Cover Sheet

Project	**Plum Brook Ordnance Works**
Study Item	**Garage Maintenance Area**

Study Team		**Office Symbol**	**Telephone**	**Discipline**
Leader	Charlie Lutz	CB&I	865-694-7434	Geology
Members	Brian Clouse	EC-TC	304-399-5350	Cost
	Duane Root	CB&I	865-694-7360	Chemistry
	Linda Ingram	EC-C	615-736-5622	Civil
Project Manager:	Rick Meadows	LRH-PM	304-399-5388	Project Manager
VE Officer:	Paula Coleman	EC	615-736-7609	VEO/Chemist

savings: $ 136,000 to 530,000*

* lowest savings is option 2 only
largest savings is option 1a and option 2 combined

Percentage of Alternate #3: 11% to 43%

200-1e
G05OH001825_04.10_0500_a

Current Status of Project

Nature and extent of contaminated soils is defined within the former Sellite Area. Surface/Ground water and sediment do not require any remedial actions. Risk has been evaluated, both human health and ecological. RAO's have been established for human health and ecological. Potential alternatives/cost have been evaluated. Cost provided assumes that local landfill will take soil with low pH for daily cover.

Individuals on PDT	Approval Authority Position/Organization	Telephone
Lisa Humphreys	LRH Technical Lead	304-399-5953
Rick Meadows	LRH Project Manager	304-399-5388
Jim Beajuon	LRN Geologist	615-736-77629
Lannae Long	LRN Risk Assessor	615-736-2049
Chris Stolz	LRN Environmental Engineer	615-736-2021

Historic Data

The former 9,000-acre PBOW facility was used for the manufacture of nitroaromatics during World War II. NASA operates and maintains the site as the Plum Brook Station, which is a satellite of the John H. Glenn Research Center, located at Lewis Field in Cleveland, Ohio. PBOW is located approximately 4 miles south of Sandusky, Ohio, and 59 miles west of Cleveland. Although primarily in Perkins and Oxford Townships, the eastern edge of PBOW extends into Huron and Milan Townships. PBOW is bounded on the north by Bogart Road, on the south by Mason Road, on the west by Patten Tract Road, and on the east by U.S Highway 250. The areas surrounding PBOW are primarily agricultural and residential. Public access is prohibited at PBOW except during the annual deer hunting season, which is by permit only.
Former Sellite Area. The Former Sellite Area is located on the north side of Maintenance Road, approximately 1,600 feet to the west of the LS. The ULA abuts the Former Sellite Area to the east. During PBOW operation, the Former Sellite Area was used for the production and storage of raw sellite which was used for the TNT washing process (Dames & Moore, Inc. [D&M], 1995). Sellite was produced by burning sulfur to produce sulfur dioxide followed by reaction with sodium carbonate. Extensive barren areas with pieces of sulfur and slag on the ground surface were observed at the Former Sellite Area during field reconnaissance by D&M (D&M, 1995) and again by Shaw in October 2010.

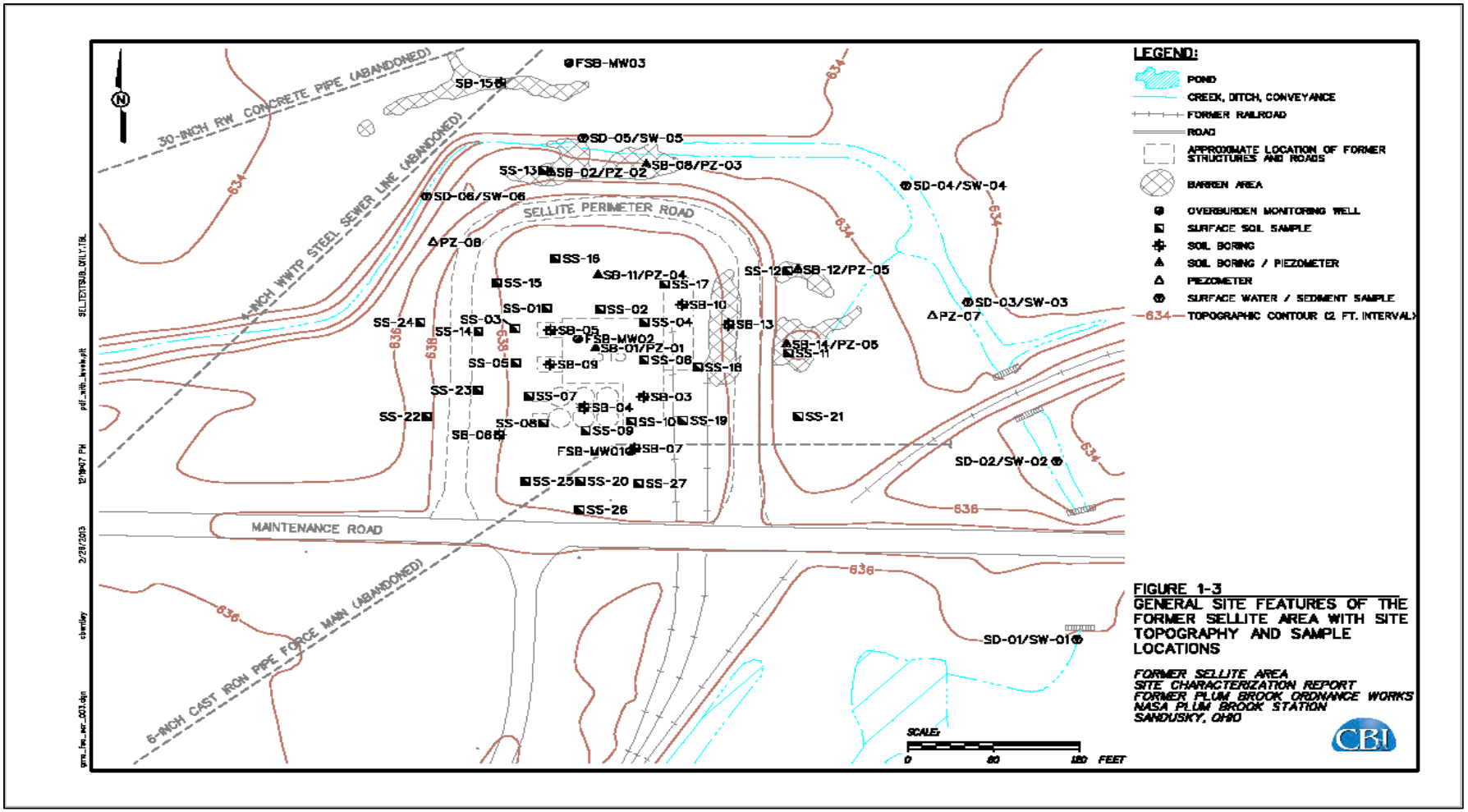
Special Criteria

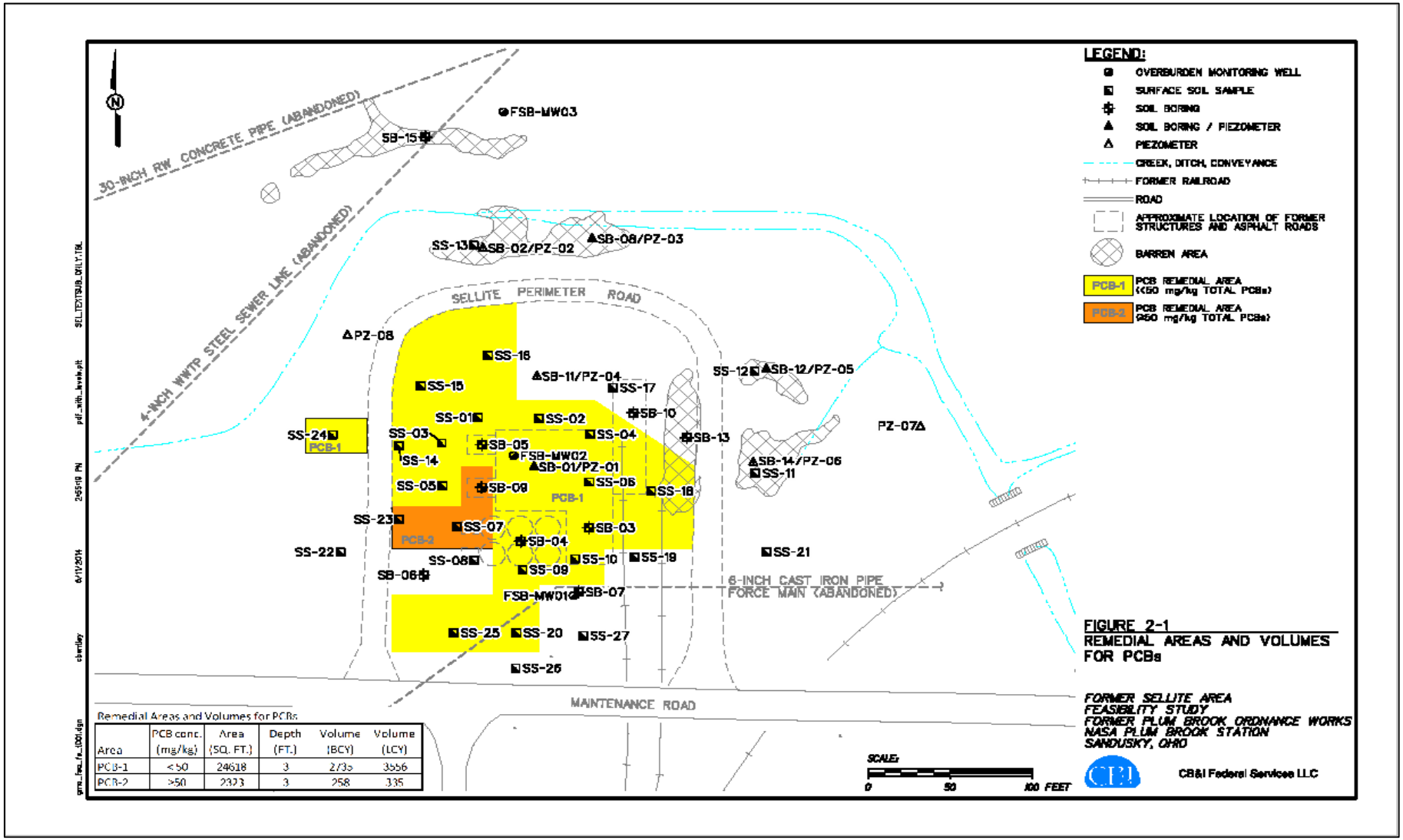
Restrictions

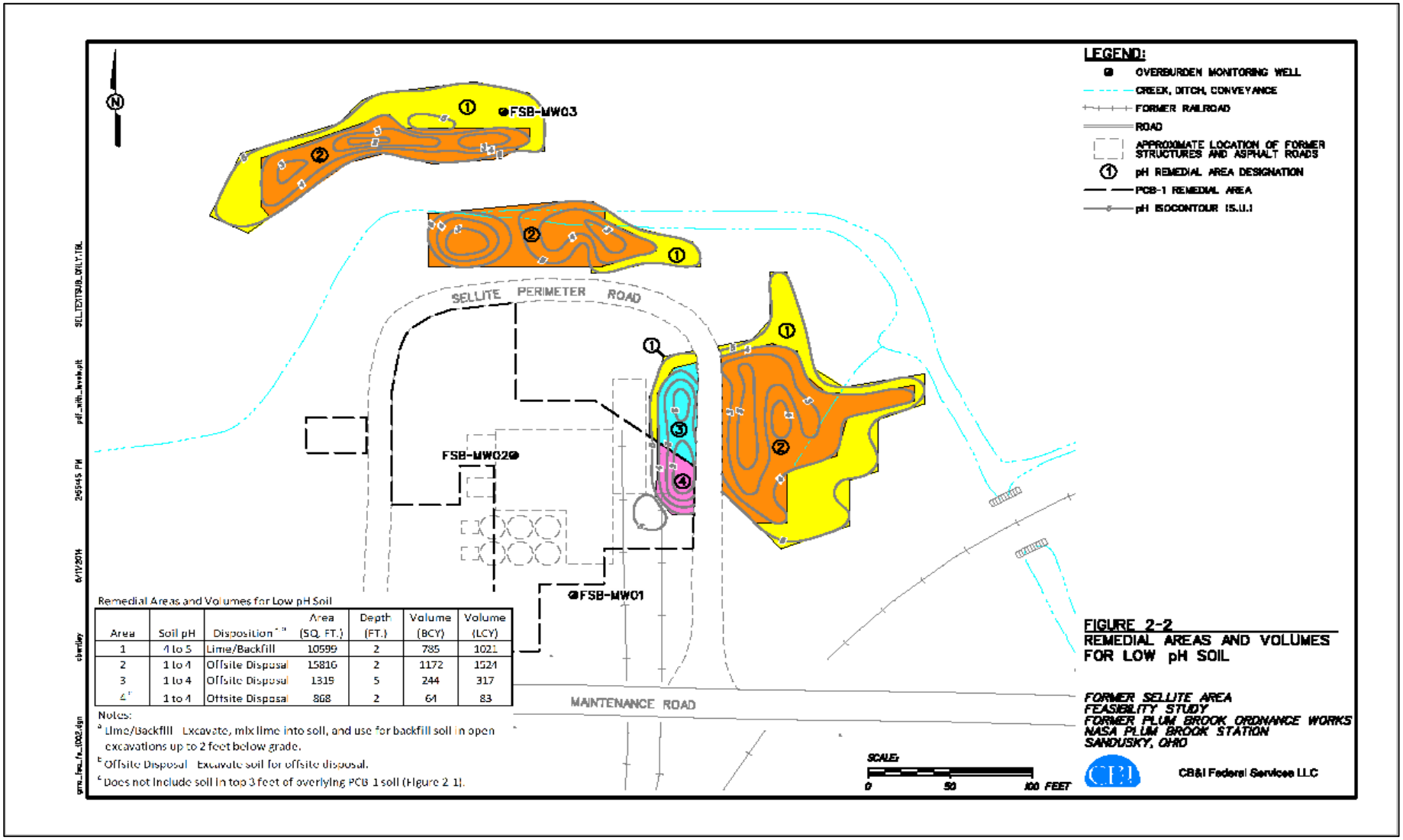
Clean up to unrestricted use.

Other

The Garage Maintenance area includes the Former Sellite Area, the Unloading Area and the Locomotive Building Area (Locomotive Shop and Railcar Wash Area). The Unloading Area and the Locomotive Building Area do not require remedial action, so the VE study focused on the Former Sellite Area.


30-INCH RW CONCRETE PIPE (ABANDONED)
4-INCH WWTP STEEL SEWER LINE (ABANDONED)
6-INCH CAST IRON PIPE FORCE MAIN (ABANDONED)
SELLITE PERIMETER ROAD
MAINTENANCE ROAD
FSB-MW03
SB-15
SD-05/SW-05
SB-08/PZ-03
SS-13
SB-02/PZ-02
SD-06/SW-06
SD-04/SW-04
PZ-08
SS-16
SB-11/PZ-04
SS-17
SS-12
SB-12/PZ-05
SS-15
SD-03/SW-03
PZ-07
SS-01
SS-02
SB-10
SS-24
SS-03
SS-04
SB-13
SS-14
SB-05
FSB-MW02
SB-01/PZ-01
SB-14/PZ-05
SS-11
SS-05
SB-09
SS-06
SS-18
SS-23
SS-07
SB-03
SB-04
SS-22
SS-21
SS-08
SS-10
SS-19
SS-09
SB-06
FSB-MW01
SB-07
SD-02/SW-02
SS-25
SS-20
SS-27
SS-26
SD-01/SW-01
LEGEND:
POND
CREEK, DITCH, CONVEYANCE
FORMER RAILROAD
ROAD
APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
BARREN AREA
OVERBURDEN MONITORING WELL
SURFACE SOIL SAMPLE
SOIL BORING
SOIL BORING / PIEZOMETER
PIEZOMETER
SURFACE WATER / SEDIMENT SAMPLE
634 TOPOGRAPHIC CONTOUR (2 FT. INTERVAL)
SCALE:
0
80
160 FEET
FIGURE 1-3
GENERAL SITE FEATURES OF THE FORMER SELLITE AREA WITH SITE TOPOGRAPHY AND SAMPLE LOCATIONS
FORMER SELLITE AREA
SITE CHARACTERIZATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO
CBI


LEGEND:
OVERBURDEN MONITORING WELL
SURFACE SOIL SAMPLE
SOIL BORING
SOIL BORING / PIEZOMETER
PIEZOMETER
CREEK, DITCH, CONVEYANCE
FORMER RAILROAD
ROAD
APPROXIMATE LOCATION OF FORMER STRUCTURES AND ASPHALT ROADS
BARREN AREA
PCB-1 PCB REMEDIAL AREA (<50 mg/kg TOTAL PCBs)
PCB-2 PCB REMEDIAL AREA (≥50 mg/kg TOTAL PCBs)
30-INCH RW CONCRETE PIPE (ABANDONED)
4-INCH WWTP STEEL SEWER LINE (ABANDONED)
SELLITE PERIMETER ROAD
6-INCH CAST IRON PIPE FORCE MAIN (ABANDONED)
MAINTENANCE ROAD
FSB-MW03
SB-15
SS-13
SB-02/PZ-02
SB-08/PZ-03
PZ-08
SS-16
SB-11/PZ-04
SS-17
SS-15
SS-12
SB-12/PZ-05
SB-10
SS-01
SS-02
SS-24
PCB-1
SS-03
SS-04
SB-13
SB-05
PZ-07
SS-14
FSB-MW02
SB-14/PZ-06
SB-01/PZ-01
SS-11
SS-05
SB-09
SS-06
SS-18
PCB-1
SS-23
SS-07
SB-03
PCB-2
SB-04
SS-22
SS-21
SS-08
SS-10
SS-19
SB-06
SS-09
FSB-MW01
SB-07
SS-25
SS-20
SS-27
SS-26
Remedial Areas and Volumes for PCBs
Area | PCB conc. (mg/kg) | Area (SQ. FT.) | Depth (FT.) | Volume (BCY) | Volume (LCY)
PCB-1 | <50 | 24618 | 3 | 2735 | 3556
PCB-2 | >50 | 2323 | 3 | 258 | 335
SCALE:
0 50 100 FEET
FIGURE 2-1
REMEDIAL AREAS AND VOLUMES FOR PCBs
FORMER SELLITE AREA
FEASIBILITY STUDY
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO
CB&I Federal Services LLC



Remedial Areas and Volumes for Low pH Soil

Area	Soil pH	Disposition [a] [b]	Area (SQ. FT.)	Depth (FT.)	Volume (BCY)	Volume (LCY)
1	4 to 5	Lime/Backfill	10599	2	785	1021
2	1 to 4	Offsite Disposal	15816	2	1172	1524
3	1 to 4	Offsite Disposal	1319	5	244	317
4 [c]	1 to 4	Offsite Disposal	868	2	64	83

Notes:
[a] Lime/Backfill: Excavate, mix lime into soil, and use for backfill soil in open excavations up to 2 feet below grade.
[b] Offsite Disposal: Excavate soil for offsite disposal.
[c] Does not include soil in top 3 feet of overlying PCB-1 soil (Figure 2-1).

Identified Need:

Clean up site for unrestricted use.

Solution Description:

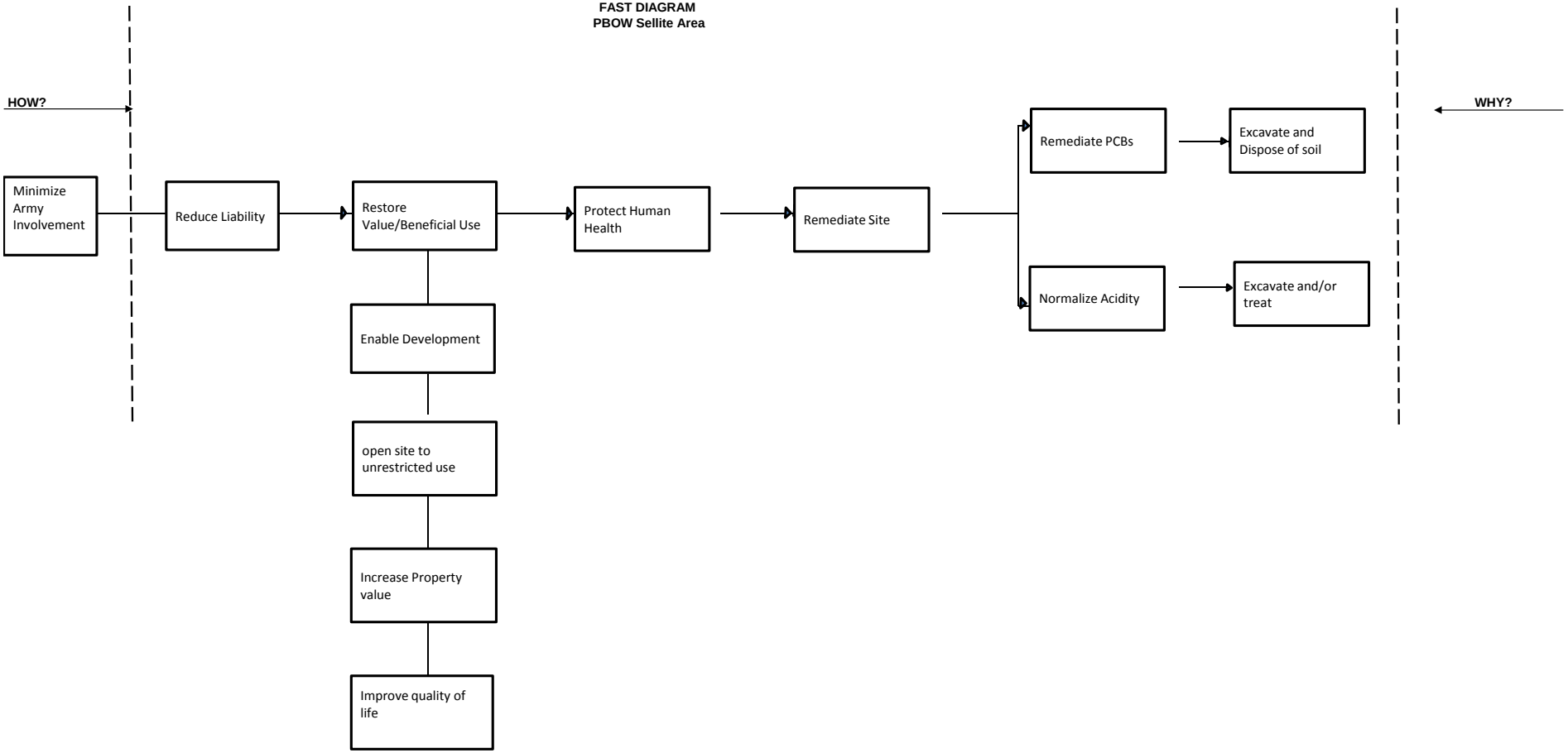
Dig and haul PCB and Lead contaminated soil to approved landfill. Treat low pH in one alternative by adding lime to increase pH.

What is to be done?
What is it to do?
WHAT is to be accomplished-not how it is to be accomplished...

	Verb	Noun
1	Protect	Human Health
2	Protect	Environment
3	Remediate	Site
4	Reduce	Liability
5	Restore	Value
6	Enable	Redevelopment
7	Remediate	PCB's
8	Normalize	Acidity
9	Minimize	Army's Involvement

FUNCTION		Basic or Secondary (B/S)	EXPLANATION
verb	noun		
Protect	Human Health	B	Mitigate Human Health hazards.
Protect	Environment	B	Mitigate hazards to ecological receptors
Remediate	Site	B	Remove or treat contaminates to meet RAO's
Reduce	Liability	S	Decrease the Army's hazard liability.
Restore	Value	B	Open site to unrestricted use in order to increase property values and quality of life.
Enable	Redevelopment	S	Allow for residential redevelopment.
Remediate	PCB's	S	Remove soil with PCB's over RG's
Normalize	Acidity	S	Remove or treat soil acidity
Minimize	Army's Involvement	S	Reduce overall life cycle cost to the Army.

FAST DIAGRAM
PBOW Sellite Area



	Possibility
1	Treating or immobilizing sulfur in place.
2	Allowing acidity to attenuate.
3	Remove bulk sulfur on the surface (to 0.5 ft bgs) and add lime
4	Reduce depth of excavation based on lack of PCB detections below 1 ft bgs
5	Reduce area excavated using PCB test kits (or lab analysis) to verify presence/absence
6	Evaluate other potential disposal locations
7	Unit cost contracting for T&D rather than lump sum contracting

IDEA NUMBER	IDEA	ADVANTAGE	DISADVANTAGE	Ranking
	(Consider: COST, TIME, PROBABILITY, BENEFIT, STATE OF THE ART, ETC.)			
1	Treating or immobilizing sulfur in place.	Elimates T&D costs for soil with low pH	Potentially leaves hazardous waste in place - 5-year reviews, etc.	**7**
2	Allowing acidity to attenuate.	Lowers cost by eliminating T&D and or treatment	Acidity does not attenuate in a timely manner	**4**
3	Remove bulk sulfur on the surface (to 0.5 ft bgs) and add lime	Mitigates cause of low pH in soil	Bulk sulfur removal does not mitigate the cause of low pH	**3**
4	Reduce depth of excavation based on lack of PCB detections below 1 ft bgs	Lowers T&D cost	Potential for missing contaminated soil at depth	**1**
5	Reduce area excavated using PCB test kits (or lab analysis) to verify	Lowers T&D cost	Potential for missing areas of contaminated soil	**2**
6	Evaluate other potential disposal locations	Lowers T&D cost	Contractor is responsible for selecting the landfill	**6**
7	Unit cost contracting for T&D rather than lump sum contracting	Potential cost savings to the Army	Potential additional cost related to contact modification	**5**

Plum Brook Ordnance Works
Garage Maintenance Area
Project Number: G05OH001825

VE Study

The Garage Maintenance area includes the Former Sellite Area, the Unloading Area and the Locomotive Building Area (Locomotive Shop and Railcar Wash Area). The Unloading Area and the Locomotive Building Area do not require remedial action, so the VE study focused on the Former Sellite Area.

The products of the VE study for the Former Sellite Area are two remedial approach options and a recommendation for contract evaluation. One remedial approach option addresses the PCB remediation and the other addresses the remediation of the low pH soil.

Remedial option 1A and 1B:

1. **PCB Soil - Lower volume of excavated soil for remediation of PCBs (and lead) by decreasing depth of excavation**

   Excavate a lower volume of soil based on the lack of PCB detections below 1 ft. bgs. Available data from the site indicate PCBs were not detected at a depth of 3-5 ft from 11 of 15 locations. The four PCB detections were at trace concentrations below the RGs. This option is considered because the volume of PCB soil remediated drives the largest cost element for remediation of the site.

   The FS recommends excavation to a depth of 3 feet bgs. To reduce the volume for T&D, the VE Team proposes either:

   1A - Excavate to 1 foot bgs with confirmation sampling on expedited turnaround time

   1B - Excavate to 2 feet bgs with confirmation sampling on expedited turnaround time

Basis/assumptions associated with this option:

- Based on existing data demonstrating contamination to a depth of 0-1 ft, excavate to 1 ft or 2 ft depth – 2 variations
- Three locations with PCBs > 50 mg/kg at 0-1 ft depth and ~20 locations with 0-1 ft depth surface PCB concentrations above RGs but less than 50 mg/kg.
- Fifteen locations were sampled for subsurface soil at depths from 3-5 ft bgs. There were four PCB detections at that depth all below RGs. Locations with detections were FSB-SB04, SB05, SB06, and SB09.
- Data confirms surface soil PCB contamination from 0-1 ft. Below 3 ft bgs is demonstrated to be below RGs.
- Obtain quick turn analytical PCB results to confirm excavate-to clean at variation depth
- Option realizes some risk for process interruption and remobilization of excavation activities but potential cost savings is believed to be worth the risk due to; only a few trace PCB detections below 1 ft bgs, quick turn analytical will expedite confirmation while on site, and risk of subsequent data rejection is deemed to be low.
- Excavation can begin at highest concentration area, PCB-2, with highest risk for additional excavation to minimize impact if additional excavation is needed.
- PCB Excavation can be coordinated with pH remediation to minimize downtime while waiting for analytical results.

Table 4-3

Cost Estimate
Alternative 4: Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio
(Page 14 of 52)

Alternative 4	**Site:**	Former Sellite Area
Excavation/Off-Site Disposal		Plum Brook Ordnance Works
PCB Soil	**Date:**	**7/16/2014**
Cost Estimate		

Scope:
1. Prepare work plan, H&S plan, materials list, and procurement along with the final report
2. Mobilize/demobilize equipment and personnel.
3. Prepare site for remedial activity.
4. Excavate contaminated soil, perform confirmation sampling & characterize waste.
5. Off-site disposal of soil with PCBs < 50 mg/kg at nonhazardous solid waste landfill.
6. Off-site disposal of soil with PCBs ≥ 50 mg/kg at TSCA TSDF.
7. Site restoration.
8. Demobilize equipment and personnel.

1.0 Work Plans and Procurement

Includes:
1. Labor to generate work plans, including engineering specifications and Health and Safety Plan, along with the Final Report.
2. Procure equipment and materials.

Service	Unit	Unit Cost		Subtotal
Work Plans and Final Report	1	$35,000.00	/ls	$35,000.00
Procurement	1	$5,000.00	/ea	$5,000.00
			Subtotal	**$40,000.00**

2.0 Mobilization/Demobilization of Equipment and Personnel

Includes:
1. Mobilization and demobilization of local equipment and personnel.
2. Set-up/tear down office trailer.

Assumptions:
1. Labor and equipment are available locally.

Service/Materials	Unit	Unit Cost		Subtotal
Labor/Equipment:				
Mobe/Demobe	1	$5,000.00	/ls	$5,000.00
Office Trailer (set up/tear down)	0	$500.00	/ls	$0.00
			Subtotal	**$5,000.00**

Table 4-3

Cost Estimate
Alternative 4: Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

3.0 Site Preparation

Includes:
1. Survey and mark proposed remediation area
2. Construction and maintenance of erosion and sediment controls
3. Clearing (medium brush without grubbing) will be performed in 100% of excavation area.
4. Assumed vegetative debris to be placed adjacent to site to decompose.
5 Improve/repair roads for truck traffic.

Assumptions and Calculations:

1a. PCB rea to be cleared =	1.1	acres
1b. Low pH area to be cleared =	0.0	acres
1c. Area to be cleared =	1.1	acres
2. Daily ouput clearing crew (acres/day) =	1	
3. Days clearing contractor in field =	2	
4. Silt Fence to be installed (lf) =	508	
5. Daily ouput silt fencing crew (LF/day) =	500	
6. Days silt fence crew in field =	2	
7. Prepare stockpile area (days) =	1	
8. Work hours/day =	8	

Services:					
Decontamination Pad	1	$10,000.00	LS	$10,000.00	
Road Improvement	1	$25,000.00	LS	$25,000.00	
Weigh Station	1	$5,000.00	LS	$5,000.00	
Contractor:					
Site PM	40	$60.00	/hr	$2,400.00	
Site Superintendent	40	$49.00	/hr	$1,960.00	
QA (Sampling) Coordinator	40	$36.00	/hr	$1,440.00	
Equipment Operator	5	$406.00	/day	$2,030.00	
Truck Driver	5	$341.60	/day	$1,708.00	
Laborer	5	$293.00	/day	$1,465.00	
H&S Coordinator	40	$49.00	/hr	$1,960.00	
Equipment:					
Excavator	5	$775.00	/day	$3,875.00	
Dump Truck	5	$615.00	/day	$3,075.00	
P/U Truck	5	$160.00	/day	$800.00	
Subcontractor:					
Surveying Crew	1	$2,000.00	/day	$2,000.00	
Bushhog	1.1	$500.00	/acre	$550.00	
Materials:					
Field Instruments	5	$46.00	/day	$230.00	
Silt Fencing	508	$1.60	/ft	$812.80	
				Subtotal	**$64,306.00**

Table 4-3

Cost Estimate
Alternative 4: Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil

Includes:
1. Excavation of soil with contaminants exceeding RGs.
2. Collect confirmatory samples to verify extent of excavation.

Assumptions and Calculations:

1a. In place volume of PCB soil (<50ppm) =	2,735	BCY
1b. In place volume of PCB soil (≥50ppm) =	258	BCY
1c. In place volume of low pH soil (pH<4) =	0	BCY
1d. In place volume of low pH soil (4≤pH<5) =	0	BCY
1e. In place volume of excavated soil =	2,993	BCY
2. Swell factor for soil upon excavation =	1.3	
3. Unconsolidated volume of soil excavated =	3,891	LCY
4. Density of unconsolidated soil =	1.1	Tons/LCY
5. Mass of unconsolidated soil =	4,280	Tons/LCY
6. Capacity of screening plant (tons/hr) =	100	
7. Excavator: hydraulic		
8. Excavator bucket heaped capacity (LCY) =	1	
9. Excavator cycle time (sec) =	18	
10. Excavator cycles/min =	3.3	
11. Excavator load factor =	0.75	
12. Excavator bucket fill factor =	0.6	excavation in lifts
13. Excavator work minutes/hour =	50	
14. Excavator output (BCY/day) =	594	
15a. Days to excavate soil =	6	
15b. Time on site (days) =	6	
16. Dump truck capacity (cy) =	12	
17. Dump truck haul distance (mi.) =	0.5	
18. Dump truck output (cy/day) =	250	
19. Number of dump trucks per day =	3	
20. Number of excavation subcontractor crew =	3	
21a. Perimeter distance between sidewall confirmation samples =	20	FT
21b. Excavation area per floor confirmation sample =	400	SF
22. Resampling factor for confirmation sampling =	1.05	
23a. Confirmatory soil samples for excavation perimeter =	56	
23b. Confirmatory samples for excavation floor =	71	
23c. Number of confirmatory samples from excavated area =	127	
24a. PCB excavation area =	26,941	SF
24b. Low pH excavation area =	0	SF
24c. Excavation area =	26,941	SF
25. Fraction of excavation work performed in Level C PPE =	0.00	
26. Labor productivity factor for Level C work =	0.67	
27. Days excavation crew in Level C =	0	
28a. Perimeter of PCB soil excavation =	1,074	FT
28b. Perimeter of low pH soil excavation =	0	FT
28c. Perimeter of excavation areas =	1,074	FT
29. Hours/workday =	8	

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site PM	48	$60.00	/hr	$2,880.00
Site Superintendent	48	$49.00	/hr	$2,352.00
QA (Sampling) Coordinator	48	$36.00	/hr	$1,728.00
H&S Coordinator	48	$49.00	/hr	$2,352.00
Equipment Operator	6	$406.00	/day	$2,436.00
Laborers	6	$293.00	/day	$1,758.00
Truck Drivers	18	$341.60	/day	$6,148.80

Table 4-3

Cost Estimate
Alternative 4: Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil (continued)

Equipment:

Excavator	6	$775.00	/day	$4,650.00
Dump Truck	18	$615.00	/day	$11,070.00
P/U Truck	6	$160.00	/day	$960.00

Analytical:

PCBs	127	$66.00	/ea	$8,382.00
Shipping	9	$40.00	/ea	$360.00

Materials & Services:

Level D PPE	18	$10.00	/day	$180.00
PID rental	6	$33.00	/day	$198.00
CGI rental	6	$13.00	/day	$78.00

Subtotal **$45,533.00**

5.0 Off-Site Disposal

Includes:

1. Analysis for off-site waste disposal.
2. Waste characterization and disposal sampling: 1 sample per 300 CY
3. Time onsite waiting for waste characterization analysis
4. Nonhaz disposal facility daily capacity (tons) = 200 tons
5. Nonhaz disposal facility daily capacity = 182 CY

Assumptions and Calculations:

1. Volume of PCB soil for nonhazardous disposal =	3,556	LCY
2. Volume of low pH soil for nonhazardous disposal =	0	LCY
3. Volume of nonhazardous soil for disposal =	3,556	LCY
4. Mass of nonhazardous soil for disposal =	3,911	tons
5. Volume of soil PCB≥50 ppm for TSCA disposal =	335	LCY
6. Mass of soil for TSCA disposal =	369	tons
7. Non-haz waste disposal costs ($/ton) =	52	Erie County Landfill
8. Non-haz waste regulatory fees ($/ton) =	0	included in disposal
9. TSCA waste transportation and disposal cost ($/ton) =	$134.00	EQ Environmental
10. Haz waste regulatory fees ($/ton) =	10	
11. Number of crew =	3	
12. Dump truck capacity (to nonhaz landfill) =	12	tons/truck
13. Travel duration (round trip) to non-haz landfill =	1	hrs/trip
14. Truckloads per day (nonhaz landfill) =	17	loads/day
15. Work day duration =	8	hrs/day
16. Trips per truck driver =	8	trips/driver
17. Truck drivers =	3	drivers
18. Truck loads of non-haz waste =	326	loads
19. Output of front-end loader (cy/day) =	889	1.25 CY loader
20. No. of wheel loaders =	1	
21. Time to load and haul nonhazardous soil =	20	work days
22. Days per week Erie County Landfill open		
23. Analytical TAT =	3	work days
24. Dump truck capacity (TSCA landfill) =	22	tons
25. Truck loads (TSCA landfill) =	17	loads
26. Time to load TSCA waste =	1	work days
27. Demurrage (TSCA waste) =	2	hrs/truck
28. Number of field days =	21	work days

Table 4-3

Cost Estimate
Alternative 4: Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Off-Site Disposal (continued)

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site PM	168	$60.00	/hr	$10,080.00	
Site Superintendent	168	$49.00	/hr	$8,232.00	
QA (Sampling) Coordinator	168	$36.00	/hr	$6,048.00	
H&S Coordinator	168	$49.00	/hr	$8,232.00	
Equipment Operator	21	$406.00	/day	$8,526.00	
Laborers	21	$293.00	/day	$6,153.00	
Truck Drivers	63	$341.60	/day	$21,520.80	
Equipment:					
Wheel Loader	21	$720.00	/day	$15,120.00	
12-Ton Dump Truck	63	$615.00	/day	$38,745.00	
P/U Truck	21	$160.00	/day	$3,360.00	
Analytical:					
Waste Characterization Sampling (Soil):					
TCLP metals	13	$112.50	/ea	$1,462.50	All soil
PCBs	13	$99.00	/ea	$1,287.00	PCB soil
Off-Site Disposal Costs:					
Disposal Cost (Non-Haz waste)	3,911	$52.00	/ton	$203,374.60	Erie County Landfill
Disposal Cost (TSCA waste)	369	$134.00	/ton	$49,437.96	EQ Environmental
Demurrage (TSCA waste)	34	$75.00	/hr	$2,550.00	EQ Environmental
				Subtotal	**$384,129.00**

6.0 Site Restoration

Includes:
1. Backfill excavated areas with clean backfill.
2. Re-seed site.
3. Confirmation sampling of soil staging areas.

Assumptions and Calculations:

1a. Volume of in place soil excavated =	2,993	BCY
1b. Volume of treated soil backfilled =	0	BCY
1c. Volume of excavation requiring backfill =	2,993	BCY
2. Compaction factor =	1.15	
3. Volume of soil required for backfill (cy) =	3,442	
4. Cost of clean backfill soil delivered to site ($/cy) =	12	
5. Output of front-end loader (cy/day) =	889	
6. Field days required to backfill soil =	4	days
7. Number of field crew =	3	

8. Upon completion of remedial action soil samples shall be taken within the laydown area to determine if any soil removal is required.
9. The laydown area shall be divided into 4 quarters and a 5-point composite collected (4 samples total).

10. Number of soil samples for laydown area confirmation =	4	samples
11. Time alloted for reseeding site and road repair.	4	days
12. Total task duration (days) =	8	days
13. Work day duration =	8	hrs
14. Excavation area =	47,916	SF

Table 4-3

Cost Estimate
Alternative 4: Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio
(Page 19 of 52)

6.0 Site Restoration (continued)					
Service/Materials	**Unit**	**Unit Cost**		**Subtotal**	
Labor:					
Site Superintendent	64	$0.00	/hr	$0.00	
QA Coordinator	64	$62.00	/hr	$3,968.00	
H&S Coordinator	64	$0.00	/hr	$0.00	
Equipment Operator	4	$406.00	/day	$1,624.00	
Equipment Operator	4	$406.00	/day	$1,624.00	
Laborer	4	$341.60	/day	$1,366.40	
Reseeding	48	$80.00	/1000 sf	$3,833.28	
Road Repair	1	$25,000.00	/ls	$25,000.00	
Equipment:					
Dozer	0.2	$3,500.00	/mo	$700.00	
Wheel Loader	4	$720.00	/day	$2,880.00	
Office Trailer	0.4	$800.00	/mo	$320.00	
Porta Jon	0.4	$175.22	/mo	$70.09	
Generator	0.4	$170.35	/mo	$68.14	
P/U Truck	8	$160.00	/day	$1,280.00	
Material:					
Backfill	3,442	$12.00	/cy	$41,303.40	delivered to site
Level D PPE	12	$10.00	/day	$120.00	
Analytical:					
PCBs	4	$99.00	/ea	$396.00	
Shipping	4	$40.00	/ea	$160.00	
				Subtotal	**$84,713.00**

7.0 Overall Cost	
Total Capital Cost	**$623,700.00**
Contingency (25%)	**$155,925.00**
Contractor Oversight (5%)	**$31,185.00**
Fee/Profit (10%)	**$0.00**
Total Cost	**$811,000.00**

*This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

Cost Estimate
VE Option 1A:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

VE Option #1a
Excavation/Off-Site Disposal
PCB Soil
Cost Estimate

Site: Former Sellite Area, Plum Brook Ordnance Works
Date: 7/17/2014

Scope:
1. Prepare work plan, H&S plan, materials list, and procurement along with the final report
2. Mobilize/demobilize equipment and personnel.
3. Prepare site for remedial activity.
4. Excavate contaminated soil, perform confirmation sampling & characterize waste.
5. Off-site disposal of soil with PCBs < 50 mg/kg at nonhazardous solid waste landfill.
6. Off-site disposal of soil with PCBs ≥ 50 mg/kg at TSCA TSDF.
7. Site restoration.
8. Demobilize equipment and personnel.

1.0 Work Plans and Procurement

Includes:
1. Labor to generate work plans, including engineering specifications and Health and Safety Plan, along with the Final Report.
2. Procure equipment and materials.

Service	Unit	Unit Cost		Subtotal
Work Plans and Final Report	1	$35,000.00	/ls	$35,000.00
Procurement	1	$5,000.00	/ea	$5,000.00
			Subtotal	**$40,000.00**

2.0 Mobilization/Demobilization of Equipment and Personnel

Includes:
1. Mobilization and demobilization of local equipment and personnel.
2. Set-up/tear down office trailer.

Assumptions:
1. Labor and equipment are available locally.

Service/Materials	Unit	Unit Cost		Subtotal
Labor/Equipment:				
Mobe/Demobe	1	$5,000.00	/ls	$5,000.00
Office Trailer (set up/tear down)	0	$500.00	/ls	$0.00
			Subtotal	**$5,000.00**

Cost Estimate
VE Option 1A:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

3.0 Site Preparation

Includes:

1. Survey and mark proposed remediation area
2. Construction and maintenance of erosion and sediment controls
3. Clearing (medium brush without grubbing) will be performed in 100% of excavation area.
4. Assumed vegetative debris to be placed adjacent to site to decompose.
5 Improve/repair roads for truck traffic.

Assumptions and Calculations:

1a. PCB rea to be cleared =	1.1	acres
1b. Low pH area to be cleared =	0.0	acres
1c. Area to be cleared =	1.1	acres
2. Daily ouput clearing crew (acres/day) =	1	
3. Days clearing contractor in field =	2	
4. Silt Fence to be installed (lf) =	508	
5. Daily ouput silt fencing crew (LF/day) =	500	
6. Days silt fence crew in field =	2	
7. Prepare stockpile area (days) =	1	
8. Work hours/day =	8	

Services:					
Decontamination Pad	1	$10,000.00	LS	$10,000.00	
Road Improvement	1	$25,000.00	LS	$25,000.00	
Weigh Station	1	$5,000.00	LS	$5,000.00	
Contractor:					
Site PM	40	$60.00	/hr	$2,400.00	
Site Superintendent	40	$49.00	/hr	$1,960.00	
QA (Sampling) Coordinator	40	$36.00	/hr	$1,440.00	
Equipment Operator	5	$406.00	/day	$2,030.00	
Truck Driver	5	$341.60	/day	$1,708.00	
Laborer	5	$293.00	/day	$1,465.00	
H&S Coordinator	40	$49.00	/hr	$1,960.00	
Equipment:					
Excavator	5	$775.00	/day	$3,875.00	
Dump Truck	5	$615.00	/day	$3,075.00	
P/U Truck	5	$160.00	/day	$800.00	
Subcontractor:					
Surveying Crew	1	$2,000.00	/day	$2,000.00	
Bushhog	1.1	$500.00	/acre	$550.00	
Materials:					
Field Instruments	5	$46.00	/day	$230.00	
Silt Fencing	508	$1.60	/ft	$812.80	
				Subtotal	**$64,306.00**

Cost Estimate
VE Option 1A:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil

Includes:
1. Excavation of soil with contaminants exceeding RGs.
2. Collect confirmatory samples to verify extent of excavation.

Assumptions and Calculations:

1a. In place volume of PCB soil (<50ppm) =	912	BCY
1b. In place volume of PCB soil (≥50ppm) =	86	BCY
1c. In place volume of low pH soil (pH<4) =	0	BCY
1d. In place volume of low pH soil (4≤pH<5) =	0	BCY
1e. In place volume of excavated soil =	998	BCY
2. Swell factor for soil upon excavation =	1.3	
3. Unconsolidated volume of soil excavated =	1,297	LCY
4. Density of unconsolidated soil =	1.1	Tons/LCY
5. Mass of unconsolidated soil =	1,427	Tons/LCY
6. Capacity of screening plant (tons/hr) =	100	
7. Excavator: hydraulic		
8. Excavator bucket heaped capacity (LCY) =	1	
9. Excavator cycle time (sec) =	18	
10. Excavator cycles/min =	3.3	
11. Excavator load factor =	0.75	
12. Excavator bucket fill factor =	0.6	excavation in lifts
13. Excavator work minutes/hour =	50	
14. Excavator output (BCY/day) =	594	
15a. Days to excavate soil =	2	
15b. Time on site (days) =	2	
16. Dump truck capacity (cy) =	12	
17. Dump truck haul distance (mi.) =	0.5	
18. Dump truck output (cy/day) =	250	
19. Number of dump trucks per day =	3	
20. Number of excavation subcontractor crew =	3	
21a. Perimeter distance between sidewall confirmation samples =	20	FT
21b. Excavation area per floor confirmation sample =	400	SF
22. Resampling factor for confirmation sampling =	1.05	
23a. Confirmatory soil samples for excavation perimeter =	56	
23b. Confirmatory samples for excavation floor =	71	
23c. Number of confirmatory samples from excavated area =	127	
24a. PCB excavation area =	26,941	SF
24b. Low pH excavation area =	0	SF
24c. Excavation area =	26,941	SF
25. Fraction of excavation work performed in Level C PPE =	0.00	
26. Labor productivity factor for Level C work =	0.67	
27. Days excavation crew in Level C =	0	
28a. Perimeter of PCB soil excavation =	1,074	FT
28b. Perimeter of low pH soil excavation =	0	FT
28c. Perimeter of excavation areas =	1,074	FT
29. Hours/workday =	8	

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site PM	16	$60.00	/hr	$960.00
Site Superintendent	16	$49.00	/hr	$784.00
QA (Sampling) Coordinator	16	$36.00	/hr	$576.00
H&S Coordinator	16	$49.00	/hr	$784.00
Equipment Operator	2	$406.00	/day	$812.00
Laborers	2	$293.00	/day	$586.00
Truck Drivers	6	$341.60	/day	$2,049.60

Cost Estimate
VE Option 1A:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio
(Page 23 of 52)

4.0 Excavation of Contaminated Soil (continued)

Equipment:

Excavator	2	$775.00	/day	$1,550.00
Dump Truck	6	$615.00	/day	$3,690.00
P/U Truck	2	$160.00	/day	$320.00

Analytical:

PCBs	127	$99.00	/ea	$12,573.00
Shipping	9	$40.00	/ea	$360.00

Materials & Services:

Level D PPE	6	$10.00	/day	$60.00
PID rental	2	$33.00	/day	$66.00
CGI rental	2	$13.00	/day	$26.00

Subtotal **$25,197.00**

5.0 Off-Site Disposal

Includes:

1. Analysis for off-site waste disposal.
2. Waste characterization and disposal sampling: 1 sample per 300 CY
3. Time onsite waiting for waste characterization analysis
4. Nonhaz disposal facility daily capacity (tons) = 200 tons
5. Nonhaz disposal facility daily capacity = 182 CY

Assumptions and Calculations:

1. Volume of PCB soil for nonhazardous disposal =	1,186	LCY
2. Volume of low pH soil for nonhazardous disposal =	0	LCY
3. Volume of nonhazardous soil for disposal =	1,186	LCY
4. Mass of nonhazardous soil for disposal =	1,304	tons
5. Volume of soil PCB≥50 ppm for TSCA disposal =	112	LCY
6. Mass of soil for TSCA disposal =	123	tons
7. Non-haz waste disposal costs ($/ton) =	52	Erie County Landfill
8. Non-haz waste regulatory fees ($/ton) =	0	included in disposal
9. TSCA waste transportation and disposal cost ($/ton) =	$134.00	EQ Environmental
10. Haz waste regulatory fees ($/ton) =	10	
11. Number of crew =	3	
12. Dump truck capacity (to nonhaz landfill) =	12	tons/truck
13. Travel duration (round trip) to non-haz landfill =	1	hrs/trip
14. Truckloads per day (nonhaz landfill) =	17	loads/day
15. Work day duration =	8	hrs/day
16. Trips per truck driver =	8	trips/driver
17. Truck drivers =	3	drivers
18. Truck loads of non-haz waste =	109	loads
19. Output of front-end loader (cy/day) =	889	1.25 CY loader
20. No. of wheel loaders =	1	
21. Time to load and haul nonhazardous soil =	7	work days
22. Days per week Erie County Landfill open		
23. Analytical TAT =	3	work days
24. Dump truck capacity (TSCA landfill) =	22	tons
25. Truck loads (TSCA landfill) =	6	loads
26. Time to load TSCA waste =	1	work days
27. Demurrage (TSCA waste) =	2	hrs/truck
28. Number of field days =	8	work days

Cost Estimate
VE Option 1A:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Off-Site Disposal (continued)

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site PM	64	$60.00	/hr	$3,840.00	
Site Superintendent	64	$49.00	/hr	$3,136.00	
QA (Sampling) Coordinator	64	$36.00	/hr	$2,304.00	
H&S Coordinator	64	$49.00	/hr	$3,136.00	
Equipment Operator	8	$406.00	/day	$3,248.00	
Laborers	8	$293.00	/day	$2,344.00	
Truck Drivers	24	$341.60	/day	$8,198.40	
Equipment:					
Wheel Loader	8	$720.00	/day	$5,760.00	
12-Ton Dump Truck	24	$615.00	/day	$14,760.00	
P/U Truck	8	$160.00	/day	$1,280.00	
Analytical:					
Waste Characterization Sampling (Soil):					
TCLP metals	5	$112.50	/ea	$562.50	All soil
PCBs	5	$99.00	/ea	$495.00	PCB soil
Off-Site Disposal Costs:					
Disposal Cost (Non-Haz waste)	1,304	$52.00	/ton	$67,816.32	Erie County Landfill
Disposal Cost (TSCA waste)	123	$134.00	/ton	$16,479.32	EQ Environmental
Demurrage (TSCA waste)	12	$75.00	/hr	$900.00	EQ Environmental
				Subtotal	**$134,260.00**

6.0 Site Restoration

Includes:
1. Backfill excavated areas with clean backfill.
2. Re-seed site.
3. Confirmation sampling of soil staging areas.

Assumptions and Calculations:

1a. Volume of in place soil excavated =	998	BCY
1b. Volume of treated soil backfilled =	0	BCY
1c. Volume of excavation requiring backfill =	998	BCY
2. Compaction factor =	1.15	
3. Volume of soil required for backfill (cy) =	1,148	
4. Cost of clean backfill soil delivered to site ($/cy) =	12	
5. Output of front-end loader (cy/day) =	889	
6. Field days required to backfill soil =	2	days
7. Number of field crew =	3	
8. Upon completion of remedial action soil samples shall be taken within the laydown area to determine if any soil removal is required.		
9. The laydown area shall be divided into 4 quarters and a 5-point composite collected (4 samples total).		
10. Number of soil samples for laydown area confirmation =	4	samples
11. Time alloted for reseeding site and road repair.	4	days
12. Total task duration (days) =	6	days
13. Work day duration =	8	hrs
14. Excavation area =	47,916	SF

Cost Estimate
VE Option 1A:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

6.0 Site Restoration (continued)					
Service/Materials	**Unit**	**Unit Cost**		**Subtotal**	
Labor:					
Site Superintendent	48	$0.00	/hr	$0.00	
QA Coordinator	48	$62.00	/hr	$2,976.00	
H&S Coordinator	48	$0.00	/hr	$0.00	
Equipment Operator	2	$406.00	/day	$812.00	
Equipment Operator	2	$406.00	/day	$812.00	
Laborer	2	$341.60	/day	$683.20	
Reseeding	48	$80.00	/1000 sf	$3,833.28	
Road Repair	1	$25,000.00	/ls	$25,000.00	
Equipment:					
Dozer	0.1	$3,500.00	/mo	$350.00	
Wheel Loader	2	$720.00	/day	$1,440.00	
Office Trailer	0.3	$800.00	/mo	$240.00	
Porta Jon	0.3	$175.22	/mo	$52.57	
Generator	0.3	$170.35	/mo	$51.11	
P/U Truck	6	$160.00	/day	$960.00	
Material:					
Backfill	1,148	$12.00	/cy	$13,772.40	delivered to site
Level D PPE	6	$10.00	/day	$60.00	
Analytical:					
PCBs	4	$99.00	/ea	$396.00	
Shipping	4	$40.00	/ea	$160.00	
				Subtotal	**$51,599.00**

7.0 Overall Cost	
Total Capital Cost	**$320,400.00**
Contingency (25%)	**$80,100.00**
Contractor Oversight (5%)	**$16,020.00**
Fee/Profit (10%)	**$0.00**
Total Cost	**$417,000.00**

*This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

FINANCIAL ANALYSIS of OPTION 1A

SUMMARY OF COST OF DESIGN:

Initial Cost	$811,000.00	
Cost of Present Design	$811,000.00	

SUMMARY OF COST OF PROPOSED DESIGN: (w/o implementation costs)

Initial Cost	$417,000.00	
Cost of Proposed Design	$417,000.00	
Gross Savings (present minus proposed)		$ 394,000.00

SUMMARY OF IMPLEMENTATION COSTS FOR PROPOSED DESIGN:

Cost of Study	$ 30,000.00	
Cost of Redesign	$ -	
Cost of Modification	$ -	
Total cost of Implementation	$ 30,000.00	
NET SAVINGS: (gross savings minus cost of implementation)		$ 364,000.00

Cost Estimate
VE Option 1B:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

VE Option #1b
Excavation/Off-Site Disposal
PCB Soil
Cost Estimate

Site: Former Sellite Area, Plum Brook Ordnance Works
Date: 7/17/2014

Scope:
1. Prepare work plan, H&S plan, materials list, and procurement along with the final report
2. Mobilize/demobilize equipment and personnel.
3. Prepare site for remedial activity.
4. Excavate contaminated soil, perform confirmation sampling & characterize waste.
5. Off-site disposal of soil with PCBs < 50 mg/kg at nonhazardous solid waste landfill.
6. Off-site disposal of soil with PCBs ≥ 50 mg/kg at TSCA TSDF.
7. Site restoration.
8. Demobilize equipment and personnel.

1.0 Work Plans and Procurement

Includes:
1. Labor to generate work plans, including engineering specifications and Health and Safety Plan, along with the Final Report.
2. Procure equipment and materials.

Service	Unit	Unit Cost		Subtotal
Work Plans and Final Report	1	$35,000.00	/ls	$35,000.00
Procurement	1	$5,000.00	/ea	$5,000.00
			Subtotal	**$40,000.00**

2.0 Mobilization/Demobilization of Equipment and Personnel

Includes:
1. Mobilization and demobilization of local equipment and personnel.
2. Set-up/tear down office trailer.

Assumptions:
1. Labor and equipment are available locally.

Service/Materials	Unit	Unit Cost		Subtotal
Labor/Equipment:				
Mobe/Demobe	1	$5,000.00	/ls	$5,000.00
Office Trailer (set up/tear down)	0	$500.00	/ls	$0.00
			Subtotal	**$5,000.00**

Cost Estimate
VE Option 1B:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

3.0 Site Preparation

Includes:

1. Survey and mark proposed remediation area
2. Construction and maintenance of erosion and sediment controls
3. Clearing (medium brush without grubbing) will be performed in 100% of excavation area.
4. Assumed vegetative debris to be placed adjacent to site to decompose.
5 Improve/repair roads for truck traffic.

Assumptions and Calculations:

1a. PCB rea to be cleared =	1.1	acres
1b. Low pH area to be cleared =	0.0	acres
1c. Area to be cleared =	1.1	acres
2. Daily ouput clearing crew (acres/day) =	1	
3. Days clearing contractor in field =	2	
4. Silt Fence to be installed (lf) =	508	
5. Daily ouput silt fencing crew (LF/day) =	500	
6. Days silt fence crew in field =	2	
7. Prepare stockpile area (days) =	1	
8. Work hours/day =	8	

Services:					
Decontamination Pad	1	$10,000.00	LS	$10,000.00	
Road Improvement	1	$25,000.00	LS	$25,000.00	
Weigh Station	1	$5,000.00	LS	$5,000.00	
Contractor:					
Site PM	40	$60.00	/hr	$2,400.00	
Site Superintendent	40	$49.00	/hr	$1,960.00	
QA (Sampling) Coordinator	40	$36.00	/hr	$1,440.00	
Equipment Operator	5	$406.00	/day	$2,030.00	
Truck Driver	5	$341.60	/day	$1,708.00	
Laborer	5	$293.00	/day	$1,465.00	
H&S Coordinator	40	$49.00	/hr	$1,960.00	
Equipment:					
Excavator	5	$775.00	/day	$3,875.00	
Dump Truck	5	$615.00	/day	$3,075.00	
P/U Truck	5	$160.00	/day	$800.00	
Subcontractor:					
Surveying Crew	1	$2,000.00	/day	$2,000.00	
Bushhog	1.1	$500.00	/acre	$550.00	
Materials:					
Field Instruments	5	$46.00	/day	$230.00	
Silt Fencing	508	$1.60	/ft	$812.80	
				Subtotal	**$64,306.00**

Cost Estimate
VE Option 1B:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil

Includes:
1. Excavation of soil with contaminants exceeding RGs.
2. Collect confirmatory samples to verify extent of excavation.

Assumptions and Calculations:

1a. In place volume of PCB soil (<50ppm) =	1,824	BCY
1b. In place volume of PCB soil (≥50ppm) =	172	BCY
1c. In place volume of low pH soil (pH<4) =	0	BCY
1d. In place volume of low pH soil (4≤pH<5) =	0	BCY
1e. In place volume of excavated soil =	1,996	BCY
2. Swell factor for soil upon excavation =	1.3	
3. Unconsolidated volume of soil excavated =	2,595	LCY
4. Density of unconsolidated soil =	1.1	Tons/LCY
5. Mass of unconsolidated soil =	2,854	Tons/LCY
6. Capacity of screening plant (tons/hr) =	100	
7. Excavator: hydraulic		
8. Excavator bucket heaped capacity (LCY) =	1	
9. Excavator cycle time (sec) =	18	
10. Excavator cycles/min =	3.3	
11. Excavator load factor =	0.75	
12. Excavator bucket fill factor =	0.6	excavation in lifts
13. Excavator work minutes/hour =	50	
14. Excavator output (BCY/day) =	594	
15a. Days to excavate soil =	4	
15b. Time on site (days) =	4	
16. Dump truck capacity (cy) =	12	
17. Dump truck haul distance (mi.) =	0.5	
18. Dump truck output (cy/day) =	250	
19. Number of dump trucks per day =	3	
20. Number of excavation subcontractor crew =	3	
21a. Perimeter distance between sidewall confirmation samples =	20	FT
21b. Excavation area per floor confirmation sample =	400	SF
22. Resampling factor for confirmation sampling =	1.05	
23a. Confirmatory soil samples for excavation perimeter =	56	
23b. Confirmatory samples for excavation floor =	71	
23c. Number of confirmatory samples from excavated area =	127	
24a. PCB excavation area =	26,941	SF
24b. Low pH excavation area =	0	SF
24c. Excavation area =	26,941	SF
25. Fraction of excavation work performed in Level C PPE =	0.00	
26. Labor productivity factor for Level C work =	0.67	
27. Days excavation crew in Level C =	0	
28a. Perimeter of PCB soil excavation =	1,074	FT
28b. Perimeter of low pH soil excavation =	0	FT
28c. Perimeter of excavation areas =	1,074	FT
29. Hours/workday =	8	

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site PM	32	$60.00	/hr	$1,920.00
Site Superintendent	32	$49.00	/hr	$1,568.00
QA (Sampling) Coordinator	32	$36.00	/hr	$1,152.00
H&S Coordinator	32	$49.00	/hr	$1,568.00
Equipment Operator	4	$406.00	/day	$1,624.00
Laborers	4	$293.00	/day	$1,172.00
Truck Drivers	12	$341.60	/day	$4,099.20

Cost Estimate
VE Option 1B:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio
(Page 30 of 52)

4.0 Excavation of Contaminated Soil (continued)

Equipment:

Excavator	4	$775.00	/day	$3,100.00
Dump Truck	12	$615.00	/day	$7,380.00
P/U Truck	4	$160.00	/day	$640.00

Analytical:

PCBs	127	$99.00	/ea	$12,573.00
Shipping	9	$40.00	/ea	$360.00

Materials & Services:

Level D PPE	12	$10.00	/day	$120.00
PID rental	4	$33.00	/day	$132.00
CGI rental	4	$13.00	/day	$52.00

Subtotal **$37,460.00**

5.0 Off-Site Disposal

Includes:

1. Analysis for off-site waste disposal.
2. Waste characterization and disposal sampling: 1 sample per 300 CY
3. Time onsite waiting for waste characterization analysis
4. Nonhaz disposal facility daily capacity (tons) = 200 tons
5. Nonhaz disposal facility daily capacity = 182 CY

Assumptions and Calculations:

1. Volume of PCB soil for nonhazardous disposal =	2,371	LCY
2. Volume of low pH soil for nonhazardous disposal =	0	LCY
3. Volume of nonhazardous soil for disposal =	2,371	LCY
4. Mass of nonhazardous soil for disposal =	2,608	tons
5. Volume of soil PCB≥50 ppm for TSCA disposal =	224	LCY
6. Mass of soil for TSCA disposal =	246	tons
7. Non-haz waste disposal costs ($/ton) =	52	Erie County Landfill
8. Non-haz waste regulatory fees ($/ton) =	0	included in disposal
9. TSCA waste transportation and disposal cost ($/ton) =	$134.00	EQ Environmental
10. Haz waste regulatory fees ($/ton) =	10	
11. Number of crew =	3	
12. Dump truck capacity (to nonhaz landfill) =	12	tons/truck
13. Travel duration (round trip) to non-haz landfill =	1	hrs/trip
14. Truckloads per day (nonhaz landfill) =	17	loads/day
15. Work day duration =	8	hrs/day
16. Trips per truck driver =	8	trips/driver
17. Truck drivers =	3	drivers
18. Truck loads of non-haz waste =	218	loads
19. Output of front-end loader (cy/day) =	889	1.25 CY loader
20. No. of wheel loaders =	1	
21. Time to load and haul nonhazardous soil =	14	work days
22. Days per week Erie County Landfill open		
23. Analytical TAT =	3	work days
24. Dump truck capacity (TSCA landfill) =	22	tons
25. Truck loads (TSCA landfill) =	12	loads
26. Time to load TSCA waste =	1	work days
27. Demurrage (TSCA waste) =	2	hrs/truck
28. Number of field days =	15	work days

Cost Estimate
VE Option 1B:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Off-Site Disposal (continued)

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site PM	120	$60.00	/hr	$7,200.00	
Site Superintendent	120	$49.00	/hr	$5,880.00	
QA (Sampling) Coordinator	120	$36.00	/hr	$4,320.00	
H&S Coordinator	120	$49.00	/hr	$5,880.00	
Equipment Operator	15	$406.00	/day	$6,090.00	
Laborers	15	$293.00	/day	$4,395.00	
Truck Drivers	45	$341.60	/day	$15,372.00	
Equipment:					
Wheel Loader	15	$720.00	/day	$10,800.00	
12-Ton Dump Truck	45	$615.00	/day	$27,675.00	
P/U Truck	15	$160.00	/day	$2,400.00	
Analytical:					
Waste Characterization Sampling (Soil):					
TCLP metals	9	$112.50	/ea	$1,012.50	All soil
PCBs	9	$99.00	/ea	$891.00	PCB soil
Off-Site Disposal Costs:					
Disposal Cost (Non-Haz waste)	2,608	$52.00	/ton	$135,632.64	Erie County Landfill
Disposal Cost (TSCA waste)	246	$134.00	/ton	$32,958.64	EQ Environmental
Demurrage (TSCA waste)	24	$75.00	/hr	$1,800.00	EQ Environmental
				Subtotal	**$262,307.00**

6.0 Site Restoration

Includes:
1. Backfill excavated areas with clean backfill.
2. Re-seed site.
3. Confirmation sampling of soil staging areas.

Assumptions and Calculations:

1a. Volume of in place soil excavated =	1,996	BCY
1b. Volume of treated soil backfilled =	0	BCY
1c. Volume of excavation requiring backfill =	1,996	BCY
2. Compaction factor =	1.15	
3. Volume of soil required for backfill (cy) =	2,295	
4. Cost of clean backfill soil delivered to site ($/cy) =	12	
5. Output of front-end loader (cy/day) =	889	
6. Field days required to backfill soil =	3	days
7. Number of field crew =	3	
8. Upon completion of remedial action soil samples shall be taken within the laydown area to determine if any soil removal is required.		
9. The laydown area shall be divided into 4 quarters and a 5-point composite collected (4 samples total).		
10. Number of soil samples for laydown area confirmation =	4	samples
11. Time alloted for reseeding site and road repair.	4	days
12. Total task duration (days) =	7	days
13. Work day duration =	8	hrs
14. Excavation area =	47,916	SF

Cost Estimate
VE Option 1B:
Excavation and Off-Site Disposal
PCB Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

6.0 Site Restoration (continued)					
Service/Materials	**Unit**	**Unit Cost**		**Subtotal**	
Labor:					
Site Superintendent	56	$0.00	/hr	$0.00	
QA Coordinator	56	$62.00	/hr	$3,472.00	
H&S Coordinator	56	$0.00	/hr	$0.00	
Equipment Operator	3	$406.00	/day	$1,218.00	
Equipment Operator	3	$406.00	/day	$1,218.00	
Laborer	3	$341.60	/day	$1,024.80	
Reseeding	48	$80.00	/1000 sf	$3,833.28	
Road Repair	1	$25,000.00	/ls	$25,000.00	
Equipment:					
Dozer	0.2	$3,500.00	/mo	$700.00	
Wheel Loader	3	$720.00	/day	$2,160.00	
Office Trailer	0.4	$800.00	/mo	$320.00	
Porta Jon	0.4	$175.22	/mo	$70.09	
Generator	0.4	$170.35	/mo	$68.14	
P/U Truck	7	$160.00	/day	$1,120.00	
Material:					
Backfill	2,295	$12.00	/cy	$27,544.80	delivered to site
Level D PPE	9	$10.00	/day	$90.00	
Analytical:					
PCBs	4	$99.00	/ea	$396.00	
Shipping	4	$40.00	/ea	$160.00	
				Subtotal	**$68,395.00**
7.0 Overall Cost					
				Total Capital Cost	**$477,500.00**
				Contingency (25%)	**$119,375.00**
				Contractor Oversight (5%)	**$23,875.00**
				Fee/Profit (10%)	**$0.00**
				Total Cost	**$621,000.00**

*This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

FINANCIAL ANALYSIS of OPTION 1B

SUMMARY OF COST OF DESIGN:

Initial Cost	$811,000.00	
Cost of Present Design	$811,000.00	

SUMMARY OF COST OF PROPOSED DESIGN: (w/o implementation costs)

Initial Cost	$621,000.00	
Cost of Proposed Design	$621,000.00	
Gross Savings (present minus proposed)		$ 190,000.00

SUMMARY OF IMPLEMENTATION COSTS FOR PROPOSED DESIGN:

Cost of Study	$ 30,000.00	
Cost of Redesign	$ -	
Cost of Modification	$ -	
Total cost of Implementation	$ 30,000.00	
NET SAVINGS: (gross savings minus cost of implementation)		$ 160,000.00

Plum Brook Ordnance Works
Garage Maintenance Area
Project Number: G05OH001825

VE Study

The Garage Maintenance area includes the Former Sellite Area, the Unloading Area and the Locomotive Building Area (Locomotive Shop and Railcar Wash Area). The Unloading Area and the Locomotive Building Area do not require remedial action, so the VE study focused on the Former Sellite Area.

The products of the VE study for the Former Sellite Area are two remedial approach options and a recommendation for contract evaluation. One remedial approach option addresses the PCB remediation and the other addresses the remediation of the low pH soil.

Remedial option 2:

2. **Low-pH Soil – Reduce volume of soil excavation by removing top 1 foot of low-pH impacted surface soil including surficial elemental sulfur and 0.5 ft slag. Add lime or calcium hydroxide amendment to address subsurface acidity to the excavation floor and mix into the top layer. Emplace top 1 ft layer of excavation with clean fill.**

   Reduce volume of excavated soil by removal of only the upper 1 ft of pH impacted source soil, sulfur and slag. Excavated soil will be removed and sent to a non-hazardous landfill. Lime or calcium hydroxide amendment to address subsurface acidity will be added to the excavation floor and mixed into the top layer. Excavation will be filled with a clean fill. Neutralization of low-pH subsurface soil will occur over time by infiltration of lime amended precipitation to neutralize the acidic matrix. Normalization of subsurface soil pH will also occur over time by infiltration of precipitation to attenuate acid in the matrix by dilution/rinsing.

   Basis/assumptions associated with this option:

   - A treatability study will be conducted to measure base requirement for soil neutralization and to determine impact of soil rinsing on soil pH after source removal.
   - Removal of 1 ft of soil is sufficient to remove the sulfur source of acidity
   - Extent of sulfur and slag acid source material is contained by the FI area footprint for pH impacted soil (pH areas 1,2,3,& 4)

Table 4-2

Cost Estimate
Alternative 3: Excavation, pH Adjustment, On-Site and Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

Alternative 3
Excavation/pH Adjustment/On-site & Off-site Disposal
PCB and Low pH Soil
Cost Estimate

Site: Former Sellite Area
Plum Brook Ordnance Works
Date: 7/16/2014

Scope:
1. Prepare work plans and closeout report, and complete procurement.
2. Collect soil samples and run titration tests in lab.
3. Mobilize/demobilize equipment and personnel.
4. Prepare site for remedial activity.
5. Excavate contaminated soil, perform confirmation sampling & characterize waste.
6. Mix lime into soil with 4≤pH<5 to increase soil pH>5.
7. On site disposal of lime-treated soil
8. Off-site disposal of soil with PCBs < 50 mg/kg and pH<4 at nonhazardous solid waste landfill.
9. Off-site disposal of soil with PCBs ≥ 50 mg/kg at TSCA TSDF.
10. Site restoration.
11. Demobilize equipment and personnel.

1.0 Treatability Study, Work Plans, Reports and Procurement

Includes:
1. Labor to generate work plans, including engineering specifications and Health and Safety Plan, along with the Final Report.
2. Procure equipment and materials.

Service	Unit	Unit Cost		Subtotal
Work Plans and Final Report	1	$35,000.00	/ls	$35,000.00
Lime Bench Study	1	$10,000.00	/ls	$10,000.00
Procurement	1	$10,000.00	/ls	$10,000.00
			Subtotal	**$55,000.00**

2.0 Mobilization/Demobilization of Equipment and Personnel

Includes:
1. Mobilization and demobilization of local equipment and personnel.
2. Set-up/tear down office trailer.

Assumptions:
1. Labor and equipment are available locally.

Service/Materials	Unit	Unit Cost		Subtotal
Labor/Equipment:				
Mobe/Demobe	1	$5,000.00	/ls	$5,000.00
Office Trailer (set up/tear down)	1	$500.00	/ls	$500.00
			Subtotal	**$5,500.00**

Table 4-2

Cost Estimate
Alternative 3: Excavation, pH Adjustment, On-Site and Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

3.0 Site Preparation

Includes:
1. Survey and mark proposed remediation area
2. Construction and maintenance of erosion and sediment controls
3. Install/improve access road for transport of equipment
4. Clearing (medium brush without grubbing) will be performed in 100% of excavation area.

Assumptions and Calculations:

1a. PCB rea to be cleared =	1.1	acres
1b. Low pH area to be cleared =	1.6	acres
1c. Area to be cleared =	2.7	acres
2. Daily ouput clearing crew (acres/day) =	1	
3. Days clearing contractor in field =	3	
4. Silt Fence to be installed (lf) =	1640	
5. Daily ouput silt fencing crew (LF/day) =	500	
6. Days silt fence crew in field =	4	
7. Prepare stockpile area (days) =	1	
8. Work hours/day =	8	

Services:					
Decontamination Pad	1	$10,000.00	LS	$10,000.00	
Road Improvement	1	$25,000.00	LS	$25,000.00	
Weigh Station	1	$5,000.00	LS	$5,000.00	
Contractor:					
Site PM	64	$60.00	/hr	$3,840.00	
Site Superintendent	64	$49.00	/hr	$3,136.00	
QA (Sampling) Coordinator	64	$36.00	/hr	$2,304.00	
Equipment Operator	8	$406.00	/day	$3,248.00	
Truck Driver	8	$341.60	/day	$2,732.80	
Laborer	8	$293.00	/day	$2,344.00	
H&S Coordinator	64	$49.00	/hr	$3,136.00	
Equipment:					
Excavator	8	$775.00	/day	$6,200.00	
Dump Truck	8	$615.00	/day	$4,920.00	
P/U Truck	8	$160.00	/day	$1,280.00	
Subcontractor:					
Surveying Crew	1	$2,000.00	/day	$2,000.00	
Bushhog	2.7	$500.00	/acre	$1,350.00	
Materials:					
Field Instruments	8	$46.00	/day	$368.00	
Silt Fencing	1,640	$1.60	/day	$2,624.00	
				Subtotal	**$79,483.00**

Table 4-2

Cost Estimate
Alternative 3: Excavation, pH Adjustment, On-Site and Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil

Includes:
1. Excavation of PCB-contaminated and low pH soil (see Figures 2-1 and 2-2).
2. Collect confirmatory samples to verify extent of excavation.

Assumptions and Calculations:

1a. In place volume of PCB soil (<50ppm) =	2,735	BCY
1b. In place volume of PCB soil (≥50ppm) =	258	BCY
1c. In place volume of low pH soil (pH<4) =	1,480	BCY
1d. In place volume of low pH soil (4≤pH<5) =	785	BCY
1e. In place volume of excavated soil =	5,258	BCY
2. Swell factor for soil upon excavation =	1.3	
3. Unconsolidated volume of soil excavated =	6,835	LCY
4. Density of unconsolidated soil =	1.1	Tons/LCY
5. Mass of unconsolidated soil =	7,519	Tons
6. Capacity of screening plant (tons/hr) =	100	
7. Excavator: hydraulic		
8. Excavator bucket heaped capacity (LCY) =	1	
9. Excavator cycle time (sec) =	18	
10. Excavator cycles/min =	3.3	
11. Excavator load factor =	0.75	
12. Excavator bucket fill factor =	0.6	excavation in lifts
13. Excavator work minutes/hour =	50	
14. Excavator output (BCY/day) =	594	
15a. Days to excavate soil =	9	
15b. Time on site (days) =	9	
16. Dump truck capacity (cy) =	12	
17. Dump truck haul distance (mi.) =	0.5	
18. Dump truck output (cy/day) =	250	
19. Number of dump trucks per day =	4	
20. Number of excavation subcontractor crew =	3	
21a. Perimeter distance between sidewall confirmation sample =	20	FT
21b. Excavation area per floor confirmation sample =	400	SF
22. Resampling factor for confirmation sampling =	1.05	
23a. Confirmatory soil samples for excavation perimeter =	145	
23b. Confirmatory samples for excavation floor =	146	
23c. Number of confirmatory samples from excavated area =	291	
24. Excavation area (SF) =	55,543	
25. Fraction of excavation work performed in Level C PPE =	0.00	
26. Labor productivity factor for Level C work =	0.67	
27. Days excavation crew in Level C =	0	
28a. Perimeter of PCB soil excavation =	1,074	FT
28b. Perimeter of low pH soil excavation =	1,690	FT
28c. Perimeter of excavation areas =	2,764	FT
29. Hours/workday =	8	

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site PM	72	$60.00	/hr	$4,320.00
Site Superintendent	72	$49.00	/hr	$3,528.00
QA (Sampling) Coordinator	72	$36.00	/hr	$2,592.00
H&S Coordinator	72	$49.00	/hr	$3,528.00
Equipment Operator	9	$406.00	/day	$3,654.00
Laborers	9	$293.00	/day	$2,637.00
Truck Drivers	36	$341.60	/day	$12,297.60

Table 4-2

Cost Estimate
Alternative 3: Excavation, pH Adjustment, On-Site and Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil (continued)

Equipment:

Excavator	9	$775.00 /day	$6,975.00	
Wheel Loader	9			
Dump Truck	36	$615.00 /day	$22,140.00	
P/U Truck	9	$160.00 /day	$1,440.00	

Analytical:

PCBs	291	$66.00 /ea	$19,206.00	
Shipping	20	$40.00 /ea	$800.00	

Materials & Services:

Level D PPE	27	$10.00 /day	$270.00	
PID rental	9	$33.00 /day	$297.00	
CGI rental	9	$13.00 /day	$117.00	
			Subtotal	**$83,802.00**

5.0 Soil pH Adjustment

Includes:
1. Mix lime into soil with 4≤pH<5.
2. Temporary storage for lime.
3. Turnaround time of 3 days for rush analytical for waste characterization

Assumptions and Calculations:

1. Area of soil to be treated =	0.25	acres
2. Thickness of treated soil =	3.0	FT
3. Volume of in place soil to be treated (cy) =	785	BCY
4. Swell factor for soil upon excavation =	1.3	
5. Cubic yards of unconsolidated soil =	1,021	LCY
6. Treatment batch size (cy) =	250	
7. Lime demand =	5.3	tons/acre*ft
8. Lime demand =	8,080	lbs
9. Water used to moisten soil =	20	gal/cy soil
10. Hydrated lime density	35	lb/CF
11. Treatment duration per batch =	2	days
12. Work days per week =	5	Small volume treatment operation
13. Number of batches =	5	
14. Number of batches during one treatment cycle =	1	
15. Number of treatment cycles =	5	
16. Duration of field work (days) =	10	
17. Work weeks =	2	
18. Work hours per day =	8	
19. Work hours per day normal operation =	4	
20. Crew size	6	
21. Volume of water (gal) =	20,420	
22. Lime available in 2000 pound super sacks, 4-feet by 4-feet by 3-feet high.		
23. Number of lime super sacks (ea) =	4	
24. Required storage capacity for lime (cf) =	192	
25. Temporary chemical storage provided in a 48-foot swing open-door land-sea cargo trailer. The trailer is 45.42-feet long by 8.25 -feet wide by 9-feet high. 40 super sacks per trailer. The monthly rental is $100/mo.		
26. Available capacity in the Land-Sea Cargo Trailer (cf) =	1,920	
27. Number of land-sea cargo trailers for lime (ea) =	1	

Table 4-2

Cost Estimate
Alternative 3: Excavation, pH Adjustment, On-Site and Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Soil pH Adjustment (continued)					
Service/Materials	**Unit**	**Unit Cost**		**Subtotal**	
Labor:					
Site PM	80	$60.00	/hr	$4,800.00	
Site Superintendent	80	$49.00	/hr	$3,920.00	
QA/Sampling Coordinator	80	$36.00	/hr	$2,880.00	
H&S Coordinator	80	$49.00	/hr	$3,920.00	
Equipment Operator	10	$406.00	/day	$4,060.00	
Equipment Operator	10	$406.00	/day	$4,060.00	
Laborer	10	$341.60	/day	$3,416.00	
Equipment:					
Excavator	0.50	$6,150.00	/mo	$3,075.00	
Wheel Loader	10	$720.00	/day	$7,200.00	
Fork Lift	10	$175.00	/day	$1,750.00	
500 gal Water Trailer	0.50	$735.00	/mo	$367.50	
21,000 gal Frac Tank	0.50	$1,400.00	/mo	$700.00	
Trash Pump	0.50	$435.00	/mo	$217.50	
Air Monitoring	1	$750.00	/ls	$750.00	
Office Trailer	0.50	$500.00	/mo	$250.00	
Generator	0.50	$595.00	/mo	$297.50	
P/U Truck	0.50	$1,050.00	/mo	$525.00	
Materials:					
Lime	8,080	$0.09	/lb	$727.20	
Storage - Lime	1	$100.00	/mo.	$100.00	
Analytical:					
Pre-Compliance Sampling:					
pH meter	0	$1,800.00	/ea	$0.00	Previously purchased
Compliance Sampling after Staging for pH Reduction:					
pH	5	$10.00	/ea	$50.00	
				Subtotal	**$43,066.00**

Table 4-2

Cost Estimate
Alternative 3: Excavation, pH Adjustment, On-Site and Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

6.0 On-Site Disposal

Includes:
1. Load lime treated soil and stockpile for use as backfill material. The cost to backfill treated soil
2. Assume soil 4≤pH<5 treated and used on-site for backfill.
3. On site pH testing will be used to determine when treated soil is suitable as backfill.

Assumptions and Calculations:

1. Volume of lime treated soil used as backfill material (LCY) =	1,021	
2. Loader output (cy/day) =	889	1.25CY loader
3. Days to load lime treated soil =	2	
4. Dump truck capacity (cy) =	12	
5. Dump truck haul distance (mi.) =	0.1	
6. Dump truck output (cy/day) =	300	
7. No. of dump trucks per day =	2	
8. The duration to load & haul treated soil (days) =	2	

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site PM	16	$60.00	/hr	$960.00	
Site Superintendent	16	$49.00	/hr	$784.00	
QA/Sampling Coordinator	16	$36.00	/hr	$576.00	
H&S Coordinator	16	$49.00	/hr	$784.00	
Equipment Operator	2	$406.00	/day	$812.00	
Laborer	2	$293.00	/day	$586.00	
Truck Drivers	4	$341.60	/day	$1,366.40	
Equipment:					
Wheel Loader	2	$720.00	/day	$1,440.00	
Dump Truck	2	$615.00	/day	$1,230.00	
65-hp Dozer	2	$350.00	/day	$700.00	
P/U Truck	2	$160.00	/day	$320.00	
Material:					
Field Instruments	2	$46.00	/day	$92.00	
Level D PPE	4	$10.00	/day	$40.00	
				Subtotal	**$9,690.00**

Table 4-2

Cost Estimate
Alternative 3: Excavation, pH Adjustment, On-Site and Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

7.0 Off-Site Disposal

Includes:
1. Dispose of soil pH<4 at a non-hazardous waste landfill.
2. Analysis for off-site waste disposal.
3. Waste characterization and disposal sampling: 1 sample per 300 LCY
4. Time onsite waiting for waste characterization analysis
5. Nonhaz disposal facility daily capacity for PBOW soil = 200 tons
6. Nonhaz disposal facility daily capacity = 182 LCY

Assumptions and Calculations:

1. Volume of PCB soil for nonhazardous disposal =	3,556	LCY
2. Volume of low pH soil for nonhazardous disposal =	1,924	LCY
3. Volume of nonhazardous soil for disposal =	5,480	LCY
4. Mass of nonhazardous soil for disposal =	6,027	tons
5. Volume of soil PCB≥50 ppm for TSCA disposal =	335	LCY
6. Mass of soil for TSCA disposal =	369	tons
7. Non-haz waste disposal costs ($/ton) =	52	Erie County Landfill
8. Non-haz waste regulatory fees ($/ton) =	0	included in disposal
9. TSCA waste transportation and disposal cost ($/ton) =	$134.00	EQ Environmental
10. Haz waste regulatory fees ($/ton) =	10	
11. Number of crew =	3	
12. Dump truck capacity (to nonhaz landfill) =	12	tons/truck
13. Travel duration (round trip) to non-haz landfill =	1	hrs/trip
14. Truckloads per day (nonhaz landfill) =	17	loads/day
15. Work day duration =	8	hrs/day
16. Trips per truck driver =	8	trips/driver
17. Truck drivers =	3	drivers
18. Truck loads of non-haz waste =	503	loads
19. Output of front-end loader (cy/day) =	889	1.25 CY loader
20. No. of wheel loaders =	1	
21. Time to load and haul nonhazardous soil =	31	work days
22. Days per week Erie County Landfill open		
23. Analytical TAT =	3	work days
24. Dump truck capacity (TSCA landfill) =	22	tons
25. Truck loads (TSCA landfill) =	17	loads
26. Time to load TSCA waste =	1	work days
27. Demurrage (TSCA waste) =	2	hrs/truck
28. Number of field days =	32	work days

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site PM	256	$60.00	/hr	$15,360.00	
Site Superintendent	256	$49.00	/hr	$12,544.00	
QA (Sampling) Coordinator	256	$36.00	/hr	$9,216.00	
H&S Coordinator	256	$49.00	/hr	$12,544.00	
Equipment Operator	32	$406.00	/day	$12,992.00	
Laborers	32	$293.00	/day	$9,376.00	
Truck Drivers	96	$341.60	/day	$32,793.60	
Equipment:					
Wheel Loader	32	$720.00	/day	$23,040.00	
12-Ton Dump Truck	96	$615.00	/day	$59,040.00	
P/U Truck	32	$160.00	/day	$5,120.00	
Analytical:					
Waste Characterization Sampling (Soil):					
TCLP metals	20	$112.50	/ea	$2,250.00	All soil
PCBs	13	$99.00	/ea	$1,287.00	PCB soil
Off-Site Disposal Costs:					
Disposal Cost (Non-Haz waste)	6,027	$52.00	/ton	$313,427.40	Erie County Landfill
Disposal Cost (TSCA waste)	369	$134.00	/ton	$49,437.96	EQ Environmental
Demurrage (TSCA waste)	34	$75.00	/hr	$2,550.00	EQ Environmental
				Subtotal	**$560,978.00**

Table 4-2

Cost Estimate
Alternative 3: Excavation, pH Adjustment, On-Site and Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

8.0 Site Restoration

Includes:
1. Backfill excavated areas with clean backfill.
2. Re-seed site.
3. Confirmation sampling of soil staging areas.

Assumptions and Calculations:

1a. Volume of in place soil excavated =	5,258	BCY
1b. Volume of treated soil backfilled =	785	BCY
1c. Volume of excavation requiring backfill =	4,473	BCY
2. Compaction factor =	1.15	
3. Volume of soil required for backfill (cy) =	5,144	
4. Cost of clean backfill soil delivered to site ($/cy) =	12	
5. Output of front-end loader (cy/day) =	889	
6. Field days required to backfill soil =	6	days
7. Number of field crew =	3	

8. Upon completion of remedial action soil samples shall be taken within the laydown area to determine if any soil removal is required.
9. The laydown area shall be divided into 4 quarters and a 5-point composite collected (4 samples total).

10. Number of soil samples for laydown area confirmation =	4	samples
11. Time alloted for reseeding site and road repair.	5	days
12. Total task duration (days) =	11	days
13. Work day duration =	8	hrs
14. Excavation area =	117,612	SF

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site Superintendent	88	$0.00	/hr	$0.00	
QA Coordinator	88	$62.00	/hr	$5,456.00	
H&S Coordinator	88	$0.00	/hr	$0.00	
Equipment Operator	6	$406.00	/day	$2,436.00	
Equipment Operator	6	$406.00	/day	$2,436.00	
Laborer	6	$341.60	/day	$2,049.60	
Reseeding	118	$80.00	/1000 sf	$9,408.96	
Road Repair	1	$25,000.00	/ls	$25,000.00	
Equipment:					
Dozer	0.3	$3,500.00	/mo	$1,050.00	
Wheel Loader	6	$720.00	/day	$4,320.00	
Office Trailer	0.5	$800.00	/mo	$400.00	
Porta Jon	0.5	$175.22	/mo	$87.61	
Generator	0.5	$170.35	/mo	$85.18	
P/U Truck	11	$160.00	/day	$1,760.00	
Material:					
Backfill	5,144	$12.00	/cy	$61,727.40	delivered to site
Level D PPE	18	$10.00	/day	$180.00	
Analytical:					
PCBs	4	$99.00	/ea	$396.00	
Shipping	4	$40.00	/ea	$160.00	
				Subtotal	**$116,953.00**

9.0 Overall Cost

Total Capital Cost	**$954,500.00**
Contingency (25%)	**$238,600.00**
Contractor Oversight (5%)	**$47,700.00**
Total Cost	**$1,241,000.00**

*This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

Cost Estimate
VE Option 2:
Excavation, pH Adjustment, Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

VE Option #2
Excavation/pH Adjustment/On-site & Off-site Disposal
PCB and Low pH Soil
Cost Estimate

Site: Former Sellite Area
Plum Brook Ordnance Works
Date: 7/16/2014

Scope:
1. Prepare work plans and closeout report, and complete procurement.
2. Collect soil samples and run titration tests in lab.
3. Mobilize/demobilize equipment and personnel.
4. Prepare site for remedial activity.
5. Excavate contaminated soil, perform confirmation sampling & characterize waste.
6. Mix lime into clean fill to increase subsurface soil pH
7. ~~On site disposal of lime-treated soil~~
8. Off-site disposal of soil with PCBs < 50 mg/kg and pH<4 at nonhazardous solid waste landfill.
9. Off-site disposal of soil with PCBs ≥ 50 mg/kg at TSCA TSDF.
10. Site restoration.
11. Demobilize equipment and personnel.

1.0 Treatability Study, Work Plans, Reports and Procurement

Includes:
1. Labor to generate work plans, including engineering specifications and Health and Safety Plan, along with the Final Report.
2. Procure equipment and materials.

Service	Unit	Unit Cost		Subtotal
Work Plans and Final Report	1	$35,000.00	/ls	$35,000.00
Lime Bench Study	1	$10,000.00	/ls	$10,000.00
Procurement	1	$10,000.00	/ls	$10,000.00
			Subtotal	**$55,000.00**

2.0 Mobilization/Demobilization of Equipment and Personnel

Includes:
1. Mobilization and demobilization of local equipment and personnel.
2. Set-up/tear down office trailer.

Assumptions:
1. Labor and equipment are available locally.

Service/Materials	Unit	Unit Cost		Subtotal
Labor/Equipment:				
Mobe/Demobe	1	$5,000.00	/ls	$5,000.00
Office Trailer (set up/tear down)	1	$500.00	/ls	$500.00
			Subtotal	**$5,500.00**

Cost Estimate
VE Option 2:
Excavation, pH Adjustment, Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

3.0 Site Preparation

Includes:
1. Survey and mark proposed remediation area
2. Construction and maintenance of erosion and sediment controls
3. Install/improve access road for transport of equipment
4. Clearing (medium brush without grubbing) will be performed in 100% of excavation area.

Assumptions and Calculations:

1a. PCB rea to be cleared =	1.1	acres
1b. Low pH area to be cleared =	1.6	acres
1c. Area to be cleared =	2.7	acres
2. Daily ouput clearing crew (acres/day) =	1	
3. Days clearing contractor in field =	3	
4. Silt Fence to be installed (lf) =	1640	
5. Daily ouput silt fencing crew (LF/day) =	500	
6. Days silt fence crew in field =	4	
7. Prepare stockpile area (days) =	1	
8. Work hours/day =	8	

Services:				
Decontamination Pad	1	$10,000.00	LS	$10,000.00
Road Improvement	1	$25,000.00	LS	$25,000.00
Weigh Station	1	$5,000.00	LS	$5,000.00
Contractor:				
Site PM	64	$60.00	/hr	$3,840.00
Site Superintendent	64	$49.00	/hr	$3,136.00
QA (Sampling) Coordinator	64	$36.00	/hr	$2,304.00
Equipment Operator	8	$406.00	/day	$3,248.00
Truck Driver	8	$341.60	/day	$2,732.80
Laborer	8	$293.00	/day	$2,344.00
H&S Coordinator	64	$49.00	/hr	$3,136.00
Equipment:				
Excavator	8	$775.00	/day	$6,200.00
Dump Truck	8	$615.00	/day	$4,920.00
P/U Truck	8	$160.00	/day	$1,280.00
Subcontractor:				
Surveying Crew	1	$2,000.00	/day	$2,000.00
Bushhog	2.7	$500.00	/acre	$1,350.00
Materials:				
Field Instruments	8	$46.00	/day	$368.00
Silt Fencing	1,640	$1.60	/day	$2,624.00
			Subtotal	**$79,483.00**

Cost Estimate
VE Option 2:
Excavation, pH Adjustment, Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil

Includes:
1. Excavation of PCB-contaminated and low pH soil (see Figures 2-1 and 2-2).
2. Collect confirmatory samples to verify extent of excavation.

Assumptions and Calculations:

1a. In place volume of PCB soil (<50ppm) =	2,735	BCY
1b. In place volume of PCB soil (≥50ppm) =	258	BCY
1c. In place volume of low pH soil (pH<4) =	635	BCY
1d. In place volume of low pH soil (4≤pH<5) =	393	BCY
1e. In place volume of excavated soil =	4,021	BCY
2. Swell factor for soil upon excavation =	1.3	
3. Unconsolidated volume of soil excavated =	5,227	LCY
4. Density of unconsolidated soil =	1.1	Tons/LCY
5. Mass of unconsolidated soil =	5,750	Tons
6. Capacity of screening plant (tons/hr) =	100	
7. Excavator: hydraulic		
8. Excavator bucket heaped capacity (LCY) =	1	
9. Excavator cycle time (sec) =	18	
10. Excavator cycles/min =	3.3	
11. Excavator load factor =	0.75	
12. Excavator bucket fill factor =	0.6	excavation in lifts
13. Excavator work minutes/hour =	50	
14. Excavator output (BCY/day) =	594	
15a. Days to excavate soil =	7	
15b. Time on site (days) =	7	
16. Dump truck capacity (cy) =	12	
17. Dump truck haul distance (mi.) =	0.5	
18. Dump truck output (cy/day) =	250	
19. Number of dump trucks per day =	3	
20. Number of excavation subcontractor crew =	3	
21a. Perimeter distance between sidewall confirmation sample =	20	FT
21b. Excavation area per floor confirmation sample =	400	SF
22. Resampling factor for confirmation sampling =	1.05	
23a. Confirmatory soil samples for excavation perimeter =	56	
23b. Confirmatory samples for excavation floor =	146	
23c. Number of confirmatory samples from excavated area =	202	
24. Excavation area (SF) =	55,543	
25. Fraction of excavation work performed in Level C PPE =	0.00	
26. Labor productivity factor for Level C work =	0.67	
27. Days excavation crew in Level C =	0	
28a. Perimeter of PCB soil excavation =	1,074	FT
28b. Perimeter of low pH soil excavation =	0	FT
28c. Perimeter of excavation areas =	1,074	FT
29. Hours/workday =	8	

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site PM	56	$60.00	/hr	$3,360.00
Site Superintendent	56	$49.00	/hr	$2,744.00
QA (Sampling) Coordinator	56	$36.00	/hr	$2,016.00
H&S Coordinator	56	$49.00	/hr	$2,744.00
Equipment Operator	7	$406.00	/day	$2,842.00
Laborers	7	$293.00	/day	$2,051.00
Truck Drivers	21	$341.60	/day	$7,173.60

Cost Estimate
VE Option 2:
Excavation, pH Adjustment, Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil (continued)

Equipment:

Excavator	7	$775.00	/day	$5,425.00
Wheel Loader	7			
Dump Truck	21	$615.00	/day	$12,915.00
P/U Truck	7	$160.00	/day	$1,120.00

Analytical:

PCBs	202	$66.00	/ea	$13,332.00
Shipping	14	$40.00	/ea	$560.00

Materials & Services:

Level D PPE	21	$10.00	/day	$210.00
PID rental	7	$33.00	/day	$231.00
CGI rental	7	$13.00	/day	$91.00

Subtotal **$56,815.00**

5.0 Soil pH Adjustment

Includes:
1. Mix lime into soil with 4≤pH<5.
2. Temporary storage for lime.
3. Turnaround time of 3 days for rush analytical for waste characterization

Assumptions and Calculations:

1. Area of soil to be treated =	0.66	acres
2. Thickness of treated soil =	4.0	FT
3. Volume of in place soil to be treated (cy) =	1,059	BCY
4. Swell factor for soil upon excavation =	1.3	
5. Cubic yards of unconsolidated soil =	1,377	LCY
6. Treatment batch size (cy) =	250	
7. Lime demand =	5.3	tons/acre*ft
8. Lime demand =	28,015	lbs
9. Water used to moisten soil =	20	gal/cy soil
10. Hydrated lime density	35	lb/CF
11. Treatment duration per batch =	2	days
12. Work days per week =	5	Small volume treatment operation
13. Number of batches =	6	
14. Number of batches during one treatment cycle =	1	
15. Number of treatment cycles =	6	
16. Duration of field work (days) =	12	
17. Work weeks =	2.4	
18. Work hours per day =	8	
19. Work hours per day normal operation =	4	
20. Crew size	6	
21. Volume of water (gal) =	27,540	
22. Lime available in 2000 pound super sacks, 4-feet by 4-feet by 3-feet high.		
23. Number of lime super sacks (ea) =	14	
24. Required storage capacity for lime (cf) =	672	
25. Temporary chemical storage provided in a 48-foot swing open-door land-sea cargo trailer. The trailer is 45.42-feet long by 8.25 -feet wide by 9-feet high. 40 super sacks per trailer. The monthly rental is $100/mo.		
26. Available capacity in the Land-Sea Cargo Trailer (cf) =	1,920	
27. Number of land-sea cargo trailers for lime (ea) =	1	

Cost Estimate
VE Option 2:
Excavation, pH Adjustment, Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Soil pH Adjustment (continued)

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site PM	96	$60.00	/hr	$5,760.00	
Site Superintendent	96	$49.00	/hr	$4,704.00	
QA/Sampling Coordinator	96	$36.00	/hr	$3,456.00	
H&S Coordinator	96	$49.00	/hr	$4,704.00	
Equipment Operator	12	$406.00	/day	$4,872.00	
Equipment Operator	12	$406.00	/day	$4,872.00	
Laborer	12	$341.60	/day	$4,099.20	
Equipment:					
Excavator	0.60	$6,150.00	/mo	$3,690.00	
Wheel Loader	12	$720.00	/day	$8,640.00	
Fork Lift	12	$175.00	/day	$2,100.00	
500 gal Water Trailer	0.60	$735.00	/mo	$441.00	
21,000 gal Frac Tank	0.60	$1,400.00	/mo	$840.00	
Trash Pump	0.60	$435.00	/mo	$261.00	
Air Monitoring	1	$750.00	/ls	$750.00	
Office Trailer	0.60	$500.00	/mo	$300.00	
Generator	0.60	$595.00	/mo	$357.00	
P/U Truck	0.60	$1,050.00	/mo	$630.00	
Materials:					
Lime	28,015	$0.09	/lb	$2,521.35	
Storage - Lime	1	$100.00	/mo.	$100.00	
Analytical:					
Pre-Compliance Sampling:					
pH meter	0	$1,800.00	/ea	$0.00	Previously purchased
Compliance Sampling after Staging for pH Reduction:					
pH	6	$10.00	/ea	$60.00	
				Subtotal	**$53,158.00**

Cost Estimate
VE Option 2:
Excavation, pH Adjustment, Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

6.0 On-Site Disposal

Includes:
1. Load lime treated soil and stockpile for use as backfill material. The cost to backfill treated soil
2. Assume soil 4≤pH<5 treated and used on-site for backfill.
3. On site pH testing will be used to determine when treated soil is suitable as backfill.

Assumptions and Calculations:

1. Volume of lime treated soil used as backfill material (LCY) =	0	
2. Loader output (cy/day) =	889	1.25CY loader
3. Days to load lime treated soil =	0	
4. Dump truck capacity (cy) =	12	
5. Dump truck haul distance (mi.) =	0.1	
6. Dump truck output (cy/day) =	300	
7. No. of dump trucks per day =	2	
8. The duration to load & haul treated soil (days) =	0	

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site PM	0	$60.00	/hr	$0.00
Site Superintendent	0	$49.00	/hr	$0.00
QA/Sampling Coordinator	0	$36.00	/hr	$0.00
H&S Coordinator	0	$49.00	/hr	$0.00
Equipment Operator	0	$406.00	/day	$0.00
Laborer	0	$293.00	/day	$0.00
Truck Drivers	0	$341.60	/day	$0.00
Equipment:				
Wheel Loader	0	$720.00	/day	$0.00
Dump Truck	0	$615.00	/day	$0.00
65-hp Dozer	0	$350.00	/day	$0.00
P/U Truck	0	$160.00	/day	$0.00
Material:				
Field Instruments	0	$46.00	/day	$0.00
Level D PPE	0	$10.00	/day	$0.00
			Subtotal	**$0.00**

Cost Estimate
VE Option 2:
Excavation, pH Adjustment, Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

7.0 Off-Site Disposal

Includes:

1. Dispose of soil pH<4 at a non-hazardous waste landfill.
2. Analysis for off-site waste disposal.
3. Waste characterization and disposal sampling: 1 sample per 300 LCY
4. Time onsite waiting for waste characterization analysis
5. Nonhaz disposal facility daily capacity for PBOW soil = 200 tons
6. Nonhaz disposal facility daily capacity = 182 LCY

Assumptions and Calculations:

1. Volume of PCB soil for nonhazardous disposal =	3,556	LCY
2. Volume of low pH soil for nonhazardous disposal =	1,146	LCY
3. Volume of nonhazardous soil for disposal =	4,701	LCY
4. Mass of nonhazardous soil for disposal =	5,172	tons
5. Volume of soil PCB≥50 ppm for TSCA disposal =	335	LCY
6. Mass of soil for TSCA disposal =	369	tons
7. Non-haz waste disposal costs ($/ton) =	52	Erie County Landfill
8. Non-haz waste regulatory fees ($/ton) =	0	included in disposal
9. TSCA waste transportation and disposal cost ($/ton) =	$134.00	EQ Environmental
10. Haz waste regulatory fees ($/ton) =	10	
11. Number of crew =	3	
12. Dump truck capacity (to nonhaz landfill) =	12	tons/truck
13. Travel duration (round trip) to non-haz landfill =	1	hrs/trip
14. Truckloads per day (nonhaz landfill) =	17	loads/day
15. Work day duration =	8	hrs/day
16. Trips per truck driver =	8	trips/driver
17. Truck drivers =	3	drivers
18. Truck loads of non-haz waste =	431	loads
19. Output of front-end loader (cy/day) =	889	1.25 CY loader
20. No. of wheel loaders =	1	
21. Time to load and haul nonhazardous soil =	26	work days
22. Days per week Erie County Landfill open		
23. Analytical TAT =	3	work days
24. Dump truck capacity (TSCA landfill) =	22	tons
25. Truck loads (TSCA landfill) =	17	loads
26. Time to load TSCA waste =	1	work days
27. Demurrage (TSCA waste) =	2	hrs/truck
28. Number of field days =	27	work days

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site PM	216	$60.00	/hr	$12,960.00	
Site Superintendent	216	$49.00	/hr	$10,584.00	
QA (Sampling) Coordinator	216	$36.00	/hr	$7,776.00	
H&S Coordinator	216	$49.00	/hr	$10,584.00	
Equipment Operator	27	$406.00	/day	$10,962.00	
Laborers	27	$293.00	/day	$7,911.00	
Truck Drivers	81	$341.60	/day	$27,669.60	
Equipment:					
Wheel Loader	27	$720.00	/day	$19,440.00	
12-Ton Dump Truck	81	$615.00	/day	$49,815.00	
P/U Truck	27	$160.00	/day	$4,320.00	
Analytical:					
Waste Characterization Sampling (Soil):					
TCLP metals	17	$112.50	/ea	$1,912.50	All soil
PCBs	13	$99.00	/ea	$1,287.00	PCB soil
Off-Site Disposal Costs:					
Disposal Cost (Non-Haz waste)	5,172	$52.00	/ton	$268,920.08	Erie County Landfill
Disposal Cost (TSCA waste)	369	$134.00	/ton	$49,437.96	EQ Environmental
Demurrage (TSCA waste)	34	$75.00	/hr	$2,550.00	EQ Environmental
				Subtotal	**$486,129.00**

Cost Estimate
VE Option 2:
Excavation, pH Adjustment, Off-Site Disposal
PCB and Low pH Soil
Sellite Area
Former Plum Brook Ordnance Works
Sandusky, Ohio

8.0 Site Restoration

Includes:
1. Backfill excavated areas with clean backfill.
2. Re-seed site.
3. Confirmation sampling of soil staging areas.

Assumptions and Calculations:

1a. Volume of in place soil excavated =	4,021	BCY
1b. Volume of treated soil backfilled =	1,059	BCY
1c. Volume of excavation requiring backfill =	2,962	BCY
2. Compaction factor =	1.15	
3. Volume of soil required for backfill (cy) =	3,406	
4. Cost of clean backfill soil delivered to site ($/cy) =	12	
5. Output of front-end loader (cy/day) =	889	
6. Field days required to backfill soil =	4	days
7. Number of field crew =	3	
8. Upon completion of remedial action soil samples shall be taken within the laydown area to determine if any soil removal is required.		
9. The laydown area shall be divided into 4 quarters and a 5-point composite collected (4 samples total).		
10. Number of soil samples for laydown area confirmation =	4	samples
11. Time alloted for reseeding site and road repair.	5	days
12. Total task duration (days) =	9	days
13. Work day duration =	8	hrs
14. Excavation area =	117,612	SF

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site Superintendent	72	$0.00	/hr	$0.00	
QA Coordinator	72	$62.00	/hr	$4,464.00	
H&S Coordinator	72	$0.00	/hr	$0.00	
Equipment Operator	4	$406.00	/day	$1,624.00	
Equipment Operator	4	$406.00	/day	$1,624.00	
Laborer	4	$341.60	/day	$1,366.40	
Reseeding	118	$80.00	/1000 sf	$9,408.96	
Road Repair	1	$25,000.00	/ls	$25,000.00	
Equipment:					
Dozer	0.2	$3,500.00	/mo	$700.00	
Wheel Loader	4	$720.00	/day	$2,880.00	
Office Trailer	0.5	$800.00	/mo	$400.00	
Porta Jon	0.5	$175.22	/mo	$87.61	
Generator	0.5	$170.35	/mo	$85.18	
P/U Truck	9	$160.00	/day	$1,440.00	
Material:					
Backfill	3,406	$12.00	/cy	$40,871.00	delivered to site
Level D PPE	12	$10.00	/day	$120.00	
Analytical:					
PCBs	4	$99.00	/ea	$396.00	
Shipping	4	$40.00	/ea	$160.00	
				Subtotal	**$90,627.00**

9.0 Overall Cost

Total Capital Cost	**$826,700.00**
Contingency (25%)	**$206,700.00**
Contractor Oversight (5%)	**$41,300.00**
Total Cost	**$1,075,000.00**

*This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

FINANCIAL ANALYSIS of OPTION 2

SUMMARY OF COST OF DESIGN:

Initial Cost	$ 1,241,000.00 *	
Cost of Present Design	$ 1,241,000.00	

SUMMARY OF COST OF PROPOSED DESIGN: (w/o implementation costs)

Initial Cost	$ 1,075,000.00 *	
Cost of Proposed Design	$ 1,075,000.00	
Gross Savings (present minus proposed)		$ 166,000.00

SUMMARY OF IMPLEMENTATION COSTS FOR PROPOSED DESIGN:

Cost of Study	$ 30,000.00	
Cost of Redesign	$ -	
Cost of Modification	$ -	
Total cost of Implementation	$ 30,000.00	
NET SAVINGS: (gross savings minus cost of implementation)		$ 136,000.00

* Both cost estimates assume PCB's being treated as originally designed

Plum Brook Ordnance Works
Garage Maintenance Area
Project Number: G05OH001825

VE Study

The Garage Maintenance area includes the Former Sellite Area, the Unloading Area and the Locomotive Building Area (Locomotive Shop and Railcar Wash Area). The Unloading Area and the Locomotive Building Area do not require remedial action, so the VE study focused on the Former Sellite Area.

The products of the VE study for the Former Sellite Area are two remedial approach options and a recommendation for contract evaluation. One remedial approach option addresses the PCB remediation and the other addresses the remediation of the low pH soil.

Recommendation:

Evaluate contract mechanism for the remedy

Consider unit cost pricing for the T&D of excavated soil rather than lump sum pricing to reflect the actual volume of soil excavated.