Replacement	% capital	\$ 64,945	5%	\$ 3,247
Annual O&M - Semi-Annual MSD Sample Collection, Analysis, Report Preparation	LS	1	\$ 5,000	\$ 5,000
Annual O&M - MSD Discharge Fees	MGAL	2102	\$ 4.00	\$ 8,410
Annual O&M - Electrical	kWh	45800	\$ 0.11	\$ 5,038
Consumables - Water	LS	1	\$ 2,000	\$ 2,000
Well Rehabilitation	well	3	\$ 1,500	\$ 4,500
LGAC changeout and disposal	each	2	\$ 2,200	\$ 4,400
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	2	\$ 357	\$ 714
Groundwater Performance Monitoring - MNA Suite	Sample	9	\$ 167	\$ 1,503
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	16	\$ 356	\$ 5,696
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 70,021</b>
<b>SYSTEM REPLACEMENT - WELLS YEARS 10, 20, 30, COMPLETE SYSTEM YEAR 20</b>				
Capital Costs of Initial Installation + Well Decommissioning + 20% for Planning, Project Management, Construction Management and Health and Safety	LS	1	\$ 115,440	\$ 115,440
Construction, design and reporting costs associated with replacement of the treatment system and wells in Year 20	LS	1	\$ 161,866	\$ 161,866
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 1,159,190</b>

**Table F4-3 Cost Estimate For DA 23/B116 Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>	<b>\$ 1,280,456</b>
<b>Contingency (15%)</b>	<b>\$ 192,068</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>	<b>\$ 1,472,524</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- System O&M costs assume capital value of \$30,000 for the existing air stripper and associated equipment.
- Assumes minimal additional well installation required to supplement existing monitoring network.
- Assumes that P&T + MNA is the selected remedy for the entire Front Valley, with 25% of capital, construction and O&M costs assigned to DA 23/B116.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F4-4 Cost Estimate For DA 23/B116 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation (Anaerobic) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Anaerobic EISB will be used to treat the COC source area in the DA 23/B116 Area. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include two new Zone AB monitoring wells near former temporary probes which will also be used to support the MNA program. Eight new Zone AB injection wells will be installed and existing wells in Zone CD will also be used. During injection, groundwater extraction and recirculation between injection wells will be used to enhance delivery of amendments between injection wells. These locations will be used to distribute electron donor, and potentially buffer, and bioaugmentation culture where COCs meet the threshold for MFR in Zone AB and CD. Additional injection events will be completed at Year 2 as needed. At Year 5, the program is expected to transition to MNA. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Light Clearing, Tree Removal	hr	6	\$ 250	\$ 1,500
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 20,000	\$ 20,000
Injection Well - Zone AB Installation, Development, Waste Management, Survey	Well	8	\$ 8,750	\$ 70,000
EVO Electron Donor	lb	34,400	\$ 1.70	\$ 58,480
Sodium Lactate Electron Donor	lb	4,800	\$ 2.00	\$ 9,600
pH Buffer, Sodium Bicarbonate	lb	9,200	\$ 0.60	\$ 5,520
KB-1 Culture	L	72	\$ 200	\$ 14,400
Injection Preparation & Demobilization Activities	Day	5	\$ 1,440	\$ 7,200
Injection Field Activities	Day	21	\$ 2,600	\$ 54,600
Generator - Diesel 56 kW and Fuel	week	5	\$ 1,400	\$ 7,000
Misc Equipment, Supplies, Sampling Equipment	week	5	\$ 1,000	\$ 5,000
Water Supply	Day	21	\$ 150	\$ 3,150
Skid Steer	Week	5	\$ 860	\$ 4,300
Site Injection Trailer - O&M Cost	Day	21	\$ 50	\$ 1,050
<b>Total Capital Cost</b>				<b>\$ 263,300</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 263,300	12%	\$ 31,596
Construction Management & As Built Report	% capital	\$ 263,300	8%	\$ 21,064
Health and Safety	% capital	\$ 263,300	2%	\$ 5,266
Project Management	% capital	\$ 263,300	6%	\$ 15,798
Mark-up on Subcontract Services	% subs.	\$ 39,450	5%	\$ 1,973
<b>Total Design and Reporting Cost</b>				<b>\$ 75,697</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEARS 1 TO 4</b>				
Annual Monitoring - Sample Collection, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Sample Collection Labor and Equipment	Well	8	\$ 356	\$ 2,848
Groundwater Performance Monitoring - MNA Suite	Sample	8	\$ 167	\$ 1,336
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	8	\$ 357	\$ 2,856
Groundwater Performance Monitoring - Molecular	Sample	3	\$ 200	\$ 600
Remedy Performance Data Analysis & Reporting	year	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEARS 1 TO 4</b>				<b>\$ 43,765</b>
<b>ANNUAL OM&amp;M - YEARS 5 TO 30</b>				
MNA Monitoring & Reporting Program and General Site Maintenance (see Table F4-2)	LS	1	\$ 37,426	\$ 37,426
<b>Subtotal - Annual OM&amp;M - YEARS 5 TO 30</b>				<b>\$ 37,426</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>REINJECTION EVENT - YEAR 2</b>				
Injection Capital Costs of Initial Event + 20% for Planning, Project Management, Construction Management and Health and Safety				\$ 191,663
<b>Estimated Total OM&amp;M</b>				<b>\$ 702,715</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,041,711</b>
<b>Contingency (15%)</b>				<b>\$ 156,257</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 1,197,968</b>

**Table F4-4 Cost Estimate For DA 23/B116 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation (Anaerobic) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

---

Notes:

1. Costs are estimated within -30% / +50%.
2. Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
3. General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
4. Assumes minimal additional well installation required to supplement existing monitoring network.
5. Bioaugmentation is not included in the reinjection events as it is assumed that the previous bioaugmentation event will be sufficient.
6. Assumes no UXO is identified during UXO clearance.
7. Assumes number of wells in the MNA PMP decreases by 30% every five years.
8. Decommissioning costs, after remedy completion, are not included.
9. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F4-5 Cost Estimate For DA 23/B116 Groundwater Alternative 5A - Enhanced In-Situ Bioremediation (Acrobic - Hydrogen Peroxide) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Aerobic EISB will be used to treat the COC source area in the DA 23/B116 Area. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include 2 Zone AB monitoring wells near the former temporary probes which will also be used to support the MNA program. Additional injection wells for amendment in Zone AB may also be installed to support source mass flux reduction. The existing on-site injection equipment will be used to support injection of hydrogen peroxide. Groundwater extraction will also be employed to enhance transport of hydrogen peroxide within the TTA, and the extracted groundwater will be amended with hydrogen peroxide and reinjected with new equipment for this purpose. Injections will be completed every other month to maintain oxygen concentrations for up to two years. At Year 3, the program is expected to transition to MNA. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Light Clearing, Tree Removal	hr	6	\$ 250	\$ 1,500
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 20,000	\$ 20,000
Injection Well - Zone AB Installation, Development, Waste Management, Survey	Well	8	\$ 8,750	\$ 70,000
Recirculation System Components (connex box, tanks, pumps, conduit, well head components, conduit to wells, winterization)	LS	1	\$ 40,000	\$ 40,000
Injection Hosing, Manifold, Switches, Well Heads and Installation	LS	1	\$ 8,000	\$ 8,000
<b>Total Capital Cost</b>				<b>\$ 141,000</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 141,000	12%	\$ 16,920
Construction Management & As Built Report	% capital	\$ 141,000	8%	\$ 11,280
Health and Safety	% capital	\$ 141,000	2%	\$ 2,820
Project Management	% capital	\$ 141,000	6%	\$ 8,460
Mark-up on Subcontract Services	% subs.	\$ 119,500	5%	\$ 5,975
<b>Total Design and Reporting Cost</b>				<b>\$ 45,455</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEARS 1 TO 2</b>				
Annual Monitoring - Sample Collection, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - Peroxide System Maintenance and Part Replacement	% capital	\$ 48,000	5%	\$ 2,400
Injection Activities - 15 days/month	day	180	\$ 1,100	\$ 198,000
Hydrogen Peroxide	lb	3,200	\$ 0.80	\$ 2,560
Gas for Generator	day	180	\$ 10	\$ 1,800
Quarterly Performance Monitoring - VOCs only (Analytical and Sample)	Sample	16	\$ 446	\$ 7,136
Sample Collection Labor and Equipment	Well	8	\$ 356	\$ 2,848
Groundwater Performance Monitoring - MNA Suite	Sample	8	\$ 167	\$ 1,336
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	8	\$ 357	\$ 2,856
Well Rehabilitation	well	3	\$ 1,500	\$ 4,500
Remedy Performance Data Analysis & Reporting	year	1	\$15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEARS 1 TO 2</b>				<b>\$ 259,561</b>
<b>ANNUAL OM&amp;M - YEARS 3 TO 30</b>				
MNA Monitoring & Reporting Program and General Site Maintenance (see Table F4-2)	LS	1	\$ 37,426	\$ 37,426
<b>Subtotal - Annual OM&amp;M - YEARS 3 TO 30</b>				<b>\$ 37,426</b>
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 904,006</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,090,461</b>
<b>Contingency (15%)</b>				<b>\$ 163,569</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 1,254,030</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes minimal additional well installation required to supplement existing monitoring network.
- Assumes no UXO is identified during UXO clearance.
- Assumes number of wells in the MNA PMP decreases by 30% every five years.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F4-6 Cost Estimate For DA 23/B116 Groundwater Alternative 5B - Enhanced In-Situ Bioremediation (Aerobic - Biosparging) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Aerobic EISB will be used to treat the COC source area in the DA 23/B116 Area. Prior to implementation, a pre-design investigation will be conducted to confirm the area that exceeds the 1000 x Screening Criteria threshold for source mass flux reduction. This is expected to include 2 Zone AB monitoring wells near the former temporary probes which will also be used to support the MNA program. Additional injection wells for amendment in Zone AB may also be installed to support source mass flux reduction. An air sparging trailer will be purchased to provide injection to two new injection wells. Groundwater extraction will be employed to enhance transport of amendments within the TTA; this extracted groundwater would be treated on-site before discharge to the POTW. Sparging will be completed in the target interval for up to two years. At Year 3, the program is expected to transition to MNA. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Light Clearing, Tree Removal	hr	6	\$ 250	\$ 1,500
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 20,000	\$ 20,000
Injection Well - Zone AB Installation, Development, Waste Management, Survey	Well	8	\$ 8,750	\$ 70,000
Electrical Service Installation (poles, transformer, extension from B104)	LS	1	\$ 20,000	\$ 20,000
Air Sparging Trailer Purchase (trailer, compressor, heat exchanger, manifold, controls)	LS	1	\$ 80,000	\$ 80,000
Air Sparge Hosing, Manifold, Switches, Well Heads and Installation	LS	1	\$ 8,000	\$ 8,000
Treatment Equipment for Extracted Water (Air Stripper, Controls, Installation)	LS	1	\$ 30,000	\$ 30,000
<b>Total Capital Cost</b>				<b>\$ 201,000</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 201,000	12%	\$ 24,120
Construction Management & As Built Report	% capital	\$ 201,000	8%	\$ 16,080
Health and Safety	% capital	\$ 201,000	2%	\$ 4,020
Project Management	% capital	\$ 201,000	6%	\$ 12,060
Mark-up on Subcontract Services	% subs.	\$ 198,000	5%	\$ 9,900
<b>Total Design and Reporting Cost</b>				<b>\$ 66,180</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEARS 1 TO 2</b>				
Annual Monitoring - Sample Collection, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - Sparging System Maintenance and Part Replacement	% capital	\$ 88,000	5%	\$ 4,400
Annual O&M - Operator Oversight, 4 hr/day During Sparging	day	135	\$ 1,100	\$ 148,500
Annual O&M - Treatment and Discharge of Extracted Water (50% of costs from P&T alternative)	% P&T	0.5	\$ 23,486	\$ 11,743
Annual O&M - Electrical	kWh	130,700	\$ 0.11	\$ 14,377
Quarterly Performance Monitoring - VOCs only (Analytical and Sample)	Sample	16	\$ 446	\$ 7,136
Sample Collection Labor and Equipment	Well	8	\$ 356	\$ 2,848
Groundwater Performance Monitoring - MNA Suite	Sample	8	\$ 167	\$ 1,336
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	8	\$ 357	\$ 2,856
Well Rehabilitation	well	5	\$ 1,500	\$ 7,500
Remedy Performance Data Analysis & Reporting	year	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEARS 1 TO 2</b>				<b>\$ 236,821</b>
<b>ANNUAL OM&amp;M - YEARS 3 TO 30</b>				
MNA Monitoring & Reporting Program and General Site Maintenance (see Table F4-2)	LS	1	\$ 37,426	\$ 37,426
<b>Subtotal - Annual OM&amp;M - YEARS 3 TO 30</b>				<b>\$ 37,426</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 861,723</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,128,903</b>
<b>Contingency (15%)</b>				<b>\$ 169,335</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 1,298,238</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Annual monitoring program costs of \$47,000 are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Front Valley, based on recent costs incurred for the Site. Based on four AOIs requiring source MFR, each is assigned 25% of the total annual cost.
- Assumes minimal additional well installation required to supplement existing monitoring network.
- Assumes no UXO is identified during UXO clearance.
- Assumes number of wells in the MNA PMP decreases by 30% every five years.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F5-1: Cost Estimate For B109-137 Soil Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** A work plan and stakeholder and regulatory negotiation would be completed to support a NFA determination for the B109-137 soil. This alternative assumes no additional activities would be needed following the NFA determination.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 7,500	\$ 7,500
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				\$ 15,600
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
<b>Subtotal - Annual OM&amp;M</b>				\$ -
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ -
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ 15,600
<b>Contingency (15%)</b>				\$ 2,340
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ 17,940

## Notes:

- Costs are estimated within -30% / +50%.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F5-2: Cost Estimate For B109-137 Soil Alternative 2 - Monitored Natural Attenuation  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** MNA will be used to confirm that the COC concentrations in Zone AB soil/soil vapor at the B109-137 Area are stable or decreasing. Two new vapor monitoring wells will be installed and sampled annually, and soil samples will be collected in Years 5, 10, 15, 20, 25 and 30. Monitoring and reporting will be completed on an annual basis over a 30 year period to confirm site conditions, remedy performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Vapor Monitoring Well - Installation, Testing, Waste Management, Survey	Well	2	\$ 4,000	\$ 8,000
<b>Total Capital Cost</b>				<b>\$ 8,000</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 7,500	\$ 7,500
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				<b>\$ 15,600</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Vapor Performance Monitoring - VOCs (Analytical)	Sample	2	\$ 170	\$ 340
Vapor Sample Collection Labor and Equipment	Sample	2	\$ 500	\$ 1,000
Remedy Performance Reporting	Annual	1	\$ 5,000	\$ 5,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 6,340</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>CONFIRMATORY SOIL SAMPLING - YEARS 5, 10, 15, 20, 25, 30</b>				
Direct Push Rig Confirmatory Soil Sampling	Day	1	\$ 3,000	\$ 3,000
Confirmatory Sample Analysis	Each	8	\$ 110	\$ 880
Field Preparation and Oversight	Day	2	\$ 1,100	\$ 2,200
<b>Subtotal - Confirmatory Soil Sampling Event</b>				<b>\$ 6,080</b>
<b>Estimated Total OM&amp;M</b>				<b>\$ 114,376</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 137,976</b>
<b>Contingency (15%)</b>				<b>\$ 20,696</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 158,672</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F5-3: Cost Estimate B109-137 Soil Alternative 3 - Excavation and Off-Site Disposal  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Soil in the B109-137 Area will be excavated in the vicinity of the former excavation to a depth of 30 ft bgs and an target area of about 40 ft by 30 ft. It will be necessary to bench the excavation to allow the excavation to achieve the 30 ft depth. During excavation soil from the benched area and top 15 ft of soil in the target area (clean fill installed following the excavation in 2011) will be stockpiled, tested and re-installed after the excavation if confirmed to be clean. It is assumed that soil excavated from 15 to 30 ft bgs can be disposed as non-hazardous waste. Confirmatory soil sampling will be completed to confirm success of the remedy, after which no further activities would be completed for the B109-137 Area soil.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Excavator and Operator, includes mobilization	Day	9	\$ 3,800	\$ 34,200
Technician and Truck	Day	9	\$ 580	\$ 5,220
Clean Fill Placement, Compaction & Grading	CY	556	\$ 15	\$ 8,333
Confirmatory Sample Analysis - Rush TAT	Each	16	\$ 165	\$ 2,640
Waste Characterization - Rush TAT	Each	3	\$ 900	\$ 2,700
Off-Site Transport - 18 Ton Truck	Loads	40	\$ 450	\$ 18,000
Off-Site Disposal - Non-Hazardous	ton	720	\$ 40	\$ 28,800
Field Oversight	Day	9	\$ 1,091	\$ 9,819
<b>Total Capital Cost</b>				<b>\$ 111,212</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	LS	1	\$ 6,000	\$ 6,000
Construction Management & As Built Report	LS	1	\$ 6,000	\$ 6,000
Health and Safety	% capital	\$ 111,212	2%	\$ 2,224
Project Management	% capital	\$ 111,212	6%	\$ 6,673
Mark-up on Subcontract Services	% capital	\$ 99,893	5%	\$ 4,995
<b>Total Design and Reporting Cost</b>				<b>\$ 25,892</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ -</b>
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M (Net Present Value)</b>				<b>\$ -</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 137,104</b>
<b>Contingency (15%)</b>				<b>\$ 20,566</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 157,670</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Assumes no UXO is identified during UXO clearance.
- The final extent of the excavation will be based on confirmatory sample results; this estimate assumes those results indicate no further excavation is required to meet the remedy objectives and that excavation under the former building slab is not required.
- The estimated volume for off-site disposal assumes that all soil excavated from 15 to 30 ft bgs has VOC concentrations that exceed risk based thresholds, based upon confirmatory sample results.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F5-4: Cost Estimate For B109-137 Alternative 4 - Soil Vapor Extraction (SVE)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** The soil vapor extraction remedy will be used to remove and treat COC mass in the B109-137 Area soil, with 4 new vapor extraction wells installed in the unsaturated interval (15 to 30 ft bgs) in the vicinity of the former excavation. The above ground system component will include off-gas treatment, if needed, and liquid phase granular activated carbon (LGAC) for any water collected in the air/water separator. The water stream is expected to have a very low flow rate and will be stored in a tank in B109-137 and be transferred to the FV treatment building MSD line periodically, treated, and discharged to the MSD sewer. Electrical service will be extended to the B109-137 Area from the B104 Area. The system is expected to operate for 1 year. Monitoring and reporting for the soil remedy will be completed during the remedy period to confirm the effectiveness of SVE, after which no further activities would be completed for B109-137 Area soil.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
SVE Extraction Well - Zone AB Installation, Testing, Waste Management, Survey	well	4	\$ 5,000	\$ 20,000
Trenching, Piping, to SVE System	ft	80	\$ 40	\$ 3,200
Electrical Service Installation (poles, transformer, extension from B104)	LS	1	\$ 40,000	\$ 40,000
SVE Equipment and Controls, Mobilization, Installation, Electrical Connection	LS	1	\$ 25,000	\$ 25,000
Vapor Phase GAC Vessels	Each	0	\$ 2,000	\$ -
Mechanical and Electrical Installation - 50% of System Materials and Equipment	%	\$ 25,000	50%	\$ 12,500
<b>Total Capital Cost</b>				<b>\$ 102,200</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 102,200	12%	\$ 12,264
Construction Management & As Built Report	% capital	\$ 102,200	8%	\$ 8,176
Health and Safety	% capital	\$ 102,200	2%	\$ 2,044
Project Management	% capital	\$ 102,200	5%	\$ 5,110
Mark-up on Subcontract Services	% capital	\$ 100,700	5%	\$ 5,035
Start-up Testing	Day	\$ 1,500	2	\$ 3,000
<b>Total Design and Reporting Cost</b>				<b>\$ 32,629</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - SVE System Operation	month	12	\$ 2,500	\$ 30,000
Annual O&M - System Maintenance and Part Replacement	% capital	\$ 42,200	5%	\$ 2,110
Annual O&M - MSD Discharge Fees	1,000/gal.	10	\$ 4.00	\$ 40
Annual O&M - Vapor Sample Collection, Analysis, Reporting	LS	1	\$ 6,000	\$ 6,000
Annual O&M - MSD Sample Collection, Analysis, Reporting	LS	1	\$ 5,000	\$ 5,000
Annual O&M - Electricity Usage	kWh	65400	\$ 0.11	\$ 7,194
Vapor Phase GAC changeout and disposal	lb	5280	\$ 1.30	\$ 6,864
LGAC changeout and disposal	year	1	\$ 2,200	\$ 2,200
Direct Push Rig Confirmatory Soil Sampling	Day	1	\$ 3,000	\$ 3,000
Confirmatory Sample Analysis	Each	8	\$ 110	\$ 880
Field Preparation and Oversight	Day	2	\$ 1,100	\$ 2,200
Remedy Performance Data Analysis & Reporting	year	1	\$15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 80,488</b>
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M (Net Present Value)</b>				<b>\$ 80,488</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 215,317</b>
<b>Contingency (15%)</b>				<b>\$ 32,298</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 247,615</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Remedy benefits for groundwater will be monitored as part of the groundwater remedy.
- If SVE was applied in both B109-137 and DA 23/B116 capital and construction costs associated with electrical service and SVE/treatment equipment would be reduced.
- Assumes spoils from trenching managed on-site.
- Assumes no UXO is identified during UXO clearance.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F6-1: Cost Estimate For B116 Soil Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** A work plan and stakeholder and regulatory negotiation would be completed to support a NFA determination for the B116 Area soil. This alternative assumes no additional activities would be needed following the NFA determination.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 7,500	\$ 7,500
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				\$ 15,600
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
				\$ -
<b>Subtotal - Annual OM&amp;M</b>				\$ -
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ -
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ 15,600
<b>Contingency (15%)</b>				\$ 2,340
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ 17,940

## Notes:

- Costs are estimated within -30% / +50%.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F6-2: Cost Estimate For B116 Soil Alternative 2 - Monitored Natural Attenuation  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** MNA will be used to confirm that the COC concentrations in Zone AB soil/soil vapor at the B116 Area are stable or decreasing. Two new vapor monitoring wells will be installed and sampled annually, and soil samples will be collected in Years 5, 10, 15, 20, 25 and 30. Monitoring and reporting will be completed on an annual basis over a 30 year period to confirm site conditions and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Vapor Monitoring Well - Installation, Testing, Waste Management, Survey	Well	2	\$ 4,000	\$ 8,000
<b>Total Capital Cost</b>				<b>\$ 8,000</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 7,500	\$ 7,500
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				<b>\$ 15,600</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Vapor Performance Monitoring - VOCs (Analytical)	Sample	2	\$ 170	\$ 340
Vapor Sample Collection Labor and Equipment	Well	2	\$ 500	\$ 1,000
Remedy Performance Reporting	Annual	1	\$ 5,000	\$ 5,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 6,340</b>
<b>CONFIRMATORY SOIL SAMPLING - YEARS 5, 10, 15, 20, 25, 30</b>				
Direct Push Rig Confirmatory Soil Sampling	Day	1	\$ 3,000	\$ 3,000
Confirmatory Sample Analysis	Each	8	\$ 110	\$ 880
Field Preparation and Oversight	Day	2	\$ 1,100	\$ 2,200
<b>Subtotal - Confirmatory Soil Sampling Event</b>				<b>\$ 6,080</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 114,376</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 137,976</b>
<b>Contingency (15%)</b>				<b>\$ 20,696</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 158,672</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Remedy benefits for groundwater will be monitored as part of the groundwater remedy.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F6-3: Cost Estimate B116 Soil Alternative 3 - Excavation and Off-Site Disposal  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Soil in the B116 Area will be excavated in the vicinity of the former excavation to a depth of 20 feet bgs and an area of about 30 ft by 40 ft. Prior to excavation, two confirmatory borings will be completed under the former building slab to confirm the target treatment extent on the eastern side. It is assumed that excavation will not be required under the slab, based on the confirmatory boring results. During excavation the top 15 ft of soil, clean fill installed following the excavation in 2011, will be stockpiled, tested and re-installed after the excavation if confirmed to be clean. It is assumed that the soil excavated from 15 to 20 ft bgs can be disposed as non-hazardous waste. Monitoring and reporting for the soil remedy will be completed in the year following excavation only to confirm the success of the excavation, after which no further activities would be completed for the B116 Area soil.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Direct Push Rig Confirmatory Soil Sampling	Day	1	\$ 3,000	\$ 3,000
Excavator and Operator, includes mobilization	Day	6	\$ 3,800	\$ 22,800
Technician and Truck	Day	6	\$ 580	\$ 3,480
Clean Fill Placement, Compaction & Grading	CY	277	\$ 15	\$ 4,155
Backhoe, Dump Truck and Operator for Debris Removal, includes mobilization	Day	2	\$ 4,100	\$ 8,200
Confirmatory Sample Analysis	Each	24	\$ 165	\$ 3,960
Waste Characterization - Rush TAT	Each	3	\$ 900	\$ 2,700
Off-Site Transport - 18 Ton Truck	Loads	15	\$ 450	\$ 6,750
Off-Site Disposal - Non-Hazardous	ton	280	\$ 40	\$ 11,200
Field Oversight	Day	7	\$ 1,091	\$ 7,637
<b>Total Capital Cost</b>				<b>\$ 73,882</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	LS	1	\$ 6,000	\$ 6,000
Construction Management & As Built Report	LS	1	\$ 6,000	\$ 6,000
Health and Safety	% capital	\$ 73,882	2%	\$ 1,478
Project Management	% capital	\$ 73,882	6%	\$ 4,433
Mark-up on Subcontract Services	% capital	\$ 66,245	5%	\$ 3,312
<b>Total Design and Reporting Cost</b>				<b>\$ 21,223</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ -</b>
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M (Net Present Value)</b>				<b>\$ -</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 95,105</b>
<b>Contingency (15%)</b>				<b>\$ 14,266</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 109,371</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Remedy benefits for groundwater will be monitored as part of the groundwater remedy.
- The final extent of the excavation will be based on confirmatory sample results; this estimate assumes those results indicate no further excavation, including under the former building slab, is required to meet the remedy objectives.
- The estimated volume for off-site disposal assumes that all soil excavated from 15 to 20 ft bgs has VOC concentrations that exceed risk based thresholds, based on confirmatory sample results.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F6-4: Cost Estimate For B116 Alternative 4 - Soil Vapor Extraction (SVE)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** The soil vapor extraction remedy will be used to remove and treat COC mass in the B116 Area soil, with 4 new vapor extraction wells installed from in the unsaturated interval (15 to 20 ft bgs) in the vicinity of the former excavation. Prior to implementation of SVE, two confirmatory borings will be completed under the former building slab to confirm the target treatment extent on the eastern side. The above ground system component will include off-gas treatment, if needed, and liquid phase granular activated carbon (LGAC) for any water collected in the air/water separator. The water stream is expected to have a very low flow rate and will be stored in a tank in B109-137 and be transferred to the FV treatment building MSD line periodically, treated, and discharged to the MSD sewer. Electrical service will be extended to the B116 Area from the B104 Area. The system is expected to operate for 1 year. Monitoring and reporting for the soil remedy will be completed during the remedy period to confirm the effectiveness of SVE, after which no further activities would be completed for B116 Area soil.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Direct Push Rig Confirmatory Soil Sampling	Day	1	\$ 3,000	\$ 3,000
Confirmatory Sample Analysis	Each	4	\$ 110	\$ 440
Extraction Well (SVE) - Zone AB Installation, Testing, Waste Management, Survey	well	4	\$ 5,000	\$ 20,000
Trenching, Piping, to SVE System	ft	80	\$ 40	\$ 3,200
Electrical Service Installation (poles, transformer, extension from B104)	LS	1	\$ 20,000	\$ 20,000
SVE Equipment and Controls, Mobilization, Installation, Electrical Connection	LS	1	\$ 25,000	\$ 25,000
Vapor Phase GAC Vessels	Each	2	\$ 2,000	\$ 4,000
Mechanical and Electrical Installation - 50% of System Materials and Equipment	%	\$ 29,000	50%	\$ 14,500
<b>Total Capital Cost</b>				<b>\$ 91,640</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 91,640	12%	\$ 10,997
Construction Management & As Built Report	% capital	\$ 91,640	8%	\$ 7,331
Health and Safety	% capital	\$ 91,640	2%	\$ 1,833
Project Management	% capital	\$ 91,640	5%	\$ 4,582
Mark-up on Subcontract Services	% capital	\$ 86,700	5%	\$ 4,335
Start-up Testing	Day	\$ 1,500	2	\$ 3,000
<b>Total Design and Reporting Cost</b>				<b>\$ 29,078</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - SVE System Operation	month	12	\$ 2,500	\$ 30,000
Annual O&M - System Maintenance and Part Replacement	% capital	\$ 51,640	5%	\$ 2,582
Annual O&M - MSD Discharge Fees	1,000/gal.	10	\$ 4.00	\$ 40
Annual O&M - Vapor Sample Collection, Analysis, Reporting	LS	1	\$ 6,000	\$ 6,000
Annual O&M - MSD Sample Collection, Analysis, Reporting	LS	1	\$ 5,000	\$ 5,000
Annual O&M - Electricity Usage	kWh	65400	\$ 0.11	\$ 7,194
Vapor Phase GAC changeout and disposal	lb	7920	\$ 1.30	\$ 10,296
LGAC changeout and disposal	year	1	\$ 2,200	\$ 2,200
Direct Push Rig Confirmatory Soil Sampling	Day	1	\$ 3,000	\$ 3,000
Confirmatory Sample Analysis	Each	8	\$ 110	\$ 880
Field Preparation and Oversight	Day	2	\$ 1,100	\$ 2,200
Remedy Performance Data Analysis & Reporting	year	1	\$15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 84,392</b>
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 84,392</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 205,110</b>
<b>Contingency (15%)</b>				<b>\$ 30,766</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 235,876</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Remedy benefits for groundwater will be monitored as part of the groundwater remedy.
- If SVE was applied in both B109-137 and DA 23/B116 capital and construction costs associated with electrical service and SVE/treatment equipment would be reduced.
- Assumes spoils from trenching managed on-site.
- Assumes no UXO is identified during UXO clearance.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F7-1: Cost Estimate For DA 9 Groundwater Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** General site maintenance will be completed for the DA 9 area for a period of 30 years. Routine monitoring will be completed to confirm site conditions.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	0.25	\$ 30,000	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 15,000	\$ 15,000
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				\$ <b>23,100</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual Monitoring - Sample Collection, Analysis, Data Compilation, Report Preparation	year	0.25	\$ 47,000	\$ 11,750
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
<b>Subtotal - Annual OM&amp;M</b>				\$ <b>21,125</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ <b>324,743</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ <b>347,843</b>
<b>Contingency (15%)</b>				\$ <b>52,176</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ <b>400,019</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Annual monitoring program costs of \$47,000 are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of DA 9 and APA across the valley, DA 9 is assigned 25% of the total annual cost.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of DA 9 and APA across the valley, DA 9 is assigned 25% of the total annual cost.
- Assumes no additional well installation required to supplement existing monitoring network.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F7-2: Cost Estimate For DA 9 Groundwater Alternative 2 - Monitored Natural Attenuation  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** MNA will be used to confirm that the groundwater plume from the DA 9 area is stable or shrinking. Existing wells will be sampled. The number of monitoring locations for the MNA program will decrease over the remedy duration, based on decreases in the plume extent. General site maintenance will also be completed for the DA 9 area for a period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				<b>\$ -</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	0.25	\$ 30,000	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 15,000	\$ 15,000
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				<b>\$ 23,100</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	3	\$ 357	\$ 1,071
Groundwater Performance Monitoring - MNA Suite	Sample	8	\$ 167	\$ 1,336
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	17	\$ 356	\$ 6,052
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 37,972</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 545,925</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 569,025</b>
<b>Contingency (15%)</b>				<b>\$ 85,354</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 654,379</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of the DA 9 and APA across the valley, DA 9 is assigned 25% of the total annual cost.
- Assumes additional well installation is not required to supplement existing monitoring network.
- Assumes initial MNA performance monitoring program (PMP) will consist of 14 wells (i.e., 6 Zone AB, 6 Zone CD, and 2 Zone EF wells) and 3 surface water locations. This MNA program is intended to represent about 25% of the total annual MNA program for the Back Valley based on the relative width of DA 9 and APA across the valley.
- Assumes number of wells in the MNA PMP decreases by 15% every five years.
- Assumes each sample is analyzed for volatile organic compounds (VOCs), nitroaromatics, and perchlorate. Assumes 60% of locations are analyzed for MNA parameters (i.e., dissolved hydrocarbon gases [DHGs], total organic carbon [TOC], and select anions) and 15% of locations for select dissolved metals.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F7-3: Cost Estimate DA 9 Groundwater Alternative 3 - Pump and Treat + Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Pump and treat will be used to capture the COC plume from the DA 9 Area, with 4 new Zone AB extraction wells, 3 new Zone CD extraction wells, and 1 new Zone EF extraction well installed for a total estimated flow of 8 gpm. Prior to design bench-scale and treatability testing will be completed to confirm the treatment train components and operating details (dosages, retention times). The treatment system proposed below will be housed in the existing BV P&T system building, however the existing equipment will be replaced as shown to allow sufficient capacity and capability for 8 gpm of treatment of all COCs requiring treatment for discharge to MSD. Conduits from DA 9 will be trenched to tie into the existing P&T system building. Additional treatment components will be added to the treatment system to reduce biofouling, reduce mineral fouling and provide treatment to COCs not treated by the existing air stripper. In an attempt to reduce biofouling and maintain flow rates, extraction wells will be redeveloped twice per year and conduits will be flushed at least once per year. The existing discharge line to metering manhole will also be replaced with an above ground line. It is expected that the extraction wells will be replaced every 10 years and the treatment system will be replaced at 20 years. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, remedy performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	2	\$ 1,500	\$ 3,000
Extraction Well Install - Zone AB, Development, Waste Mgt. Survey	Well	4	\$ 11,350	\$ 45,400
Extraction Well Install - Zone C, Development, Waste Mgt. Survey	well	3	\$ 30,600	\$ 91,800
Extraction Well Install - Zone DE, Development, Waste Mgt. Survey	well	1	\$ 56,000	\$ 56,000
Extraction Pump/Install + Wellhead Piping: Grundfos Redi-Flo3 w/Controller interface, Teflon cabling pkg.	Well	8	\$ 4,940	\$ 39,520
Groundwater Performance Monitoring - Extraction Well Baseline Sampling (Analytical, labor, consumables)	Well	8	\$ 750	\$ 6,000
Extraction Well Housing/Protection	Each	8	\$ 5,000	\$ 40,000
Conveyance Piping Installation (Trenching, Piping, Electrical, Controls of Sufficient Width for # EWs)	ft	353	\$ 150	\$ 52,875
Spoils Management	DAY	2	\$ 11,197	\$ 22,394
Air Stripper - Venturi Method w/feed pump, dP monitoring, stripper tank, fan.	LS	0.25	\$ 49,500	\$ 12,375
EQ Tank: XHDPE 1,100-gal. conical-bottom w/stand	LS	0.25	\$ 2,625	\$ 656
Potable Water Pipe (4-in.) - trenching, bedding, compaction, 30-in. depth	ft	500	\$ 8.75	\$ 4,375
Utility Clearance Pipeline (plus potholing)	Sq Ft	2,500	\$ 2.00	\$ 5,000
Pump Station - potable water line Booster Sta., Electrical, & Enclosure Bldg.	LS	0.25	\$ 35,000	\$ 8,750
Clarifier - 10-ft. dia., solids contact unit w/ mixers, drive, launders.	LS	0.25	\$ 150,000	\$ 37,500
Clarifier - concrete foundation, steel work, & base.	LS	0.25	\$ 40,000	\$ 10,000
Tank - Clarifier sludge storage, 900-gal. HD poly w/ 45-deg. conical bottom. Liquids =	LS	0.25	\$ 2,900	\$ 725
Dewatering - lime sludge filter press	LS	0.25	\$ 65,000	\$ 16,250
Lime - hydrated storage tank, dosing / metering, feed system.	LS	0.25	\$ 160,000	\$ 40,000
Oxidation system	LS	0.25	\$ 400,000	\$ 100,000
Recarbonation - CO2 recarbonation system for clarifier effluent	LS	0.25	\$ 185,000	\$ 46,250
Piping, instrumentation and process control equipment	LS	0.25	\$ 25,000	\$ 6,250
Electrical - Upgrade 100 Amp Service Panel to 200 Amp Service	LS	0.25	\$ 2,500	\$ 625
Tank - Oxidation conical bottom poly storage tank w/ stand (500-gal.)	LS	0.25	\$ 1,275	\$ 319
Decommission Existing Extraction Well + Services	LS	0.25	\$ 27,000	\$ 6,750
Treatment System Building Upgrades/Maintenance	LS	0.25	\$ 10,000	\$ 2,500
Equalization Tank, Booster Pump, and Above Ground Discharge Line to MSD	LS	0.25	\$ 104,000	\$ 26,000
Biotreatment unit	LS	0.25	\$ 1,400,000	\$ 350,000
P&T System Construction - 50% of Equip. Costs (excluding Extraction Wells)	%	\$ 279,700	50%	\$ 139,850
<b>Total Capital Cost</b>			<b>\$</b>	<b>1,178,164</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 1,178,164	8%	\$ 94,253
Construction Management & As Built Report	% capital	\$ 1,178,164	6%	\$ 70,690
Project Management	% capital	\$ 1,178,164	5%	\$ 58,908
Treatability Testing - Bench Scale Testing & Work Plan	LS	1	\$30,000	\$ 30,000
Health and Safety	% capital	\$ 1,178,164	2%	\$ 23,563
Mark-up on Subcontract Services	% subs	\$ 1,168,164	5%	\$ 58,408
Startup Testing	Day	20	\$1,500	\$ 30,000
<b>Total Design and Reporting Cost</b>			<b>\$</b>	<b>365,823</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - P&T System Maintenance and Part Replacement	% capital	\$ 974,964	5%	\$ 48,748
Annual O&M - Dumpster, 20-yd. capacity for dewatered sludge storage + disposal.	Month	3	\$498	\$ 1,494
Annual O&M - MSD Discharge Fees	1,000/gal.	3950	\$4.00	\$ 15,800
Annual O&M - MSD Sample Collection, Analysis, Reporting	LS	0.25	\$ 5,000	\$ 1,250

**Table F7-3: Cost Estimate DA 9 Groundwater Alternative 3 - Pump and Treat + Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

Annual O&M - Electricity Usage	kWh	93200	\$	0.10	\$	9,320
Annual O&M - Extraction Well Rehab - Twice Annual redevelopment, incl. labor & equip.	well	16	\$	1,500	\$	24,000
Annual O&M - Conveyance Piping / acid flush, scale removal, labor & mat'l. (Annual)	LS	1	\$	3,000	\$	3,000
Annual O&M - Lime slurry / clarifier feed	Month	12	\$	125	\$	1,500
Annual O&M - CO2 for Recarbonation System	Month	12	\$	125	\$	1,500
Annual O&M - Oxidation consumables	year	1	\$	5,000	\$	5,000
Annual O&M - Biological system	year	0.25	\$	250,000	\$	62,500
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$	357	\$	4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	3	\$	357	\$	1,071
Groundwater Performance Monitoring - MNA Suite	Sample	8	\$	167	\$	1,336
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$	70	\$	140
Sample Collection Labor and Equipment	Well	17	\$	356	\$	6,052
Remedy Performance Data Analysis & Reporting	year	1		\$15,000	\$	15,000
<b>Subtotal - Annual OM&amp;M</b>					<b>\$</b>	<b>212,084</b>
Anticipated Number of Years of OM&M						30
Discount Rate (%)						5%
<b>SYSTEM REPLACEMENT - WELLS YEARS 10, 20, 30, COMPLETE SYSTEM YEAR 20</b>						
Capital Costs of Initial Installation + Well Decommissioning + 20% for Planning, Project Management, Construction Management and Health and Safety		1	\$	303,840	\$	303,840
Construction, design and reporting costs associated with replacement of the treatment system and wells in Year 20	LS	1	\$	1,543,986	\$	1,543,986
<b>Estimated Total OM&amp;M (Net Present Value)</b>					<b>\$</b>	<b>3,163,031</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>					<b>\$</b>	<b>4,707,017</b>
<b>Contingency (15%)</b>					<b>\$</b>	<b>706,053</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>					<b>\$</b>	<b>5,413,069</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of the DA 9 and APA across the valley, DA 9 is assigned 25% of the total annual cost.
- Assumes additional well installation is not required to supplement existing monitoring network.
- Assumes that P&T + MNA is the selected remedy for the entire Back Valley, with 25% of capital, construction and O&M costs assigned to DA 9.
- Assumes spoils from trenching managed on-site.
- Assumes no UXO is identified during UXO clearance.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F7-4: Cost Estimate For DA 9 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation - Anaerobic Biobarrier and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** A biobarrier will be created by injections of EHC-L, pH Buffers and KB-1 into a row of injection wells (IW) located downgradient of the DA 9 area. For the purposes of feasibility evaluations and costing a period of 30 years is assumed. Prior to implementation a pre-design investigation will be completed to support the full-scale design. The IWs will be spaced 20 ft apart in the A/B unit and 50 ft apart in the C/D unit (one to three screen intervals will be used in each zone, depending on thickness). Substrate reinjection will occur at Year 2, then every 3 years until Year 11, and then every 5 years up to Year 30. The first injection event is expected to establish an anaerobic and reducing bioactive zone and thus KB-1 addition will only be completed in the first reinjection event and the electron donor will also be changed to EVO. The amount of electron donor and Neutral Zone pH buffer will be decreased by half following the first reinjection event. General site maintenance will also be completed for the DA 9 area for a period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 50,000	\$ 50,000
Injection Well - Zone AB Installation, Development, Waste Management, Survey	well	30	\$ 8,350	\$ 250,500
Injection Well - Zone CD Installation, Development, Waste Management, Survey	well	8	\$ 30,600	\$ 244,800
EHC-L Electron Donor	lb	104,640	\$ 1.70	\$ 177,889
pH Buffer, Sodium Bicarbonate	lb	27,907	\$ 0.60	\$ 16,744
pH Buffer, Neutral Zone	lb	27,907	\$ 2.30	\$ 64,186
KB-1 Culture - Low pH	L	114	\$ 200	\$ 22,800
Injection Preparation & Demobilization Activities	Day	5	\$ 1,440	\$ 7,200
Injection Field Activities	Day	28	\$ 2,600	\$ 72,235
Generator - Diesel 56 kW Purchase	LS	1	\$ 16,000	\$ 16,000
Generator - Fuel	week	6	\$ 300	\$ 1,800
Misc Equipment, Supplies, Sampling Equipment	week	6	\$ 1,000	\$ 6,000
Potable Water Pipe (4-in.) - trenching, bedding, compaction, 30-in. depth	LS	500	\$ 8.75	\$ 4,375
Utility Clearance Pipeline (plus potholing)	LS	2,500	\$ 2.00	\$ 5,000
Pump Station - potable water line Booster Sta., Electrical, & Enclosure Bldg.	LS	1	\$ 35,000	\$ 35,000
Skid Steer	LS	1	\$ 40,000	\$ 40,000
Site Injection Trailer - O&M Cost	Days	28	\$ 50	\$ 1,389
<b>Total Capital Cost</b>				<b>\$ 1,024,419</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 1,024,419	8%	\$ 81,953
Construction Management & As Built Report	% capital	\$ 1,024,419	6%	\$ 61,465
Health and Safety	% capital	\$ 1,024,419	2%	\$ 20,488
Project Management	% capital	\$ 1,024,419	5%	\$ 51,221
Mark-up on Subcontract Services	% capital	\$ 495,300	5%	\$ 24,765
<b>Total Design and Reporting Cost</b>				<b>\$ 239,893</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	3	\$ 357	\$ 1,071
Groundwater Performance Monitoring - MNA Suite	Sample	8	\$ 167	\$ 1,336
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	17	\$ 356	\$ 6,052
Remedy Performance Data Analysis & Reporting	year	1	\$15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 37,972</b>
<b>REINJECTION EVENT - YEAR 2</b>				
Injection Capital Costs of Initial Event + Well Redevelopment (\$20,000) + 20% for Planning, Project Management, Construction Management and Health and Safety				<b>\$ 390,705</b>
<b>REINJECTION EVENT - YEAR 5, 8, 11, 16, 21, 26</b>				
Injection Capital Costs of Initial Event (Only Half Volume of Amendments) + Well Redevelopment (\$20,000) + 20% for Planning, Project Management, Construction Management and Health and Safety				<b>\$ 260,527</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 1,439,288</b>

**Table F7-4: Cost Estimate For DA 9 Groundwater Alternative 4 - Enhanced In-Situ Bioremediation - Anaerobic Biobarrier and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>	<b>\$ 2,703,600</b>
<b>Contingency (15%)</b>	<b>\$ 405,540</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>	<b>\$ 3,109,139</b>

---

Notes:

1. Costs are estimated within -30% / +50%.
2. General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of the DA 9 and APA across the valley, DA 9 is assigned 25% of the total annual cost.
3. Assumes additional well installation is not required to supplement existing monitoring network.
4. Bioaugmentation is only included in the first reinjection event as it is assumed that the desired microbial population will be established by then.
5. Assumes number of wells in the MNA PMP decreases by 15% every five years.
6. Assumes no UXO is identified during UXO clearance.
7. Decommissioning costs, after remedy completion, are not included.
8. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F7-5: Cost Estimate For DA 9 Groundwater Alternative 5 - Groundwater Diversion Remedy and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** The groundwater diversion remedy consists of an upgradient subsurface barrier constructed along the north side of DA 9. Prior to implementation a pre-design investigation will be completed to support remedy design. The barrier consists of a soil-bentonite vertical barrier wall (VBW) from the ground surface down to the top of rock. The wall will be placed in contact with competent rock to the extent practical. In addition, a grout curtain will be installed to a depth of 115 ft below the top of competent rock. The grout curtain is assumed to consist of two inclined grout points at a spacing of 10 ft, with one inclined away from the APA and one inclined toward the APA. The grout points are assumed to be inclined at 20 degrees to the horizontal. A drain will be installed 3 ft above the top of rock along the northern side of the VBW. A geomembrane cap will be installed from the edge of the existing APA cap to to 5 ft past the center line of the VBW. A fence will be extended around the the GDR alignment and the cap extension. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Site Preparation</b>				
Construction Survey Layout	DAY	1	\$ 1,950	\$ 1,950
Clearing and Grubbing	ACRE	1	\$ 7,000	\$ 7,000
Pre-Design Investigation	LS	1	\$ 50,000	\$ 50,000
Cut & Chip Trees	ACRE	1	\$ 16,000	\$ 16,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Chain Link Fence Removal	LF	225	\$ 2.39	\$ 538
E&S Measures, Double Silt Line Fence	LF	800	\$ 4.22	\$ 3,376
Access Road Improvements	LS	0.25	\$ 231,000	\$ 57,750
<b>Groundwater Drain</b>				
Upgradient Drain, Excavation	SF	3298	\$ 13	\$ 42,379
Upgradient Drain, Aggregate	TON	68	\$ 25	\$ 1,700
Upgradient Drain, 6" HDPE	LF	163	\$ 19	\$ 3,048
Upgradient Drain, Backfill	DAY	2	\$ 5,657	\$ 11,315
<b>Vertical Barrier Wall</b>				
Working Bench Installation/Teardown	LF	325	\$ 17	\$ 5,410
VBW mobilization, >50 ft. deep	LS	0.25	\$ 612,796	\$ 153,199
VBW Construction, >50 ft. deep	SF	10214	\$ 13	\$ 131,239
Spoils Management	DAY	3	\$ 11,197	\$ 33,590
Waste Disposal Estimate (Assumes most non-hazardous)	CY	1135	\$ 83	\$ 94,468
Spoils Solidification	CY	1135	\$ 16	\$ 17,713
<b>Grout Curtain</b>				
Contractor Mobilization - Grout Curtain	LS	0.25	\$ 52,020	\$ 13,005
HSA drilling through soil/saprolite	LF	2043	\$ 31	\$ 63,766
Drilling and grouting through PWR and Rock	LF	7343	\$ 156	\$ 1,145,949
<b>Directional Drilling</b>				
Medium Equipment Mobilization Costs	EA	0.25	\$ 1,530	\$ 383
Set Up Fee	EA	1	\$ 765	\$ 765
Drilling up to 12" diameter	LF	193	\$ 165.00	\$ 31,845
<b>Geosynthetic Cap</b>				
Extend Geosynthetic Over Cap	SF	21609	\$ 1.56	\$ 33,723
Topsoil Stripping and Stockpiling	CY	1601	\$ 2.06	\$ 3,298
Backfill, Structural	LCY	3002	\$ 2.79	\$ 8,376
Finish Grading	DAY	0.25	\$ 1,887	\$ 472
<b>Site Restoration</b>				
Chain Link Fence Installation	LF	413	\$ 44	\$ 17,966
Hydroseed Slopemix	MSF	33	\$ 62	\$ 2,030
<b>H&amp;S</b>				
Level C Upgrade	%	16,483	\$ 0.35	\$ 5,769
<b>Total Construction Cost</b>				<b>\$ 1,959,520</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 1,959,520	8%	\$ 156,762
Construction Management & As Built Report	% capital	\$ 1,959,520	6%	\$ 117,571
Project Management	% capital	\$ 1,959,520	5%	\$ 97,976
Health and Safety	% capital	\$ 1,959,520	2%	\$ 39,190
Mark-up on Subcontract Services	% subs	\$ 1,934,570	5%	\$ 96,728
<b>Total Design and Reporting Cost</b>				<b>\$ 508,228</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 45,000	\$ 11,250
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	3	\$ 357	\$ 1,071
Groundwater Performance Monitoring - MNA Suite	Sample	8	\$ 167	\$ 1,336
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140

**Table F7-5: Cost Estimate For DA 9 Groundwater Alternative 5 - Groundwater Diversion Remedy and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

Sample Collection Labor and Equipment	Well	17	\$	356	\$	6,052
Remedy Performance Data Analysis & Reporting	year	1	\$	15,000	\$	15,000
<b>Subtotal - Annual OM&amp;M</b>						<b>\$ 39,847</b>
Anticipated Number of Years of OM&M						30
Discount Rate (%)						5%
<b>Estimated Total OM&amp;M</b>						<b>\$ 557,878</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>						<b>\$ 3,025,625</b>
<b>Contingency (15%)</b>						<b>\$ 453,844</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>						<b>\$ 3,479,469</b>

**Notes:**

1. Costs are estimated within -30% / +50%.
2. General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. This has been increased to \$45,000 based on a 20% increase in capped area in GDR option. Based on the relative widths of the DA 9 and APA across the valley, the DA 9 is assigned 25% of the total annual cost.
3. Assumes no additional well installation required to supplement existing monitoring network.
4. Assumes that the drain will discharge to the creek under a NPDES permit. The associated permit, monitoring and reporting costs are incorporated above.
5. Assumes Level C upgrade is only required for drilling and spoils management for GDR along the side of DA 9, which is about 10% of the GDR length.
6. Assumes drilling cuttings are non-hazardous and are emplaced under the cap extension and will not require off-site disposal.
7. Assumes that GDR + MNA is the selected remedy for the entire Back Valley, with 25% of capital, construction and O&M costs assigned to DA 9.
8. Assumes number of wells in the MNA PMP decreases by 15% every five years.
9. Assumes no UXO is identified during UXO clearance.
10. Decommissioning costs, after remedy completion, are not included.
11. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F7-6: Cost Estimate For DA 9 Groundwater Alternative 6 - Electrical Resistance Heating (ERH) and Soil Vapor Extraction (SVE) and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** The electrical resistance heating and soil vapor extraction remedy will be used to capture the COC plume the DA 9 Area, with fifteen new horizontal wells (two sets of 5 wells in Zone AB and one set of 5 wells in Zone C). Prior to implementation a pre-design investigation will be completed to support remedy design. The above ground system component will include electrical resistance equipment, off-gas treatment, and aqueous treatment (using the same processes described for the P&T alternative 3) for any water collected in the air/water separator. The water supply to the Back Valley will be upgraded and extended to DA 9 to support the remedy and associated health and safety. Electrical service to the Back Valley will need to be upgraded to provide 750 kWh supply and this service will need to be extended to the DA 9 area. The system is expected to operate for 4 years. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	1	\$ 7,000	\$ 7,000
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Pre-Design Investigation	LS	1	\$ 50,000	\$ 50,000
Horizontal Well (Average Cost for Installation in Zones A, B and C)	Well	15	\$ 91,000	\$ 1,365,000
Groundwater Performance Monitoring - Extraction Well Baseline Sampling (Analytical, labor, consumables)	Well	15	\$ 750	\$ 11,250
Extraction Well Housing/Protection (assumes multi-level wells are co-located)	Each	5	\$ 5,000	\$ 25,000
Trenching, Piping, to Existing Treatment System Building	ft	1,410	\$ 40	\$ 56,400
Electrical/Communications Cable	ft	8,050	\$ 0.20	\$ 1,610
Electrical Service Installation (poles, transformer from Back Valley road)	LS	1	\$ 310,000	\$ 310,000
ERH Equipment and Controls Mobilization, Installation, Electrical Connection	LS	1	\$ 410,000	\$ 410,000
Potable Water Pipe (4-in.) - trenching, bedding, compaction, 30-in. depth	ft	2,000	\$ 8.75	\$ 17,500
Utility Clearance Pipeline (plus potholing)	Sq Ft	10,000	\$ 2.00	\$ 20,000
Pump Station - potable water line Booster Sta., Electrical, & Enclosure Bldg.	LS	1	\$ 35,000	\$ 35,000
Thermal Oxidation and Acid Gas Scrubber- ERH/SVE Off-Gas Treatment	LS	1	\$ 200,000	\$ 200,000
Treatment for Water (50% costs for aqueous treatment listed for P&T alternative)	%	\$ 279,700	50%	\$ 139,850
Piping, instrumentation and process control equipment	LS	1	\$ 25,000	\$ 25,000
Liquid/Off-Gas System Construction - 50% of Equip. Costs (excluding Extraction Wells)	%	\$ 364,850	25%	\$ 91,213
<b>Total Capital Cost</b>				<b>\$ 2,766,323</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 2,766,323	8%	\$ 221,306
Construction Management & As Built Report	% capital	\$ 2,766,323	6%	\$ 165,979
Project Management	% capital	\$ 2,766,323	5%	\$ 138,316
Treatability Testing - Bench Scale Testing & Work Plan	LS	1	\$ 20,000	\$ 20,000
Health and Safety	% capital	\$ 2,766,323	2%	\$ 55,326
Mark-up on Subcontract Services	% subs	\$ 2,757,823	5%	\$ 137,891
Startup Testing	LS	\$ 20,000	1	\$ 20,000
<b>Total Design and Reporting Cost</b>				<b>\$ 758,819</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEAR 1 AND 2</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
Annual O&M - ERH System Operation	month	12	\$ 17,000	\$ 204,000
Annual O&M - System Maintenance and Part Replacement	% capital	\$ 726,400	5%	\$ 36,320
Annual O&M - MSD Discharge Fees	1,000/gal.	600	\$ 4.00	\$ 2,400
Annual O&M - Vapor Sample Collection, Analysis, Reporting	LS	1	\$ 12,000	\$ 12,000
Annual O&M - MSD Sample Collection, Analysis, Reporting	LS	1	\$ 5,000	\$ 5,000
Annual O&M - Electricity Usage	kWh	4555200	\$ 0.09	\$ 409,968
Annual O&M - Oxidation consumables	year	1	\$ 10,000	\$ 10,000
Annual O&M - Treatment and Discharge of Water from Air/Water Separator (50% of costs from P&T alternative)	%	\$ 147,112	50%	\$ 73,556
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	14	\$ 357	\$ 4,998
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	3	\$ 357	\$ 1,071
Groundwater Performance Monitoring - MNA Suite	Sample	8	\$ 167	\$ 1,336
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	2	\$ 70	\$ 140
Sample Collection Labor and Equipment	Well	17	\$ 356	\$ 6,052
Remedy Performance Data Analysis & Reporting	year	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M - YEAR 1 THROUGH 4</b>				<b>\$ 791,216</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) - YEAR 5 TO 30</b>				
Annual O&M - General Site & Cap Maintenance	year	0.25	\$ 37,500	\$ 9,375
MNA Monitoring Program (see Table F7-2 and above)	year	1	\$ 28,597	\$ 28,597

**Table F7-6: Cost Estimate For DA 9 Groundwater Alternative 6 - Electrical Resistance Heating (ERH) and Soil Vapor Extraction (SVE) and Monitored Natural Attenuation (MNA) Chemtronics Site, Swannanoa, North Carolina**

<b>Subtotal - Annual OM&amp;M - YEAR 5 TO 30</b>	<b>\$ 37,972</b>
Anticipated Number of Years of OM&M	30
Discount Rate (%)	5%
<b>Estimated Total OM&amp;M (Net Present Value)</b>	<b>\$ 3,254,689</b>
<b>ERH EQUIPMENT DEMOBILIZATION - YEAR 5</b>	
Demobilization Costs + 20% for Planning, Project Management, Construction Management and Health and Safety	<b>\$ 48,000</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>	<b>\$ 6,779,830</b>
<b>Contingency (15%)</b>	<b>\$ 1,016,975</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>	<b>\$ 7,796,805</b>

Notes:

1. Costs are estimated within -30% / +50%.
2. General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of the DA 9 and APA across the valley, DA 9 is assigned 25% of the total annual cost.
3. Assumes additional well installation is not required to supplement existing monitoring network.
4. Assumes spoils from trenching managed on-site.
5. Assumes no UXO is identified during UXO clearance.
6. Decommissioning costs, after remedy completion, are not included.
7. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F8-1: Cost Estimate For APA Groundwater Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** General site maintenance will be completed for the APA for a period of 30 years. Routine monitoring will be completed to confirm site conditions.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				<b>\$ -</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	0.75	\$ 30,000	\$ 22,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 15,000	\$ 15,000
Project Management	% design	\$ 22,500	8%	\$ 1,800
<b>Total Design and Reporting Cost</b>				<b>\$ 39,300</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual Monitoring - Sample Collection, Analysis, Data Compilation, Report Preparation	year	0.75	\$ 47,000	\$ 35,250
Annual O&M - General Site & Cap Maintenance	year	0.75	\$ 37,500	\$ 28,125
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 63,375</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 974,229</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 1,013,529</b>
<b>Contingency (15%)</b>				<b>\$ 152,029</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 1,165,558</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Annual monitoring program costs of \$47,000 are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of DA 9 and APA across the valley, the APA is assigned 75% of the total annual cost.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of DA 9 and APA across the valley, the APA is assigned 75% of the total annual cost.
- Assumes no additional well installation required to supplement existing monitoring network.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F8-2: Cost Estimate For APA Groundwater Alternative 2 - Monitored Natural Attenuation  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** MNA will be used to confirm that the groundwater plume from the APA is stable or shrinking. Existing wells will be sampled. The number of monitoring locations for the MNA program will decrease over the remedy duration, based on decreases in the plume extent. General site maintenance will also be completed for the APA for a period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	0.75	\$ 30,000	\$ 22,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 15,000	\$ 15,000
Project Management	% design	\$ 22,500	8%	\$ 1,800
<b>Total Design and Reporting Cost</b>				\$ 39,300
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.75	\$ 37,500	\$ 28,125
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	44	\$ 357	\$ 15,708
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	9	\$ 357	\$ 3,213
Groundwater Performance Monitoring - MNA Suite	Sample	27	\$ 167	\$ 4,509
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	7	\$ 70	\$ 490
Sample Collection Labor and Equipment	Well	53	\$ 356	\$ 18,868
Remedy Performance Reporting	Annual	1	\$ 30,000	\$ 30,000
<b>Subtotal - Annual OM&amp;M</b>				\$ 100,913
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ 1,415,176
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ 1,454,476
<b>Contingency (15%)</b>				\$ 218,171
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ 1,672,648

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of the DA 9 and APA across the valley, the APA is assigned 75% of the total annual cost.
- Assumes additional well installation is not required to supplement existing monitoring network.
- Assumes initial MNA performance monitoring program (PMP) will consist of 44 wells (i.e., 19 Zone AB, 19 Zone CD, and 6 Zone EF wells) and 9 surface water locations. This MNA program is intended to represent about 75% of the total annual MNA program for the Back Valley based on the relative width of DA 9 and APA across the valley.
- Assumes number of wells in the MNA PMP decreases by 15% every five years.
- Assumes each sample is analyzed for volatile organic compounds (VOCs), nitroaromatics, and perchlorate. Assumes 60% of locations are analyzed for MNA parameters (i.e., dissolved hydrocarbon gases [DHGs], total organic carbon [TOC], and select anions) and 15% of locations for select dissolved metals.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F8-3: Cost Estimate APA Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Pump and treat will be used to capture the COC plume from the APA, with 12 new Zone AB extraction wells, 10 new Zone C extraction wells, and 2 new Zone DE extraction wells installed for a total estimated flow of 22 gpm. Prior to design bench-scale and treatability testing will be completed to confirm the treatment train components and operating details (dosages, retention times). The treatment system proposed below will be housed in the existing BV P&T system building, however the existing equipment will be replaced as shown to allow sufficient capacity and capability for 22 gpm of treatment of all COCs requiring treatment for discharge to MSD. Conduits from the APA will be trenched to tie into the existing P&T system building. Additional treatment components will be added to the treatment system to reduce biofouling, reduce mineral fouling and provide treatment to COCs not treated by the existing air stripper. In an attempt to reduce biofouling and maintain flow rates, extraction wells will be redeveloped twice per year and conduits will be flushed at least once per year. The existing discharge line to metering manhole will also be replaced with an above ground line. It is expected that the extraction wells will be replaced every 10 years and the treatment system will be replaced at 20 years. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, remedy performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	2	\$ 7,000	\$ 14,000
UXO Clearing	LS	5	\$ 1,500	\$ 7,500
Extraction Well Install - Zone AB, Development, Waste Mgt. Survey	well	12	\$ 11,350	\$ 136,200
Extraction Well Install - Zone C, Development, Waste Mgt. Survey	well	10	\$ 30,600	\$ 306,000
Extraction Well Install - Zone DE, Development, Waste Mgt. Survey	well	2	\$ 56,000	\$ 112,000
Extraction Pump/Install + Wellhead Piping: Grundfos Redi-Flo3 w/Controller interface, Teflon cabling pkg.	well	24	\$ 4,940	\$ 118,560
Groundwater Performance Monitoring - Extraction Well Baseline Sampling (Analytical, labor, consumables)	well	24	\$ 750	\$ 18,000
Extraction Well Housing/Protection	Each	24	\$ 5,000	\$ 120,000
Conveyance Piping Installation (Trenching, Piping, Electrical, Controls of Sufficient Width for # EWs)	ft	1058	\$ 150	\$ 158,700
Spoils Management	DAY	2	\$ 11,197	\$ 22,394
Air Stripper - Venturi Method w/feed pump, dP monitoring, stripper tank, fan.	LS	0.75	\$ 49,500	\$ 37,125
EQ Tank: XHDPE 1,100-gal. conical-bottom w/stand	LS	0.75	\$ 2,625	\$ 1,969
Potable Water Pipe (4-in.) - trenching, bedding, compaction, 30-in. depth	ft	1500	\$ 8.75	\$ 13,125
Utility Clearance Pipeline (plus potholing)	Sq Ft	7500	\$ 2.00	\$ 15,000
Pump Station - potable water line Booster Sta., Electrical, & Enclosure Bldg.	LS	0.75	\$ 35,000	\$ 26,250
Clarifier - 10-ft. dia., solids contact unit w/ mixers, drive, launders.	LS	0.75	\$ 150,000	\$ 112,500
Clarifier - concrete foundation, steel work, & base.	LS	0.75	\$ 40,000	\$ 30,000
Tank - Clarifier sludge storage, 900-gal. HD poly w/ 45-deg. conical bottom. Liquids =	LS	0.75	\$ 2,900	\$ 2,175
Dewatering - lime sludge filter press	LS	0.75	\$ 65,000	\$ 48,750
Lime - hydrated storage tank, dosing / metering, feed system.	LS	0.75	\$ 160,000	\$ 120,000
Oxidation system	LS	0.75	\$ 400,000	\$ 300,000
Recarbonation - CO2 recarbonation system for clarifier effluent	LS	0.75	\$ 185,000	\$ 138,750
Piping, instrumentation and process control equipment	LS	0.75	\$ 25,000	\$ 18,750
Electrical - Upgrade 100 Amp Service Panel to 200 Amp Service	LS	0.75	\$ 2,500	\$ 1,875
Tank - Oxidation conical bottom poly storage tank w/ stand (500-gal.)	LS	0.75	\$ 1,275	\$ 956
Decommission Existing Extraction Well + Services	LS	0.75	\$ 27,000	\$ 20,250
Treatment System Building Upgrades/Maintenance	LS	0.75	\$ 10,000	\$ 7,500
Equalization Tank, Booster Pump, and Above Ground Discharge Line to MSD Connection	LS	0.75	\$ 196,000	\$ 147,000
Biotreatment unit	LS	0.75	\$ 1,400,000	\$ 1,050,000
P&T System Construction - 50% of Equip. Costs (excluding Extraction Wells)	%	\$ 1,013,850	50%	\$ 506,925
<b>Total Capital Cost</b>				<b>\$ 3,612,254</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	%	\$ 3,612,254	8%	\$ 288,980
Construction Management & As Built Report	%	\$ 3,612,254	6%	\$ 216,735
Project Management	%	\$ 3,612,254	5%	\$ 180,613
Treatability Testing - Bench Scale Testing & Work Plan	LS	1	\$ 20,000	\$ 20,000
Health and Safety	%	\$ 3,612,254	2%	\$ 72,245
Mark-up on Subcontract Services	%	\$ 3,612,254	5%	\$ 180,613
Startup Testing	Day	20	\$ 1,500	\$ 30,000
<b>Total Design and Reporting Cost</b>				<b>\$ 989,186</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.75	\$ 37,500	\$ 28,125
Annual O&M - P&T System Maintenance and Part Replacement	% capital	\$ 3,036,554	5%	\$ 151,828
Annual O&M - Dumpster, 20-yd. capacity for dewatered sludge storage + disposal.	Month	3	\$ 498	\$ 1,494

**Table F8-3: Cost Estimate APA Groundwater Alternative 3 - Pump and Treat and Monitored Natural Attenuation  
Chemtronics Site, Swannanoa, North Carolina**

Annual O&M - MSD Discharge Fees	1,000/gal.	11850	\$	4.00	\$	47,400
Annual O&M - MSD Sample Collection, Analysis, Reporting	LS	0.75	\$	5,000	\$	3,750
Annual O&M - Electricity Usage	kWh	279600	\$	0.10	\$	27,960
Annual O&M - Extraction Well Rehab - Twice Annual redevelopment, incl. labor & equip.	well	48	\$	1,500	\$	72,000
Annual O&M - Conveyance Piping / acid flush, scale removal, labor & mat'l. (Annual)	LS	1	\$	9,000	\$	9,000
Annual O&M - Lime slurry / clarifier feed	Month	12	\$	375	\$	4,500
Annual O&M - CO2 for Recarbonation System	Month	12	\$	375	\$	4,500
Annual O&M - Oxidation consumables	year	1	\$	15,000	\$	15,000
Annual O&M - Biological system	year	0.75	\$	250,000	\$	187,500
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	44	\$	357	\$	15,708
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	9	\$	357	\$	3,213
Groundwater Performance Monitoring - MNA Suite	Sample	27	\$	167	\$	4,509
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	7	\$	70	\$	490
Sample Collection Labor and Equipment	Well	53	\$	356	\$	18,868
Remedy Performance Data Analysis & Reporting	year	1	\$	30,000	\$	30,000
<b>Subtotal - Annual OM&amp;M</b>					<b>\$</b>	<b>625,845</b>
Anticipated Number of Years of OM&M						30
Discount Rate (%)						5%
<b>SYSTEM REPLACEMENT - WELLS YEARS 10, 20, 30, COMPLETE SYSTEM YEAR 20</b>						
Capital Costs of Initial Installation + Well Decommissioning + 20% for Planning, Project Management, Construction Management and Health and Safety					\$	881,040
Construction, design and reporting costs associated with replacement of the treatment system and wells in Year 20	LS	1	\$	4,601,440	\$	4,601,440
<b>Estimated Total OM&amp;M (Net Present Value)</b>					<b>\$</b>	<b>9,259,869</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>					<b>\$</b>	<b>13,861,308</b>
<b>Contingency (15%)</b>					<b>\$</b>	<b>2,079,196</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>					<b>\$</b>	<b>15,940,505</b>

## Notes:

- Costs are estimated within -30% / +50%.
- General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of the DA 9 and APA across the valley, the APA is assigned 75% of the total annual cost.
- Assumes additional well installation is not required to supplement existing monitoring network.
- Assumes that P&T + MNA is the selected remedy for the entire Back Valley, with 75% of capital, construction and O&M costs assigned to APA.
- Assumes spoils from trenching managed on-site.
- Assumes no UXO is identified during UXO clearance.
- Decommissioning costs, after remedy completion, are not included.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F8-4: Cost Estimate For APA Groundwater Alternative 4 - Enhanced In-Situ Bioremediation - Anaerobic Biobarrier and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** A biobarrier will be created by injections of electron donor, pH Buffers and KB-1 into a row of injection wells (IW) located downgradient of the APA. For the purposes of feasibility evaluations and costing, a period of 30 years is assumed. Prior to implementation a pre-design investigation will be completed to support full-scale design. The IWs will be spaced 20 ft apart in the A/B unit and 50 ft apart in the C/D unit (one to three screen intervals will be used in each zone depending on thickness). Substrate reinjection will occur in Year 2, then every 3 years until Year 11 and then every 5 years up to Year 30. The first injection event is expected to establish an anaerobic and reducing bioactive zone and thus KB-1 addition will only be completed in the first reinjection event and the electron donor will also be changed to EVO. The amount of electron donor and Neutral Zone pH buffer will be decreased by half following the first reinjection event. General site maintenance will also be completed for the APA for a period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
Clearing and Grubbing	acre	2	\$ 7,000	\$ 14,000
UXO Clearing	LS	2	\$ 1,500	\$ 3,000
Pre-Design Investigation	LS	1	\$ 150,000	\$ 150,000
Injection Well - Zone AB Installation, Development, Waste Management, Survey	well	58	\$ 8,350	\$ 484,300
Injection Well - Zone CD Installation, Development, Waste Management, Survey	well	24	\$ 30,600	\$ 734,400
EHC-L Electron Donor	lb	259,732	\$ 1.70	\$ 441,545
pH Buffer, Sodium Bicarbonate	lb	69,269	\$ 0.60	\$ 41,562
pH Buffer, Neutral Zone	lb	69,269	\$ 2.30	\$ 159,319
KB-1 Culture - Low pH	L	249	\$ 200	\$ 49,800
Injection Preparation & Demobilization Activities	Day	10	\$ 1,440	\$ 14,400
Injection Field Activities	Day	106	\$ 2,600	\$ 275,659
Generator - Diesel 56 kW Purchase	LS	1	\$ 16,000	\$ 16,000
Generator - Fuel	week	22	\$ 300	\$ 6,600
Misc Equipment, Supplies, Sampling Equipment	week	22	\$ 1,000	\$ 22,000
Potable Water Pipe (4-in.) - trenching, bedding, compaction, 30-in. depth	LS	500	\$ 8.75	\$ 4,375
Utility Clearance Pipeline (plus potholing)	LS	2,500	\$ 2.00	\$ 5,000
Pump Station - potable water line Booster Sta., Electrical, & Enclosure Bldg.	LS	1	\$ 35,000	\$ 35,000
Skid Steer	LS	1	\$ 40,000	\$ 40,000
Site Injection Trailer - O&M Cost	Days	106	\$ 50	\$ 5,301
<b>Total Capital Cost</b>				<b>\$ 2,502,262</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	% capital	\$ 2,502,262	8%	\$ 200,181
Construction Management & As Built Report	% capital	\$ 2,502,262	6%	\$ 150,136
Health and Safety	% capital	\$ 2,502,262	2%	\$ 50,045
Project Management	% capital	\$ 2,502,262	5%	\$ 125,113
Mark-up on Subcontract Services	% capital	\$ 1,218,700	5%	\$ 60,935
<b>Total Design and Reporting Cost</b>				<b>\$ 586,410</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.75	\$ 37,500	\$ 28,125
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	44	\$ 357	\$ 15,708
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	9	\$ 357	\$ 3,213
Groundwater Performance Monitoring - MNA Suite	Sample	27	\$ 167	\$ 4,509
Groundwater Performance Monitoring - Metals only (Analytical)	Sample	7	\$ 70	\$ 490
Sample Collection Labor and Equipment	Well	53	\$ 356	\$ 18,868
Remedy Performance Data Analysis & Reporting	year	1	\$30,000	\$ 30,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 100,913</b>
<b>REINJECTION EVENT - YEAR 2</b>				
Injection Capital Costs of Initial Event + Well Redevelopment (\$100,000) + 20% for Planning, Project Management, Construction Management and Health and Safety				<b>\$ 1,123,825</b>
<b>REINJECTION EVENT - YEAR 5, 8, 11, 16, 21, 26</b>				
Injection Capital Costs of Initial Event (Only Half Volume of Amendments) + Well Redevelopment (\$100,000) 20% for Planning, Project Management, Construction Management and Health and Safety				<b>\$ 816,289</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%

**Table F8-4: Cost Estimate For APA Groundwater Alternative 4 - Enhanced In-Situ Bioremediation - Anaerobic Biobarrier and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

<b>Estimated Total OM&amp;M</b>	<b>\$ 5,045,561</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>	<b>\$ 8,134,233</b>
<b>Contingency (15%)</b>	<b>\$ 1,220,135</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>	<b>\$ 9,354,368</b>

---

Notes:

1. Costs are estimated within -30% / +50%.
2. General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. Based on the relative widths of the DA 9 and APA across the valley, the APA is assigned 75% of the total annual cost.
3. Assumes additional well installation is not required to supplement existing monitoring network.
4. Bioaugmentation is only included in the first reinjection event as it is assumed that the desired microbial population will be established by then.
5. Assumes number of wells in the MNA PMP decreases by 15% every five years.
6. Assumes no UXO is identified during UXO clearance.
7. Decommissioning costs, after remedy completion, are not included.
8. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F8-5: Cost Estimate For APA Groundwater Alternative 5 - Groundwater Diversion Remedy and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** The groundwater diversion remedy consists of an upgradient subsurface barrier constructed along the North and West sides of the APA. Prior to implementation a pre-design investigation will be completed to support design. The barrier consists of a soil-bentonite vertical barrier wall (VBW) from the ground surface down to the top of rock. The wall will be placed in contact with competent rock to the extent practical. In addition, a grout curtain will be installed to a depth of 115 ft below the top of competent rock. The grout curtain is assumed to consist of two inclined grout points at a spacing of 10 ft, with one inclined away from the APA and one inclined toward toward the APA. The grout points are assumed to be inclined at 20 degrees to the horizontal. A drain will be installed 3 ft above the top of rock along the northern side of the VBW. A geomembrane cap will be installed from the edge of the existing APA cap to to 5 ft past the center line of the VBW. A fence will be extended around the the GDR alignment and the cap extension. General site maintenance will be completed for the remedy period of 30 years. Monitoring and reporting will be completed on an annual basis to confirm site conditions, treatment performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Site Preparation</b>				
Construction Survey Layout	DAY	2	\$ 1,950	\$ 3,900
Clearing and Grubbing	ACRE	3	\$ 7,000	\$ 21,000
Pre-Design Investigation	LS	1	\$ 150,000	\$ 150,000
Cut & Chip Trees	ACRE	3	\$ 16,000	\$ 48,000
UXO Clearing	LS	3	\$ 1,500	\$ 4,500
Chain Link Fence Removal	LF	675	\$ 2.39	\$ 1,613
E&S Measures, Double Silt Line Fence	LF	2400	\$ 4.22	\$ 10,128
Access Road Improvements	LS	0.75	\$ 231,000	\$ 173,250
<b>Groundwater Drain</b>				
Upgradient Drain, Excavation	SF	9893	\$ 13	\$ 127,125
Upgradient Drain, Aggregate	TON	204	\$ 25	\$ 5,100
Upgradient Drain, 6" HDPE	LF	488	\$ 19	\$ 9,126
Upgradient Drain, Backfill	DAY	6	\$ 5,657	\$ 33,944
<b>Vertical Barrier Wall</b>				
Working Bench Installation/Teardown	LF	975	\$ 17	\$ 16,230
VBW mobilization, >50 ft. deep	LS	0.75	\$ 612,796	\$ 459,597
VBW Construction, >50 ft. deep	SF	30642	\$ 13	\$ 393,717
Spoils Management	DAY	9	\$ 11,197	\$ 100,771
Waste Disposal Estimate (Assumes most non-hazardous)	CY	3405	\$ 83	\$ 283,405
Spoils Solidification	CY	3405	\$ 16	\$ 53,138
<b>Grout Curtain</b>				
Contractor Mobilization - Grout Curtain	LS	0.75	\$ 52,020	\$ 39,015
HSA drilling through soil/saprolite	LF	6128	\$ 31	\$ 191,267
Drilling and grouting through PWR and Rock	LF	22028	\$ 156	\$ 3,437,690
<b>Directional Drilling</b>				
Medium Equipment Mobilization Costs	EA	0.75	\$ 1,530	\$ 1,148
Set Up Fee	EA	2	\$ 765	\$ 1,530
Drilling up to 12" diameter	LF	578	\$ 165	\$ 95,370
<b>Geosynthetic Cap</b>				
Extend Geosynthetic Over Cap	SF	86,434	\$ 1.56	\$ 134,889
Topsoil Stripping and Stockpiling	CY	4802	\$ 2.06	\$ 9,892
Backfill, Structural	LCY	9004	\$ 2.79	\$ 25,121
Finish Grading	DAY	1	\$ 1,887	\$ 1,415
<b>Site Restoration</b>				
Chain Link Fence Installation	LF	1238	\$ 44	\$ 53,853
Hydroseed Slopemix	MSF	99	\$ 62	\$ 6,089
<b>H&amp;S</b>				
Level C Upgrade	%	49,449	\$ 0.35	\$ 17,307
<b>Total Construction Cost</b>				<b>\$ 5,909,129</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting	%	\$ 5,909,129	8%	\$ 472,730
Construction Management & As Built Report	%	\$ 5,909,129	6%	\$ 354,548
Project Management	%	\$ 5,909,129	5%	\$ 295,456
Health and Safety	%	\$ 5,909,129	2%	\$ 118,183
Mark-up on Subcontract Services	%	\$ 5,909,129	5%	\$ 295,456
<b>Total Design and Reporting Cost</b>				<b>\$ 1,536,374</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Annual O&M - General Site & Cap Maintenance	year	0.75	\$ 45,000	\$ 33,750
Groundwater Performance Monitoring - Annual Event Suite (Analytical)	Sample	44	\$ 357	\$ 15,708
Surface Water Performance Monitoring - Annual Event Suite (Analytical)	Sample	9	\$ 357	\$ 3,213
Groundwater Performance Monitoring - MNA Suite	Sample	27	\$ 167	\$ 4,509

**Table F8-5: Cost Estimate For APA Groundwater Alternative 5 - Groundwater Diversion Remedy and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

Groundwater Performance Monitoring - Metals only (Analytical)	Sample	7	\$	70	\$	490
Sample Collection Labor and Equipment	Well	53	\$	356	\$	18,868
Remedy Performance Data Analysis & Reporting	year	1	\$	30,000	\$	30,000
<b>Subtotal - Annual OM&amp;M</b>					<b>\$</b>	<b>106,538</b>
Anticipated Number of Years of OM&M						30
Discount Rate (%)						5%
<b>Estimated Total OM&amp;M</b>					<b>\$</b>	<b>1,454,354</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>					<b>\$</b>	<b>8,899,857</b>
<b>Contingency (15%)</b>					<b>\$</b>	<b>1,334,978</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>					<b>\$</b>	<b>10,234,835</b>

Notes:

1. Costs are estimated within -30% / +50%.
2. General Site and cap maintenance costs of \$37,500 per annum are for the entire Back Valley, based on recent costs incurred for the Site. This has been increased to \$45,000 based on a 20% increase in capped area in GDR option. Based on the relative widths of the DA 9 and APA across the valley, the APA is assigned 75% of the total annual cost.
3. Assumes no additional well installation required to supplement existing monitoring network.
4. Assumes that the drain will discharge to the creek under a NPDES permit. The associated permit, monitoring and reporting costs are incorporated above.
5. Assumes Level C upgrade is only required for drilling and spoils management for GDR along the side of DA 9, which is about 10% of the GDR length.
6. Assumes drilling cuttings are non-hazardous and are emplaced under the cap extension and will not require off-site disposal.
7. Assumes that GDR + MNA is the selected remedy for the entire Back Valley, with 75% of capital, construction and O&M costs assigned to APA.
8. Assumes number of wells in the MNA PMP decreases by 15% every five years.
9. Assumes no UXO is identified during UXO clearance.
10. Decommissioning costs, after remedy completion, are not included.
11. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F9-1: Cost Estimate For DA 9 Soil/Waste Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** A work plan and stakeholder and regulatory negotiation would be completed to support a NFA determination for the DA 9 soil/waste. This alternative assumes no additional activities would be needed following the NFA determination.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 15,000	\$ 15,000
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				\$ <b>23,100</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
<b>Subtotal - Annual OM&amp;M</b>				\$ -
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ -
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ <b>23,100</b>
<b>Contingency (15%)</b>				\$ <b>3,465</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ <b>26,565</b>

## Notes:

- Costs are estimated within -30% / +50%.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F9-2: Cost Estimate For DA 9 Soil/Waste Alternative 2 - Engineering Controls and Monitored Natural Attenuation  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** The caps and fence will be maintained and the results from the groundwater monitoring program would be used to confirm that the objectives of the existing remedy are continuing to be met. Costs for cap maintenance and groundwater monitoring are included under the groundwater remedy. Data evaluation and reporting is expected to be completed for an annual basis to confirm site conditions and assess natural attenuation

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 15,000	\$ 15,000
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				<b>\$ 23,100</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Remedy Performance Reporting	Annual	1	\$ 10,000	\$ 10,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 10,000</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 153,725</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 176,825</b>
<b>Contingency (15%)</b>				<b>\$ 26,524</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 203,348</b>

## Notes:

1. Costs are estimated within -30% / +50%.
2. Remedy benefits for groundwater will be monitored as part of the groundwater remedy.
3. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F9-3: Cost Estimate For DA 9 Soil/Waste Alternative 3 - Engineering Controls and Monitored Natural Attenuation (MNA) with contingent Soil Vapor Extraction (SVE)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** The caps and fence will be maintained and the results from the groundwater monitoring program would be used to confirm that the objectives of the existing remedy are continuing to be met. Costs for cap maintenance and groundwater monitoring are included under the groundwater remedy. If data obtained from future groundwater performance monitoring indicates that additional remedial measures are necessary at DA 9 to achieve RAOs (for example, if monitoring shows consistent increases in TC concentrations indicating that contaminants may be leaching from DA 9 at an accelerated rate), then soil gas sampling and potential implementation of a SVE contingency measure will be considered. A detailed cost estimate for these activities has not been provided as the scope and costs would be developed based on monitoring results, however the anticipated range in costs associated with these activities is provided in the notes. Data evaluation and reporting is expected to be completed for an annual basis to confirm site conditions, treatment performance and assess natural attenuation, and would continue following the contingent SVE remedy, if employed.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				<b>\$ -</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 15,000	\$ 15,000
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				<b>\$ 23,100</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M) MNA - YEARS 1 TO 5 AND 11 TO 30</b>				
Remedy Performance Reporting	Annual	1	\$ 10,000	\$ 10,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 10,000</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 153,725</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 176,825</b>
<b>Contingency (15%)</b>				<b>\$ 26,524</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 203,348</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Remedy benefits for groundwater will be monitored as part of the groundwater remedy.
- If employed, the contingent SVE component may be operated for a period of 1 to 4 years, with the total cost including any pre-design investigation and pilot testing in the range of \$1,000,000 to \$5,000,000, dependant on remedy scope and duration.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F10-1: Cost Estimate For APA Soil/Waste Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** A work plan and stakeholder and regulatory negotiation would be completed to support a NFA determination for the APA soil/waste. This alternative assumes no additional activities would be needed following the NFA determination.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 22,500	\$ 22,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 15,000	\$ 15,000
Project Management	% design	\$ 22,500	8%	\$ 1,800
<b>Total Design and Reporting Cost</b>				\$ 39,300
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
				\$ -
<b>Subtotal - Annual OM&amp;M</b>				\$ -
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ -
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ 39,300
<b>Contingency (15%)</b>				\$ 5,895
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ 45,195

## Notes:

- Costs are estimated within -30% / +50%.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F10-2: Cost Estimate For APA Soil/Waste Alternative 2 - Engineering Controls and Monitored Natural Attenuation (MNA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** The caps and fence will be maintained and the results from the groundwater monitoring program would be used to confirm that the objectives of the existing remedy are continuing to be met. Costs for cap maintenance and groundwater monitoring are included under the groundwater remedy. Data evaluation and reporting will be completed on an annual basis for a 30 year period to confirm site conditions and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 22,500	\$ 22,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 15,000	\$ 15,000
Project Management	% design	\$ 22,500	8%	\$ 1,800
<b>Total Design and Reporting Cost</b>				<b>\$ 39,300</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Remedy Performance Reporting	Annual	1	\$ 15,000	\$ 15,000
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ 15,000</b>
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				<b>\$ 230,587</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 269,887</b>
<b>Contingency (15%)</b>				<b>\$ 40,483</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 310,370</b>

## Notes:

1. Costs are estimated within -30% / +50%.
2. Remedy benefits for groundwater will be monitored as part of the groundwater remedy.
3. While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F11-1: Cost Estimate For Debris Area 1 Soil Alternative 1 - No Further Action (NFA)  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** A work plan and stakeholder and regulatory negotiation would be completed to support a NFA determination for the Debris Area 1 soil/debris. This alternative assumes no additional activities would be needed following the NFA determination.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 7,500	\$ 7,500
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				\$ 15,600
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
				\$ -
<b>Subtotal - Annual OM&amp;M</b>				\$ -
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ -
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ 15,600
<b>Contingency (15%)</b>				\$ 2,340
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ 17,940

## Notes:

- Costs are estimated within -30% / +50%.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F11-2: Cost Estimate For Debris Area 1 Soil Alternative 2 - Monitored Natural Attenuation  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** MNA will be used to confirm that the RDX concentrations in soil at Debris Area 1 are stable or decreasing. Monitoring and reporting will be completed on an annual basis over a 30 year period to confirm site conditions, remedy performance and assess natural attenuation.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
<b>Total Capital Cost</b>				\$ -
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design and Work Plan	LS	1	\$ 7,500	\$ 7,500
Stakeholder & Regulatory Negotiation (Meetings, Response to Comments)	LS	1	\$ 7,500	\$ 7,500
Project Management	% design	\$ 7,500	8%	\$ 600
<b>Total Design and Reporting Cost</b>				\$ 15,600
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
Shallow Soil Sample Collection	Day	0.5	\$ 1,100	\$ 550
Confirmatory Sample Analysis	Each	8	\$ 110	\$ 880
Field Preparation and Oversight	Day	0.5	\$ 1,100	\$ 550
Remedy Performance Reporting	Annual	1	\$ 5,000	\$ 5,000
<b>Subtotal - Annual OM&amp;M</b>				\$ 6,980
Anticipated Number of Years of OM&M				30
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M</b>				\$ 107,300
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				\$ 122,900
<b>Contingency (15%)</b>				\$ 18,435
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				\$ 141,335

## Notes:

- Costs are estimated within -30% / +50%.
- Decommissioning costs, after remedy completion, are not included.
- Assumes each sample is analyzed for nitroaromatics, MNA parameters (i.e., dissolved hydrocarbon gases [DHGs], total organic carbon [TOC], and select anions) and select
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.

**Table F11-3: Cost Estimate Debris Area 1 Soil Alternative 3 - Excavation and Off-Site Disposal  
Chemtronics Site, Swannanoa, North Carolina**

**Description:** Shallow soil in Debris Area 1 in the vicinity of soil boring S3 will be voluntarily excavated to a depth of 2 ft bgs and an area of about 10 ft by 10 ft. The excavation footprint will be pre-defined based on prior characterization data; therefore post-excavation confirmatory sampling will not be performed. In addition, debris in the area will be removed. It is assumed that the soil and debris can be disposed of as non-hazardous waste. No further activities will be completed after excavation and backfill for Debris Area 1 soil.

Item	Unit	No. of Units	Unit Cost	Total
<b>CAPITAL AND CONSTRUCTION COSTS</b>				
UXO Clearing	LS	1	\$ 1,500	\$ 1,500
Excavator and Operator, includes mobilization	Day	1	\$ 3,800	\$ 3,800
Technician and Truck	Day	1	\$ 580	\$ 580
Clean Fill Placement, Compaction & Grading	CY	7	\$ 15	\$ 105
Backhoe, Dump Truck and Operator for Debris Removal, includes mobilization	Day	1	\$ 4,100	\$ 4,100
Characterization Sample Analysis	Each	4	\$ 200	\$ 800
Roll-Off for Waste Containerization	LS	1	\$ 2,600	\$ 2,600
Off-Site Disposal - Non-Hazardous (soil and debris)	ton	15	\$ 40	\$ 600
Field Meters	Day	2	\$ 500	\$ 1,000
Field Oversight	Day	2	\$ 1,091	\$ 2,182
<b>Total Capital Cost</b>				<b>\$ 17,267</b>
<b>DESIGN AND REPORTING COSTS</b>				
Detailed Design, Work Plan, H&S Plan & Permitting, <\$500K Cap Cost	LS	\$ 1	8,000	\$ 8,000
Construction Management & As Built Report <\$500K Cap Cost	LS	\$ 1	8,000	\$ 8,000
Health and Safety	% capital	\$ 17,267	2%	\$ 345
Project Management <\$500K Cap Cost	% capital	\$ 17,267	6%	\$ 1,036
Mark-up on Subcontract Services	% capital	\$ 15,085	5%	\$ 754
<b>Total Design and Reporting Cost</b>				<b>\$ 18,136</b>
<b>ANNUAL OPERATIONS, MAINTENANCE &amp; MONITORING (OM&amp;M)</b>				
<b>Subtotal - Annual OM&amp;M</b>				<b>\$ -</b>
Anticipated Number of Years of OM&M				0
Discount Rate (%)				5%
<b>Estimated Total OM&amp;M (Net Present Value)</b>				<b>\$ -</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE</b>				<b>\$ 35,403</b>
<b>Contingency (15%)</b>				<b>\$ 5,310</b>
<b>ESTIMATED COST OF REMEDIAL ALTERNATIVE INCLUDING 15% CONTINGENCY</b>				<b>\$ 40,713</b>

## Notes:

- Costs are estimated within -30% / +50%.
- Assumes no UXO is identified during UXO clearance.
- While the 1998 USEPA guidance recommends application of a 7% discount rate, a discount rate of 5% was applied to the cost estimates in Appendix F to reflect the current economic conditions.