

APPENDIX E

**NAPL EVALUATION FIGURES, COST ESTIMATE SPREADSHEETS
AND OTHER SUPPORTING MATERIALS**

APPENDIX E – NAPL SOURCE AREAS COST ESTIMATES

GLOBAL ASSUMPTIONS

The following table presents the global assumptions that apply to NAPL remedial alternative cost estimates. These assumptions are further divided into general assumptions followed by assumptions that are specific to certain remedial technologies. Other specific assumptions are listed as footnotes in each cost spreadsheet.

A. Global Assumptions – General	
1.	Costs are based on available RI data, assumed site conditions and design, and are intended for Feasibility Study purposes. Cost estimates are approximate but do include a comprehensive list of tasks from all phases starting with initial investigation to define areal extent of source area to design, permitting, implementation, and finally sampling for closure. Cost estimates are expected to meet +50%/-30% precision requirements of CERCLA RI/FS guidance (USEPA, 1988).
2.	Costs include Capital and Annual costs. Capital costs include Direct Capital and Indirect Capital costs.
3.	Present worth costs are estimated based on Capital and Annual costs and the duration of the remedial alternative using a discount rate of 5%.
4.	Assume 100-year operation of ICs and Monitoring to be equivalent to indefinite operation.
5.	Site investigation cost is based on an assumed sampling density in the range of 1 boring per 1000 ft ² for simple remediation systems (SVE and Hyd Ext) to 1 boring per 400 ft ² for more aggressive technologies (ERH and ISCO), with drilling and sampling conducted by a direct push rig. Workplan and report costs are included as well.
6.	Indirect Capital cost items include project management (5% to 10% of direct capital cost), remedial design (6% to 20% of direct capital cost), construction management (6% to 15% of direct capital cost), and contingency (20% to 40% of total project cost). The percentages for professional/technical services costs are based on the USEPA/US Army Corps of Engineers document "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (USEPA 2000b).
7.	Cost estimate does not consider all site-specific details. For example, property owners were not consulted regarding best location of treatment compounds, best routing of pipelines, availability of utilities, etc.
8.	Assume electricity unit cost \$0.15/KWhr and a natural gas unit cost of \$1.08/therm. Total estimated electricity and natural gas usage and associated monthly utility costs for each NAPL source area alternative is presented in Appendix E-3.
9.	Drilling unit costs based on 2008 quotes from experienced vendors (e.g., Gregg Drilling, Vironex) in vertical and horizontal wells and direct push technology. Unit costs for wells vary based on well casing materials, depth, indoor (limited access rigs) or outdoor application, and include soil cuttings disposal costs. Soil cuttings from drilling are assumed to be RCRA hazardous for disposal purposes.
10.	Contingency costs include scope and bid contingencies and percentages vary by complexity of technology from 20% (ICs, SVE, Hyd Ext) to 40% (ISCO, ERH).
11.	Annual O&M costs are assumed to be the same for each year.
12.	All intermediate and bottom line costs rounded to the nearest \$1,000.

13.	Site setup and equipment mobilization/demobilization unit costs were determined for a representative Source Area as a function of the impacted area for convenience and consistency. These unit costs range from \$0.75/sf for simple remediation systems (SVE and Hyd Ext) to \$1.5/sf for more complex technologies (ERH and ISCO).
14.	Post treatment confirmation sampling and analysis for site closure assumes 1 soil boring per 2,500 square feet.
15.	Greenhouse gas estimates (carbon footprint in metric tons of CO ₂ -equivalent) for all NAPL remedial alternatives are presented in Appendix E-3.
B. General Assumptions for Each Technology	
ICs and Monitoring	
1.	Assume ICs and Monitoring operate for 100 years.
2.	Summary of IC layers for each Source Area is derived from the applicable ICs for the corresponding EAPC and is shown in Table D-3.1.
3.	ICs Capital and O&M costs are included in Table D-3.2.
4.	Assume 20% contingency for cost estimate.
SVE	
1.	Assume SVE system operates for 4 years for NAPL areas.
2.	Assume 0.1 to 0.5 scfm/foot of vapor flow in 0 to 15 feet bgs and 15 to 30 feet bgs soil zones based on low permeability formations composed of silt/clay with fine sands. Assume 1 to 5 scfm/foot of vapor flow in soil zones below 30 feet bgs composed of fine sands with lower amounts of silt/clay. Soil data from the RI for soils deeper than 25 feet bgs have indicated permeability in the range of 1 to 3 darcies, while shallow soils have a permeability range of 100 to 300 millidarcy. The unit flow rates are rough order of magnitude estimates based on experience at other sites and from the article "A Practical Approach to the Design, Operation, and Monitoring of In-situ Soil Venting Systems", by P.C. Johnson et al, Groundwater Monitoring and Remediation Journal, Spring 1990. (GWMR 1990)
3.	Blower sizing was based on the assumed unit flow rates, screen intervals and number of wells. In addition to the estimated vapor flow from the subsurface, additional capacity was incorporated in the blower size to account for dilution air that may be needed to keep VOC vapor concentrations below LEL. More precise determination of blower sizing would require field pilot testing, which would be performed during remedial design if this technology is selected.
4.	Assume vapor treatment with thermal oxidizer for BTEX VOC-impacted areas; thermal oxidizer + scrubber for high-concentration chlorinated VOC-impacted areas; and vapor phase GAC for low-concentration chlorinated VOC-impacted areas.
5.	Treatment equipment assumed to be purchased.
6.	Control and instrumentation cost assumed to be 6% of treatment equipment capital cost.

7.	Vendor estimated drilling unit costs for PVC vertical SVE wells for a source based on groundwater depth and indoor or outdoor application: \$5500 and \$6,000 for outdoor wells with groundwater table at 40 and 50 feet bgs, respectively, and \$7,500 for indoor wells with groundwater table at 50 feet bgs.
8.	Horizontal wells are assumed to be installed at a depth of 30 feet bgs using directional drilling.
9.	Assume 80 ft by 40 ft area for SVE treatment system compound.
10.	Assume 10% system downtime.
11.	Assume 20% contingency for cost estimate.
Hydraulic Extraction	
1.	Assume hydraulic extraction system operates for 10 years and SVE for 4 years.
2.	Vendor estimated drilling and installation unit costs for groundwater extraction wells for a source based on indoor or outdoor application: \$9,500 for outdoor wells and \$11,500 for indoor wells.
3.	Each hydraulic extraction well is expected to provide an average groundwater flow rate of 1 gpm.
4.	Water treated by oil-water separator (OWS), advanced oxidation (H ₂ O ₂ +Ozone) (HiPOx unit from APT) and air stripping (shallow tray stripper) with discharge to storm drain.
5.	Blower treats both the SVE extracted vapors and the air stripper effluent vapors from the groundwater treatment system.
6.	Liquid phase carbon included in the treatment train as a backup or polishing treatment process.
7.	Treatment system assumed to be purchased.
8.	Control and instrumentation cost assumed to be 6% of treatment equipment capital cost.
9.	Groundwater is extracted from UBF/MBF and some wells are expected to go dry.
10.	Assume 100 ft by 60 ft area for Hyd. Ext. + SVE treatment system compound.
11.	Assume 20% contingency for cost estimate.
ISCO	
1.	Assume ISCO system operates for 2 years.
2.	Assume SVE included with ISCO operates for 4 years.
3.	Acidified Fenton's is assumed for SA12 and SA3 and involves injection of 20% hydrogen peroxide, acids and ferrous iron. Injection equipment and operator is assumed to be rented. Initial injection in 100% of injection wells and subsequently 2 injections per year in 50% of injection wells.
4.	Peroxone ISCO is assumed for other source areas (SA6, SA11, SA 9, SA4, SA7, SA8). Injection is continuous over a 2-year period with ozone and peroxide being sequentially injected in cycles across pre-selected sets of wells. Ozone-Peroxide treatment equipment is assumed to be purchased. Ozone capital cost includes air compressor, dryer, chiller, ozone generator, and controls. Distribution

	manifold assumed to be compatible for use with ozone and peroxide.
5.	Vendor estimated drilling unit costs for CPVC vertical SVE wells for a source based on groundwater depth and indoor or outdoor application: \$6,000 and \$6,500 for outdoor wells with groundwater table at 40 and 50 feet bgs, respectively, and \$7,500 for indoor wells with groundwater table at 50 feet bgs.
6.	Waste disposal cost includes removal and disposal of NAPL that tend to accumulate in wells as a result of peroxide injection. This NAPL would be bailed or pumped and disposed offsite at a permitted facility as RCRA hazardous waste at an estimated cost of \$1.50 per gallon.
7.	ISCO cost estimate based on vendor and URS experience at other sites because no specific pilot test data is available.
8.	Remediation area and treatment equipment area that are outdoors are assumed to be fenced and not accessible to the public.
9.	Control and instrumentation cost assumed to be 13% of treatment equipment capital cost.
10.	Assume 100 ft by 60 ft area for ISCO + SVE treatment system compound.
11.	Assume 40% contingency for cost estimate.
ISSH (ERH)	
1.	Assume Electric Resistance Heating for ISSH and ISSH + SVE system operates for 2 years.
2.	Vendor estimated drilling and installation unit costs for electrode/vapor extraction wells for a source based on indoor or outdoor application: \$12,500 for outdoor wells and \$13,000 for indoor wells.
3.	SVE piping and electrical power supply cables are placed in trenches below grade where remediation area is in driveways, loading docks or parking areas.
4.	Electrical energy (Kilowatt-hours, KWhr) needed for remediation is based on vendor estimates. Total energy needed depends on volume of soil being heated and level of contamination. The vendor (Thermal Remediation Services, Inc.) was provided available site data relating to types of chemical contaminants, soil and groundwater contaminant concentrations, soil type and lithologic cross section, groundwater level, and site map showing buildings and parking areas. Based on vendor estimates, the total energy for ISSH remediation of a VOC source area is approximately 200 KWhr/cubic yard.
5.	The average power usage was estimated based on total energy (kWhr) needed for remediation divided by the total number of months of remediation (24 months). Actual usage per month would depend on heating implementation schedule.
6.	Condensate treatment system includes advanced oxidation (HiPO _x unit, APT) and liquid phase carbon adsorption.
7.	Remediation area and treatment equipment area that are outdoors are assumed to be fenced and not accessible to the public.
8.	Vapor treatment equipment assumed to be purchased. Power conditioning unit (transformer) assumed to be rented.
9.	Control and instrumentation cost assumed to be 13% of treatment equipment capital cost.

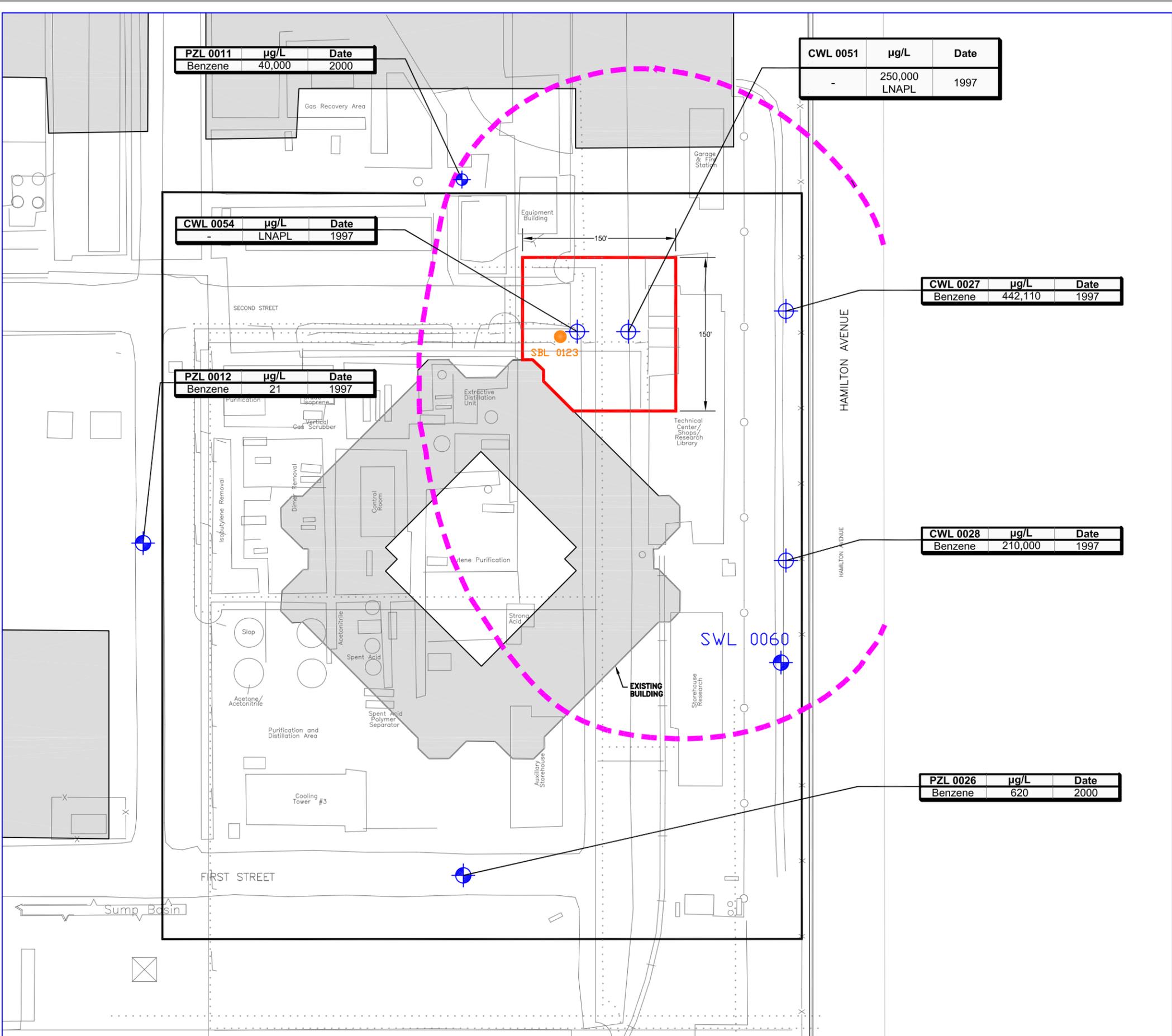
10.	Assume 100 ft by 60 ft area for ERH treatment system compound.
11.	Assume 40% contingency for cost estimate.

APPENDIX E-1

SOURCE AREAS

SOURCE AREA 12

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PZL 0011	µg/L	Date
Benzene	40,000	2000

CWL 0051	µg/L	Date
-	250,000 LNAPL	1997

CWL 0054	µg/L	Date
-	LNAPL	1997

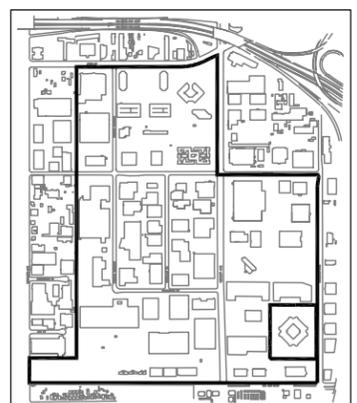
CWL 0027	µg/L	Date
Benzene	442,110	1997

PZL 0012	µg/L	Date
Benzene	21	1997

CWL 0028	µg/L	Date
Benzene	210,000	1997

PZL 0026	µg/L	Date
Benzene	620	2000

- ### Legend
- Assumed extent of NAPL source area based on LNAPL accumulations or observed ROST NAPL signatures within one or more water table monitoring wells, temporary well points or borings.
 - Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
 - Approximate location of former underground pipelines with a potential to have transported VOC-containing fluids
 - Parcel boundary
 - Outlines of historical features with use/contents indicated
 - ⊕ Monitoring well location in water table zone with contaminant concentration and date of sample
 - ⊕ Temporary well point with historical data
 - Continuous core soil boring with observed LNAPL and hydrocarbon saturation confirmation data (1997)



Area shown in this map

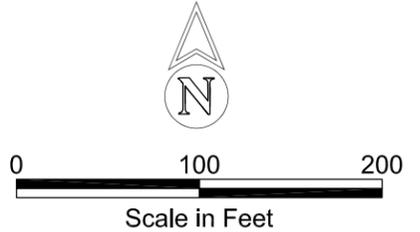
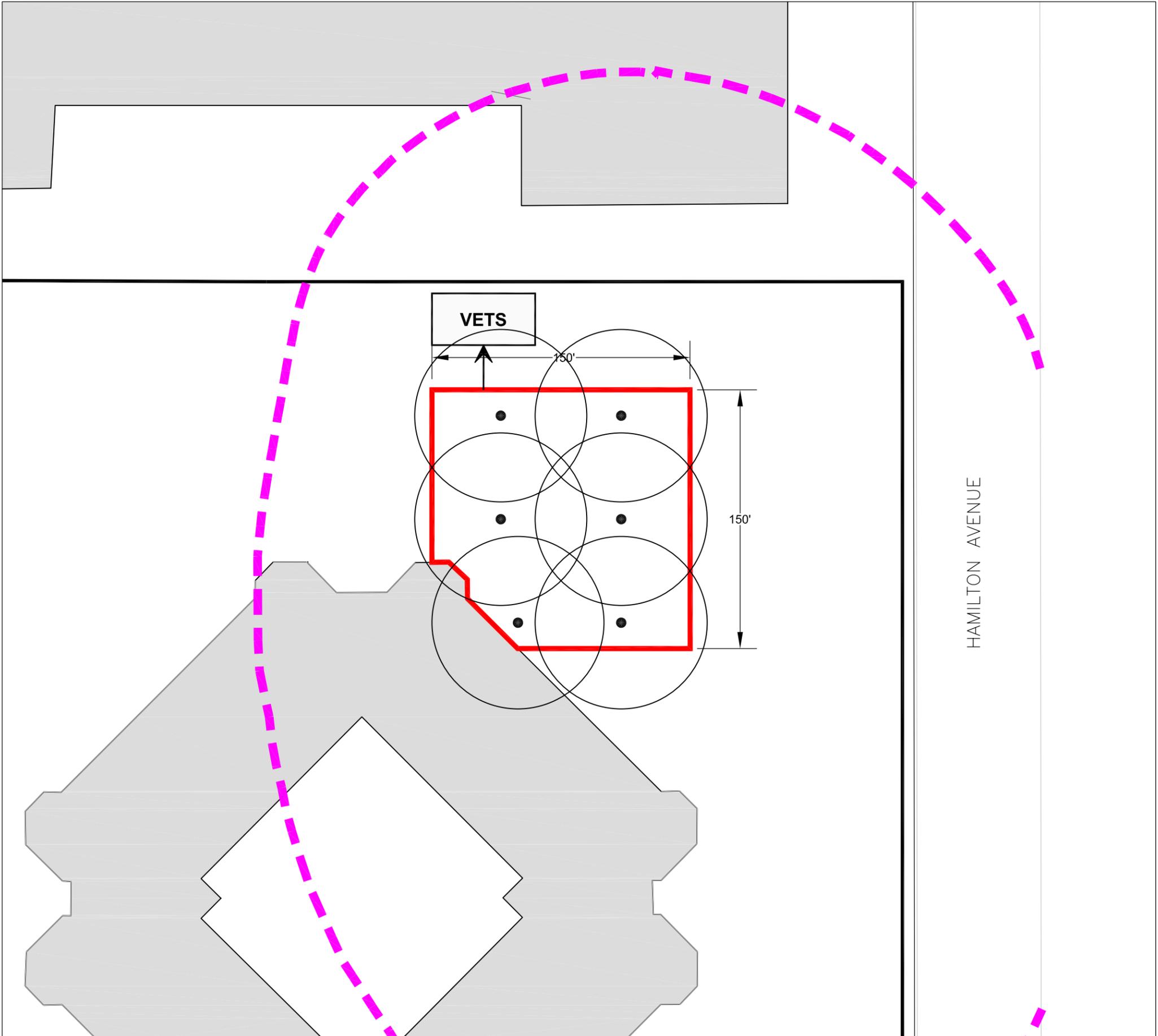


FIGURE 7.2-1
ASSUMED EXTENT OF NAPL CONTAMINATION
Parcel No. 7351-033-017
 Source Area 12
 Del Amo Soil + NAPL FS



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Legend

-  Assumed extent of NAPL source area based on LNAPL accumulations or observed ROST NAPL signatures within one or more water table monitoring wells, temporary well points or borings.
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  SVE/BV vertical well (70-foot spacing), circle denotes assumed 50-foot radius of influence
-  Vapor Extraction Treatment System

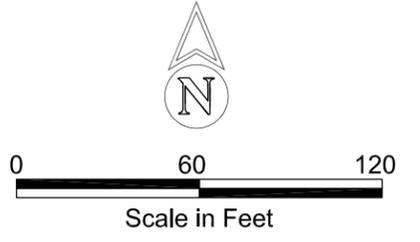
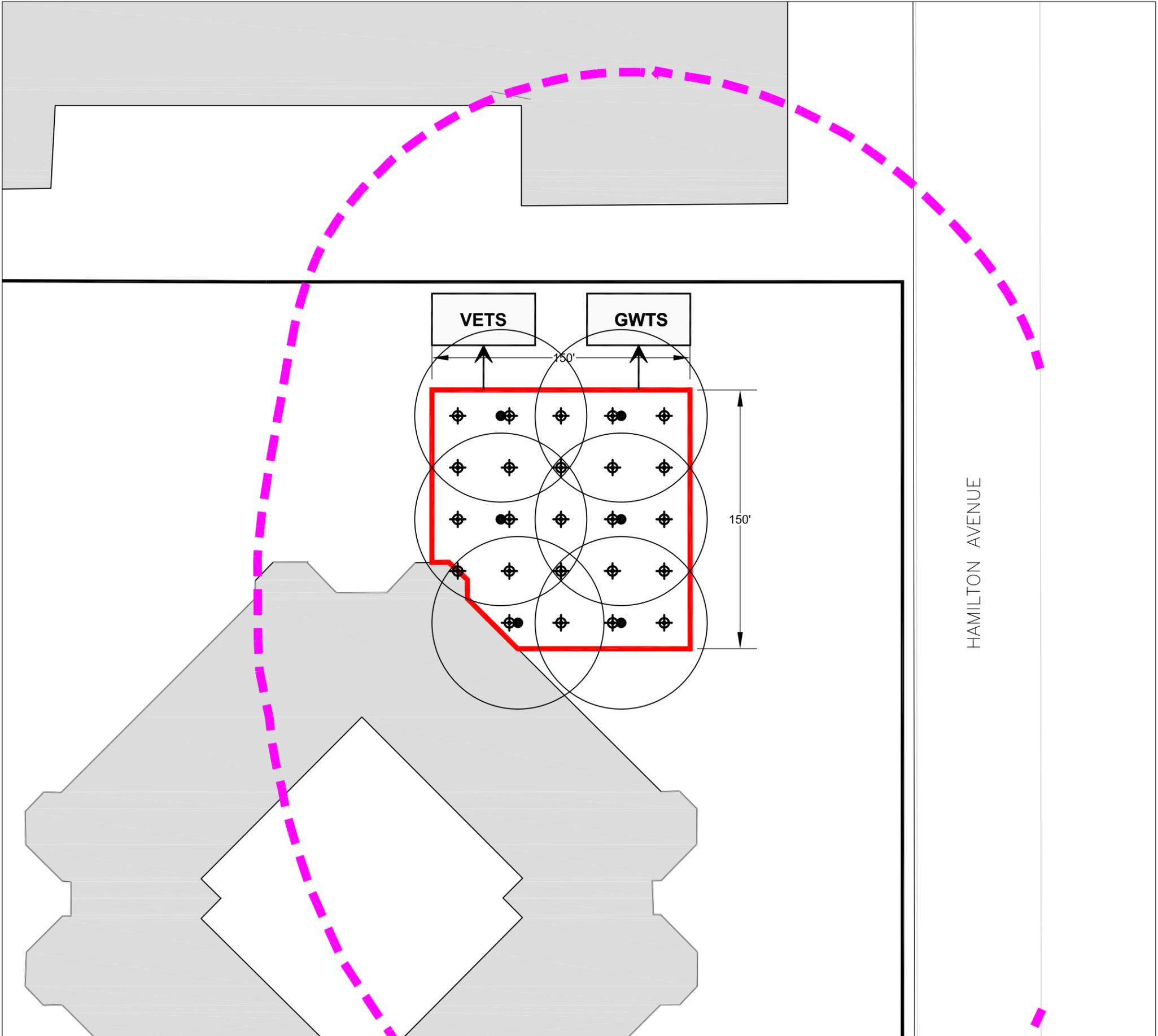


FIGURE 7.2-2
Alternative 3
SOIL VAPOR EXTRACTION/BIOVENTING,
ICS AND MONITORING
Parcel No. 7351-033-017

Source Area 12
 Del Amo Soil + NAPL FS



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Legend

-  Assumed extent of NAPL source area based on LNAPL accumulations or observed ROST NAPL signatures within one or more water table monitoring wells, temporary well points or borings.
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  Groundwater Extraction Well (30-foot spacing)
-  SVE/BV vertical well (approximate 70-foot spacing)
-  Vapor Extraction Treatment System
-  Groundwater Treatment System

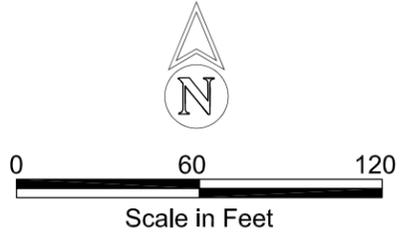
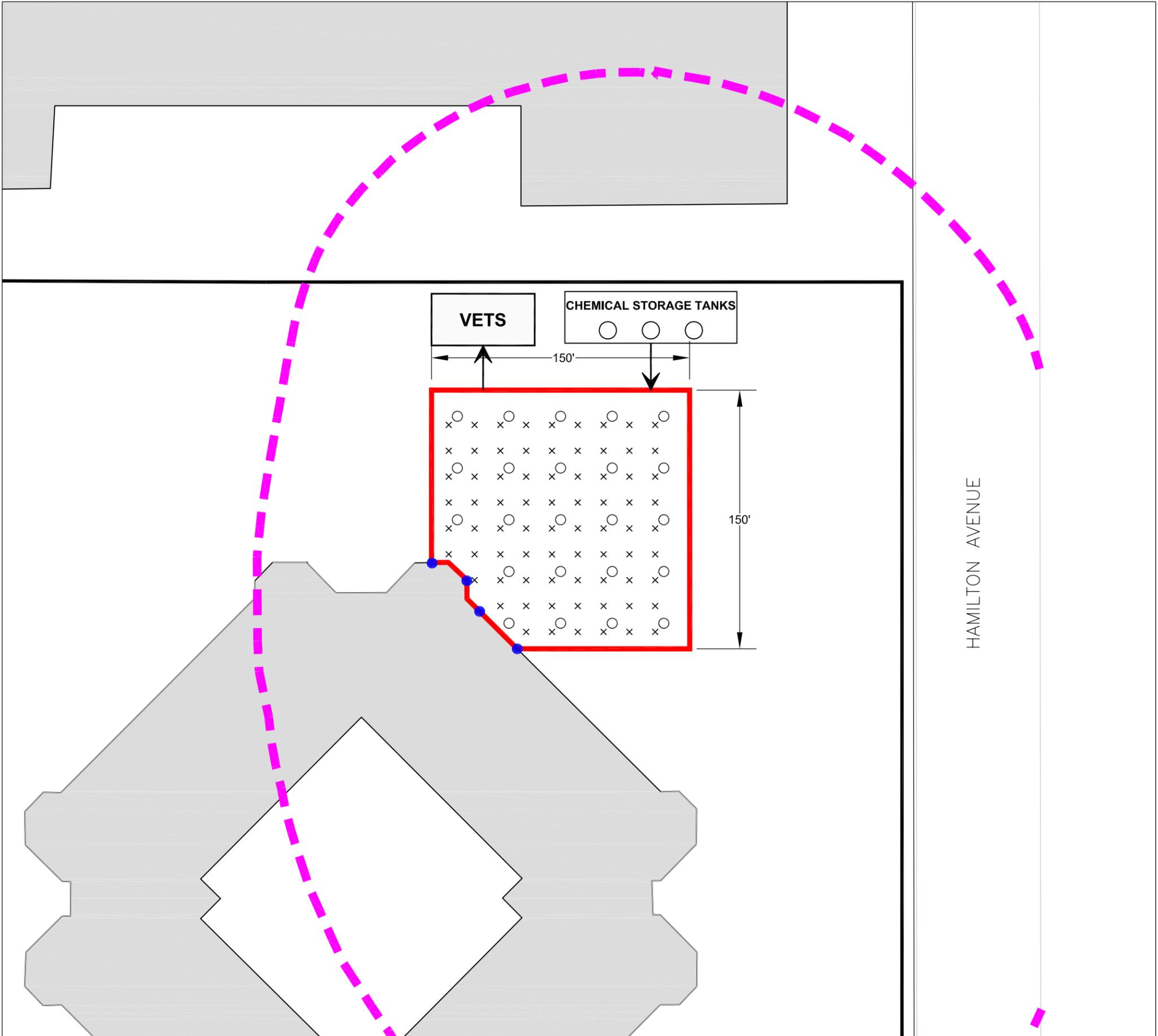


FIGURE 7.2-3
Alternative 4
HYDRAULIC EXTRACTION, SVE/BV,
ICS AND MONITORING
Parcels No. 7351-033-017

Source Area 12
 Del Amo Soil + NAPL FS



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Legend

-  Assumed extent of NAPL source area based on LNAPL accumulations or observed ROST NAPL signatures within one or more water table monitoring wells, temporary well points or borings.
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  ISCO injection well (15-foot spacing)
-  SVE sentry well (30-foot spacing)
-  SVE interior well, dual screen (30-foot spacing)
-  Vapor Extraction Treatment System

Notes:

- (1) Temperature monitoring points are not shown on the figure. These points would typically be distributed throughout the source area at a 50-75 foot spacing.
- (2) SVE radius of influence circles are not shown for each well due to the large number of closely spaced wells in the figure.

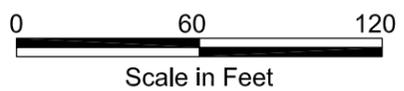
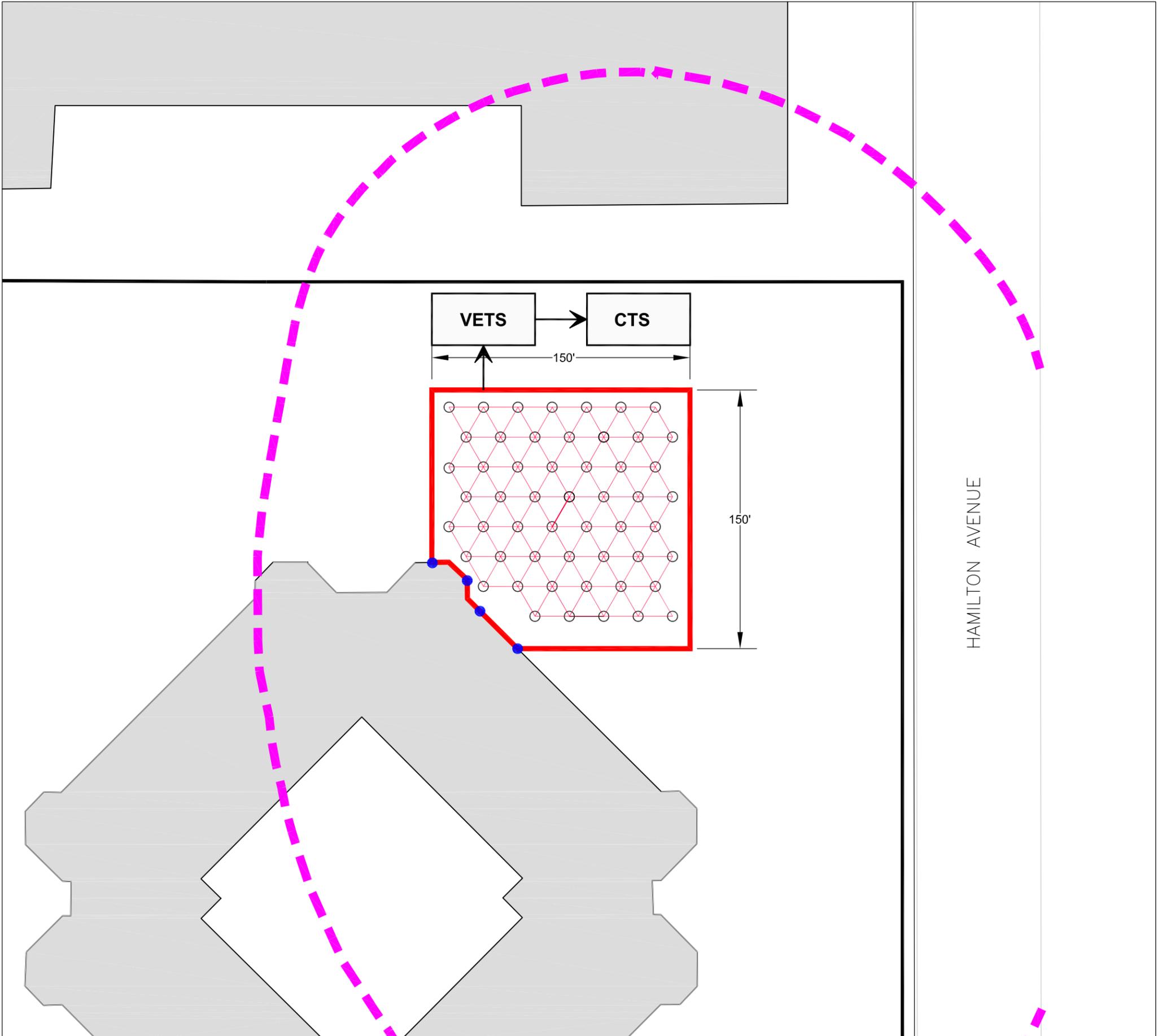


FIGURE 7.2-4
Alternative 5
IN-SITU CHEMICAL OXIDATION, SVE,
ICS AND MONITORING
Parcel No. 7351-033-017

Source Area 12
 Del Amo Soil + NAPL FS



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Legend

-  Assumed extent of NAPL source area based on LNAPL accumulations or observed ROST NAPL signatures within one or more water table monitoring wells, temporary well points or borings.
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  SVE sentry well (30-foot spacing)
-  ERH electrode and SVE interior well, dual screen (20-foot spacing)
-  VETS
Vapor Extraction Treatment System
-  CTS
Condensate Treatment System

Notes:

- (1) Temperature monitoring points are not shown on the figure. These points would typically be distributed throughout the source area at a 50-75 foot spacing.
- (2) SVE radius of influence circles are not shown for each well due to the large number of closely spaced wells in the figure.

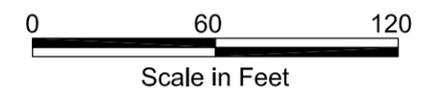


FIGURE 7.2-5
Alternative 6
IN-SITU SOIL HEATING, SVE,
ICS AND MONITORING
Parcels No. 7351-033-017

Source Area 12
 Del Amo Soil + NAPL FS



TABLE E.1-1
SOURCE AREA 12 - REMEDIAL ALTERNATIVE 2
ICs + MONITORING COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	ICs Design, Documentation, Implementation	1	ls	\$ 34,110	\$ 34,110
Direct Capital Total					\$ 34,000
Item No.	Indirect Capital Costs				
1	Project Management	10%	of	\$ 34,000	\$ 3,400
Indirect Capital Subtotal					\$ 3,400
Total Direct + Indirect Capital Cost					\$ 37,400
Item No.	Operation and Maintenance Costs				
1	Institutional Controls, Inspections, Monitoring	1	year	\$ 3,275	\$ 3,275
2	Groundwater Monitoring	1	year	\$ 15,000	\$ 15,000
ICs Annual Operation and Maintenance Subtotal					\$ 18,275
Present Worth of ICs Operation and Maintenance Costs (5%, 100 Years)					\$ 363,000
Contingency (20% of total project cost)					\$ 80,000
Total Capital and ICs O&M Cost					\$ 481,000

NOTES/ASSUMPTIONS

1. ICs include IC layers 1, 2, 3, 4A and 5.
2. ICs capital and O&M costs are estimated based on applicable IC layers per parcel as shown in Tables D3-1 and D3-2.

TABLE E.1-2
SOURCE AREA 12 - REMEDIAL ALTERNATIVE 3
SVE/BV COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 110,000	\$ 110,000
2	Mobilization/Demobilization	22,500	sf	\$ 1.25	\$ 29,000
3	Electrical Service/Hookup/Utilities	1	ls	\$ 20,000	\$ 20,000
4	Site Preparation/Geophysical	22,500	sf	\$ 0.8	\$ 18,000
5	SVE Wells	6	ea	\$ 5,500	\$ 33,000
6	Well Headworks/Vault (24" traffic rated)	6	ea	\$ 3,000	\$ 18,000
7	VETS Installation and Startup	1	ls	\$ 60,000	\$ 60,000
8	SVE Blower + Thermal Oxidizer: 200 cfm	1	ls	\$ 65,000	\$ 65,000
9	Controls and Instrumentation	1	ls	\$ 5,000	\$ 5,000
10	Misc Treat System: Tanks, Piping, Pumps, Fittings	1	ls	\$ 10,000	\$ 10,000
11	Trenching, Piping, Backfill and Resurfacing	500	lf	\$ 30	\$ 15,000
12	Equipment Pad/Enclosure/Fence	1	ea	\$ 20,000	\$ 20,000
13	Post Treatment Sampling + Analysis	9	borings	\$ 5,000	\$ 45,000
Direct Capital Total					\$ 448,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	15%	of	\$ 448,000	\$ 68,000
2	Project Management, Agency Reporting/Coordination	8%	of	\$ 448,000	\$ 36,000
3	Construction Management	10%	of	\$ 448,000	\$ 45,000
Indirect Capital Subtotal					\$ 149,000
Total Direct + Indirect Capital Cost					\$ 597,000
Item No.	Operation and Maintenance Cost				
1	Fuel: Natural Gas (Thermal Oxidizer)	12	mths	\$ 6,000	\$ 72,000
2	Electricity: SVE blower, misc equip	12	mths	\$ 1,700	\$ 20,400
3	Operations & Maintenance	12	mths	\$ 5,000	\$ 60,000
4	Maintenance (hardware, filters, monitoring equipment)	12	mths	\$ 1,500	\$ 18,000
5	Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 3,000	\$ 36,000
6	Project Management/Consultant support/Reports	12	mths	\$ 4,000	\$ 48,000
7	Waste/NAPL/Water Disposal	12	mths	\$ 2,000	\$ 24,000
8	Health & Safety/Air Monitoring	1	ls	\$ 3,000	\$ 3,000
9	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 3,000	\$ 36,000
SVE Annual Operation and Maintenance Subtotal					\$ 318,000
SVE Present Worth of Operation and Maintenance Costs (5%, 4 Years)					\$ 1,128,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (20% of SVE)					\$ 345,000
Total Capital and O&M Cost Present Worth					\$ 2,551,000

NOTES/ASSUMPTIONS

1. SVE (OS) system: Uses 6 V-SVE wells, 30-40 feet bgs screens.
2. Vapor treatment system uses thermal oxidizer, 200 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.

TABLE E.1-3
SOURCE AREA 12 - REMEDIAL ALTERNATIVE 4
HYDRAULIC EXTRACTION AND SVE/BV COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 110,000	\$ 110,000
2	Mobilization/Demobilization	22,500	sf	\$ 1.25	\$ 29,000
3	Electrical Service/Hookup	1	ls	\$ 40,000	\$ 40,000
4	Site Preparation/Geophysical	22,500	sf	\$ 0.8	\$ 18,000
5	SVE Vertical Wells	6	ea	\$ 6,000	\$ 36,000
6	Groundwater Extraction Wells	24	ea	\$ 9,500	\$ 228,000
7	Well Headworks/Vault/Extraction Pumps (24" traffic rated)	30	ea	\$ 3,000	\$ 90,000
8	Treatment System Installation and Startup (SVE + Hyd Ext)	1	ls	\$ 150,000	\$ 150,000
9	SVE Blower + Thermal Oxidizer; 600 cfm	1	ls	\$ 90,000	\$ 90,000
10	Control and Instrumentation	1	ls	\$ 38,000	\$ 38,000
11	Advanced Oxidation Treatment system (24 gpm) (HiPOx)	1	ls	\$ 452,000	\$ 452,000
12	Air Stripping Unit+Blower (STAT 80)	1	ls	\$ 17,000	\$ 17,000
13	Carbon Adsorption Vessels - VPGAC and LPGAC	4	ls	\$ 10,000	\$ 40,000
14	Misc Treat System: OWS, Tanks, Piping, Pumps	1	ls	\$ 60,000	\$ 60,000
15	Trenching, Piping, Cables, Backfill and Resurfacing	900	lf	\$ 30	\$ 27,000
16	Equipment Pad/Enclosure/Fence	1	ea	\$ 50,000	\$ 50,000
17	Post Treatment Sampling + Analysis	9	borings	\$ 5,000	\$ 45,000
Direct Capital Total					\$ 1,520,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	8%	of	\$ 1,520,000	\$ 122,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 1,520,000	\$ 76,000
3	Construction Management	6%	of	\$ 1,520,000	\$ 92,000
Indirect Capital Subtotal					\$ 290,000
Total Direct+Indirect Cost					\$ 1,810,000
Item No.	Operation and Maintenance Cost				
1	Fuel:Natural Gas (Thermal oxidizer)	12	mths	\$ 10,000	\$ 120,000
2	Electricity (SVE blower, HiPOx, Air Stripper blower)	12	mths	\$ 12,400	\$ 148,800
3	Operations & Maintenance	12	mths	\$ 8,000	\$ 96,000
4	Chemicals for HiPOx: H2O2	12	mths	\$ 3,500	\$ 42,000
5	Carbon - Liquid Phase	12	mths	\$ 2,000	\$ 24,000
6	Carbon - Vapor Phase (post-thermal/catox)	12	mths	\$ 4,000	\$ 48,000
7	Groundwater/Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 8,000	\$ 96,000
8	Project Management/Consultant support/Reports	12	mths	\$ 8,000	\$ 96,000
9	Waste/NAPL/Water Disposal	12	mths	\$ 4,000	\$ 48,000
10	Health & Safety/Air Monitoring	1	ls	\$ 6,000	\$ 6,000
11	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 5,000	\$ 60,000
SVE Annual Operation and Maintenance Subtotal					\$ 410,000
Present Worth of SVE Operation and Maintenance Costs (5%, 4 Years)					\$ 1,454,000
Hydraulic Extraction Annual Operation and Maintenance Subtotal					\$ 375,000
Present Worth of Hydraulic Extraction Operation and Maintenance Costs (5%, 10 Years)					\$ 2,896,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (20% of Hydraulic Extraction)					\$ 1,232,000
Total Capital and O&M Cost Present Worth					\$ 7,873,000

NOTES/ASSUMPTIONS

1. SVE (OS) system: Uses 6 V-SVE wells, 30-40 feet bgs screens.
2. Vapor treatment system uses thermal oxidizer, 600 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.
4. Hydraulic extraction system: Uses 24 groundwater extraction wells, 40-80 feet bgs screens with a max extraction flow rate of 24 gpm.
5. Water is treated by oil-water separator (OWS), APT's HiPOx (H2O2+Ozone) system and air stripping with discharge to storm drain.
6. Liquid phase carbon is used as a backup or polishing treatment process. Assumes 2 carbon changeouts per month.
7. Assume hydraulic extraction operation for 10 years.
8. Vapor phase carbon is used after SVE operation is completed to treat air stripper discharge. Assumes 1 carbon changeout/month.
9. Groundwater is extracted from UBF/MBF and some wells are expected to go dry.

TABLE E.1-4
SOURCE AREA 12 - REMEDIAL ALTERNATIVE 5
IN-SITU CHEMICAL OXIDATION AND SVE COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 263,000	\$ 263,000
2	Mobilization/Demobilization	22,500	sf	\$ 1.5	\$ 34,000
3	Electrical Service/Hookup/Utilities	1	ls	\$ 40,000	\$ 40,000
4	Site Preparation/Geophysical survey	22,500	sf	\$ 0.8	\$ 18,000
5	Chemical Injection Well Points	300	ea	\$ 4,200	\$ 1,260,000
6	Vapor Extraction Interior Wells (outdoor)	23	ea	\$ 6,000	\$ 138,000
7	Vapor Extraction Sentry Wells (outdoor)	4	ea	\$ 6,000	\$ 24,000
8	Temperature Monitoring Well Points (outdoor)	5	ea	\$ 10,000	\$ 50,000
9	Well Headworks/Vault (24" traffic rated)	107	ea	\$ 3,000	\$ 321,000
10	Treatment System Installation and Startup (ChemOx + SVE)	1	ls	\$ 100,000	\$ 100,000
11	Misc. Treatment Sys Equipment: tanks, piping	1	ls	\$ 50,000	\$ 50,000
12	SVE Equipment : 500 CFM Blower+ThermOx	1	ls	\$ 80,000	\$ 80,000
13	Chemicals: H2O2, Fentons/Acids, Misc. (First event, all wells)	75	wells	\$ 10,000	\$ 750,000
14	Control and Instrumentation	1	ls	\$ 17,000	\$ 17,000
15	Trenching, Piping, Backfill and Resurfacing	1,000	lf	\$ 50	\$ 50,000
16	Equipment Pad/Enclosure/Fence	1	ea	\$ 40,000	\$ 40,000
17	Post Treatment Sampling + Analysis	9	borings	\$ 5,000	\$ 45,000
Direct Capital Total					\$ 3,280,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	8%	of	\$ 3,280,000	\$ 263,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 3,280,000	\$ 164,000
3	Construction Management	6%	of	\$ 3,280,000	\$ 197,000
Indirect Capital Subtotal					\$ 624,000
Total Direct + Indirect Capital Cost					\$ 3,904,000
Item No.	Operation and Maintenance Cost				
1	Fuel: Natural Gas (Thermal oxidizer)	12	mths	\$ 9,000	\$ 108,000
2	Electricity: (SVE Blower and misc elec equip)	12	mths	\$ 3,200	\$ 38,400
3	SVE System Operation and Monitoring Labor	12	units	\$ 8,000	\$ 96,000
4	SVE Maintenance Materials and Expenses	12	mths	\$ 3,000	\$ 36,000
5	ISCO Fentons Chemicals: H2O2, Acids, Iron (refer to notes 5, 6)	75	wells	\$ 10,000	\$ 750,000
6	ISCO Vendor Labor+Equipment rental	12	units	\$ 10,000	\$ 120,000
7	ISCO Consultant Oversight	12	mths	\$ 5,000	\$ 60,000
8	SVE Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 4,000	\$ 48,000
9	ISCO Soil and Groundwater Monitoring/Sampling Analytical Lab Costs (semi annually)	2	rounds	\$ 50,000	\$ 100,000
10	Project Management/Consultant support/Reports	12	mths	\$ 10,000	\$ 120,000
11	Waste/Water Disposal	12	mths	\$ 5,000	\$ 60,000
12	H&S/Air Monitoring	1	ls	\$ 8,000	\$ 8,000
13	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 8,000	\$ 96,000
SVE Annual Operation and Maintenance Subtotal					\$ 502,000
SVE Present Worth of Operation and Maintenance Costs (5%, 4 Years)					\$ 1,781,000
ISCO Annual Operation and Maintenance Subtotal					\$ 1,139,000
Present Worth of ISCO Operation and Maintenance Costs (5%, 2 Years)					\$ 2,118,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (40% of ISCO)					\$ 3,122,000
Total Capital and O&M Cost Present Worth					\$ 11,406,000

NOTES/ASSUMPTIONS

1. Assume 23 SVE wells with dual screens 15-30 and 30-40 feet bgs and 4 SVE sentry wells with 15-30 feet bgs screens.
2. Vapor treatment system uses thermal oxidizer, 500 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.
4. ISCO uses 75 direct push injection wells, each well a cluster of four 3/4"-SS injection points screened at 4 depths between 40-80 feet bgs.
5. Assume acidified Fenton's process, injection of 5,000 gal of oxidant mixture (20% H2O2, acids)/well per cycle for total of 1,125,000 gal.
6. Assume ISCO operation for 2 years with one initial injection in all wells and 2 subsequent injections per year in 50% of injection wells.

TABLE E.1-5
SOURCE AREA 12 - REMEDIAL ALTERNATIVE 6
IN-SITU SOIL HEATING AND SVE COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

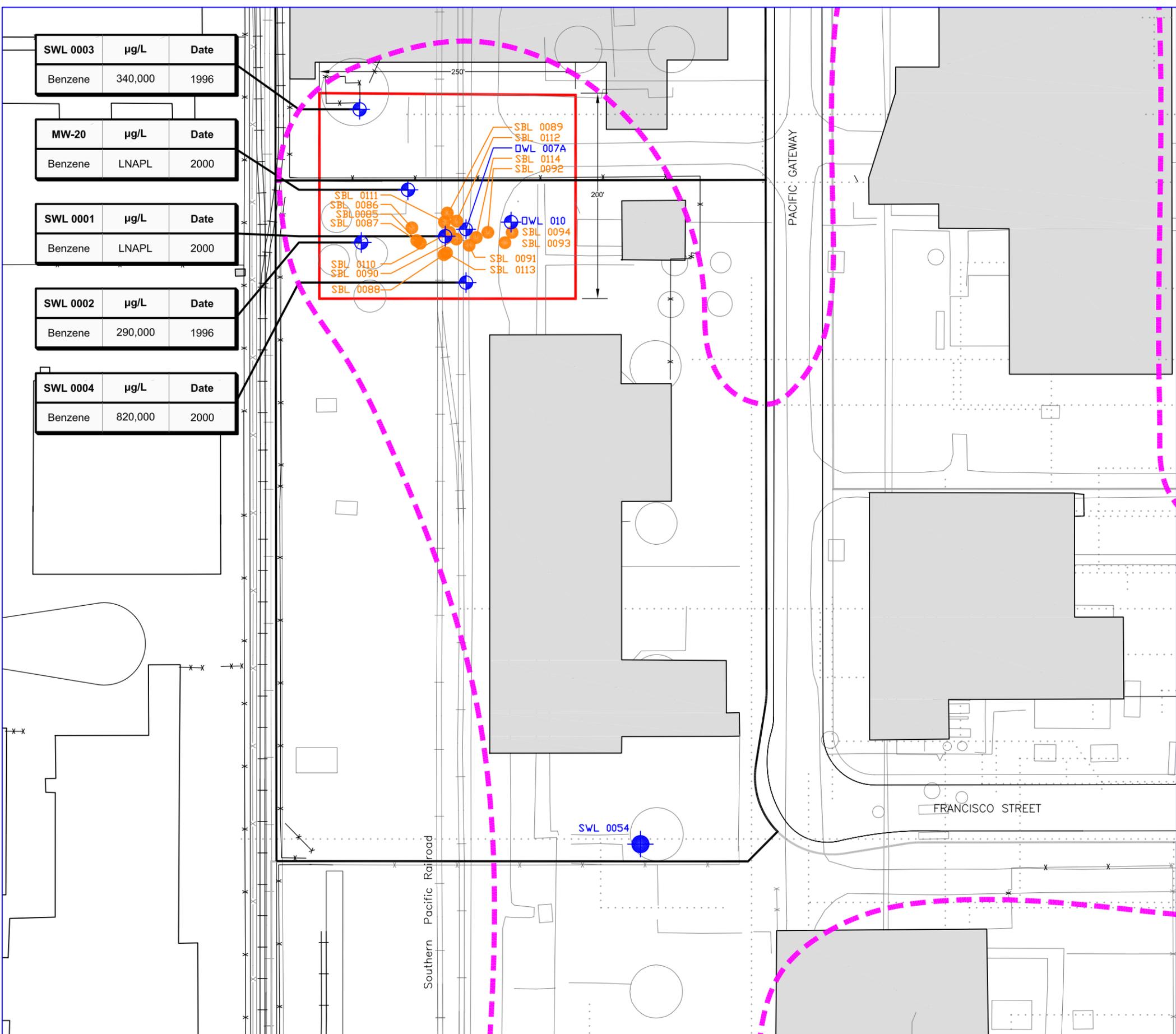
Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 263,000	\$ 263,000
2	Mobilization/Demobilization	22,500	sf	\$ 1.5	\$ 34,000
3	Electrical Service/ hookup 12kV, 60A, 3Φ	1	ls	\$ 50,000	\$ 50,000
4	Site Preparation/Geophysical	22,500	sf	\$ 0.8	\$ 18,000
5	Transformer/Power Control Unit	1	ls	\$ 120,000	\$ 120,000
6	Electrode/Vapor Extraction Wells	53	ea	\$ 12,500	\$ 662,500
7	Vapor Extraction Wells - Sentry	4	ea	\$ 6,000	\$ 24,000
8	Monitoring Wells	15	ea	\$ 10,000	\$ 150,000
9	Temperature Monitoring Points/Thermocouples	12	ea	\$ 10,000	\$ 120,000
10	Well Headworks/Vault (24" traffic rated)	84	ea	\$ 3,000	\$ 252,000
11	Treatment System Installation and Startup (Vapor and Liquid)	1	ls	\$ 160,000	\$ 160,000
12	High Vac Blower + Thermal Oxidizer; 1,500 cfm	1	unit	\$ 130,000	\$ 130,000
13	Control and Instrumentation	1	ls	\$ 79,000	\$ 79,000
14	Condensate Water Treatment System, 20 gpm (HiPOx, LPGAC)	1	ls	\$ 475,000	\$ 475,000
15	Trenching, Piping, Cables, Backfill and Resurfacing	1,800	lf	\$ 50	\$ 90,000
16	Equipment Pad/Enclosure/Fence/Berms/Trailer	1	ea	\$ 50,000	\$ 50,000
17	PreTreatment Sampling+Analysis (Sampling during well installation)	1	ls	\$ 150,000	\$ 150,000
18	Post Treatment Sampling + Analysis	9	borings	\$ 5,000	\$ 45,000
Direct Capital Total					\$ 2,873,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	8%	of	\$ 2,873,000	\$ 230,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 2,873,000	\$ 144,000
3	Construction Management	6%	of	\$ 2,873,000	\$ 173,000
Indirect Capital Subtotal					\$ 547,000
Total Direct + Indirect Capital Cost					\$ 3,420,000
Item No.	Operation and Maintenance Cost				
1	Electricity - ERH for soil heating	12	units	\$ 84,635	\$ 1,016,000
2	Electricity - SVE, HiPOx and misc elec equip	12	units	\$ 13,500	\$ 162,000
3	Operations & Maintenance	12	mths	\$ 25,000	\$ 300,000
4	Fuel: Natural Gas (Thermal Oxidizer)	12	mths	\$ 21,000	\$ 252,000
5	Liquid Phase Carbon	12	mths	\$ 2,000	\$ 24,000
6	Chemicals for water treatment (HiPOx) : H2O2	12	mths	\$ 3,550	\$ 42,600
7	Labor - Groundwater/Vapor Treatment System Influent/Effluent Monitoring	12	mths	\$ 12,000	\$ 144,000
8	Project Management/Consultant Support/Reports	12	mths	\$ 12,000	\$ 144,000
9	Waste/NAPL/Water Disposal	12	mths	\$ 6,000	\$ 72,000
10	Health & Safety/Air Monitoring	12	mths	\$ 8,000	\$ 96,000
11	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 12,000	\$ 144,000
SVE + ERH Annual Operation and Maintenance Subtotal					\$ 2,397,000
Present Worth of SVE Operation and Maintenance Costs (5%, 2 Years)					\$ 4,458,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (40% of ERH)					\$ 3,152,000
Total Capital and O&M Cost Present Worth					\$ 11,511,000

NOTES/ASSUMPTIONS

1. Assume 53 electrode SVE wells with dual conductive interval 25-45 and 50-80 ft bgs, dual-completed SVE with 15-30 and 30-40 ft bgs screens.
2. Assume 4 SVE sentry wells with 15-30 feet bgs screens.
3. Vapor treatment system uses thermal oxidizer, 1500 scfm, positive displacement (PD) blower.
4. Condensate treatment system designed to treat 20 gpm using APT's HiPOx (H2O2+O3) system and LPGAC with discharge to storm drain.
5. Assume ERH+SVE operation for 2 years.
6. Assume average power usage of 564,000 KWhr/month and total electrical energy of 13.5 million KWhr for soil heating.
7. Assume system heating time on average of 50% of days in year.
8. Power conditioning unit (transformer) assumed to be rented.

SOURCE AREA 3

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SWL 0003	µg/L	Date
Benzene	340,000	1996

MW-20	µg/L	Date
Benzene	LNAPL	2000

SWL 0001	µg/L	Date
Benzene	LNAPL	2000

SWL 0002	µg/L	Date
Benzene	290,000	1996

SWL 0004	µg/L	Date
Benzene	820,000	2000

Legend

- Assumed extent of NAPL source area based on:
 1. Visible LNAPL accumulations occur within one or more water table monitoring wells or temporary well points, or
 2. Laboratory measurements of hydrocarbon saturation (Dean Stark testing)
 3. Jar testing data
- Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
- Approximate location of former underground pipelines with a potential to have transported VOC-containing fluids
- Parcel boundary
- Outlines of historical features with use/contents indicated
- Soil boring location with hydrocarbon saturation/jar testing data (MW-20 Pilot Program Summary Report, Oct 15, 2003)
- ⊕ Monitoring well location in water table zone with contaminant concentration and date of sample
- ⊕ Monitoring well location in Middle Bellflower C-sand zone.

Area shown in this map

N

Scale in Feet

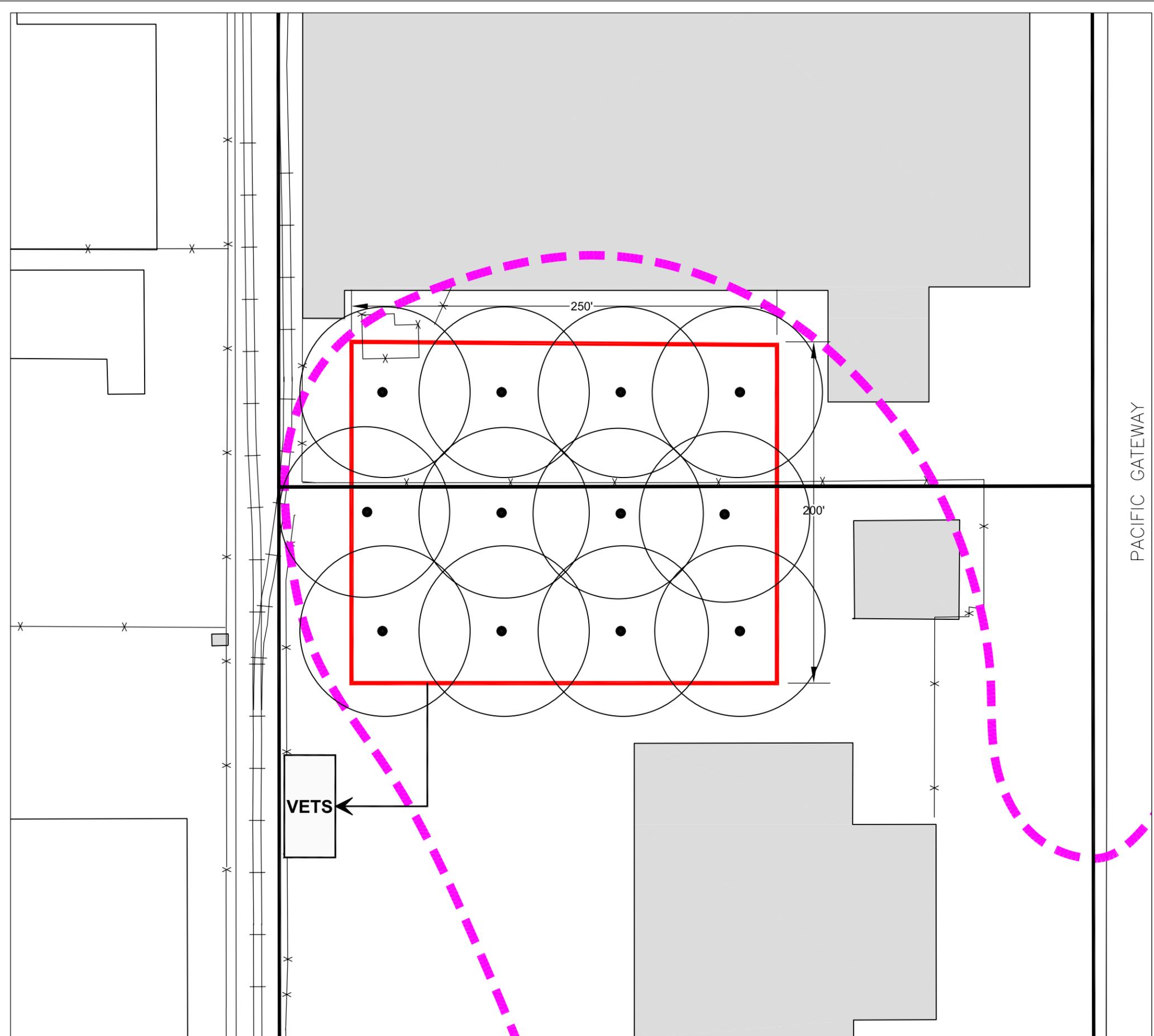
FIGURE 7.3-1

ASSUMED EXTENT OF NAPL CONTAMINATION

Parcel Nos. 7351-034-056 and 7351-034-057

Source Area 3
Del Amo Soil + NAPL FS

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Legend



Assumed extent of NAPL source area based on:

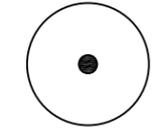
1. Visible LNAPL accumulations occur within one or more water table monitoring wells or temporary well points, or
2. Laboratory measurements of hydrocarbon saturation (Dean Stark testing)



Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)



Parcel boundary



SVE/BV vertical well (70-foot spacing), circle denotes assumed 50-foot radius of influence



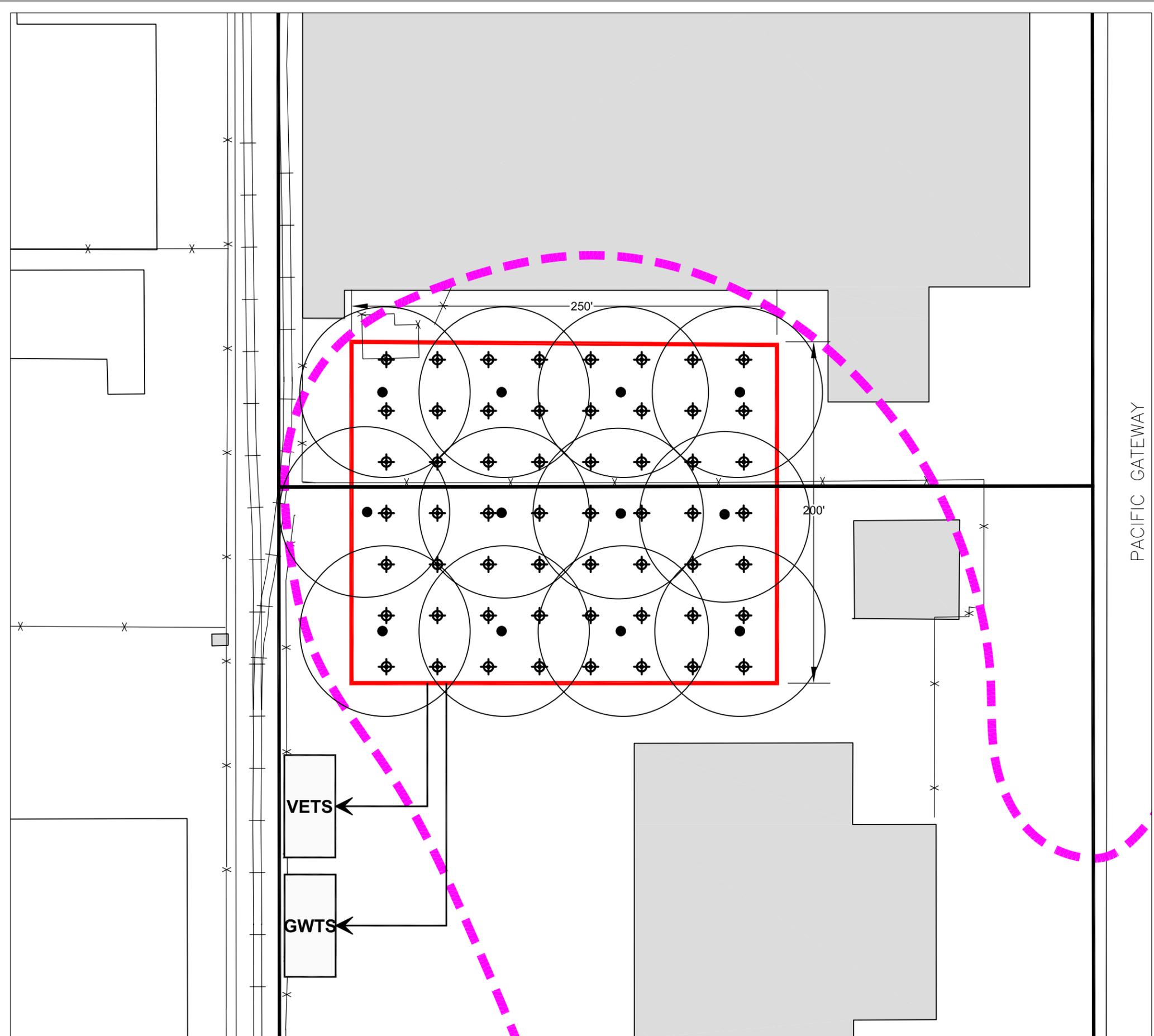
Vapor Extraction Treatment System



FIGURE 7.3-2
Alternative 3
SOIL VAPOR EXTRACTION/BIOVENTING,
ICS AND MONITORING
Parcel Nos. 7351-034-056 and 7351-034-057
 Source Area 3
 Del Amo Soil + NAPL FS



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Legend

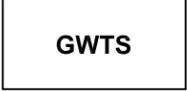
-  Assumed extent of NAPL source area based on:
 1. Visible LNAPL accumulations occur within one or more water table monitoring wells or temporary well points, or
 2. Laboratory measurements of hydrocarbon saturation (Dean Stark testing)
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  Groundwater Extraction Well (30-foot spacing)
-  SVE/BV vertical well (approximate 70-foot spacing)
-  VETS
Vapor Extraction Treatment System
-  GWTS
Groundwater Treatment System

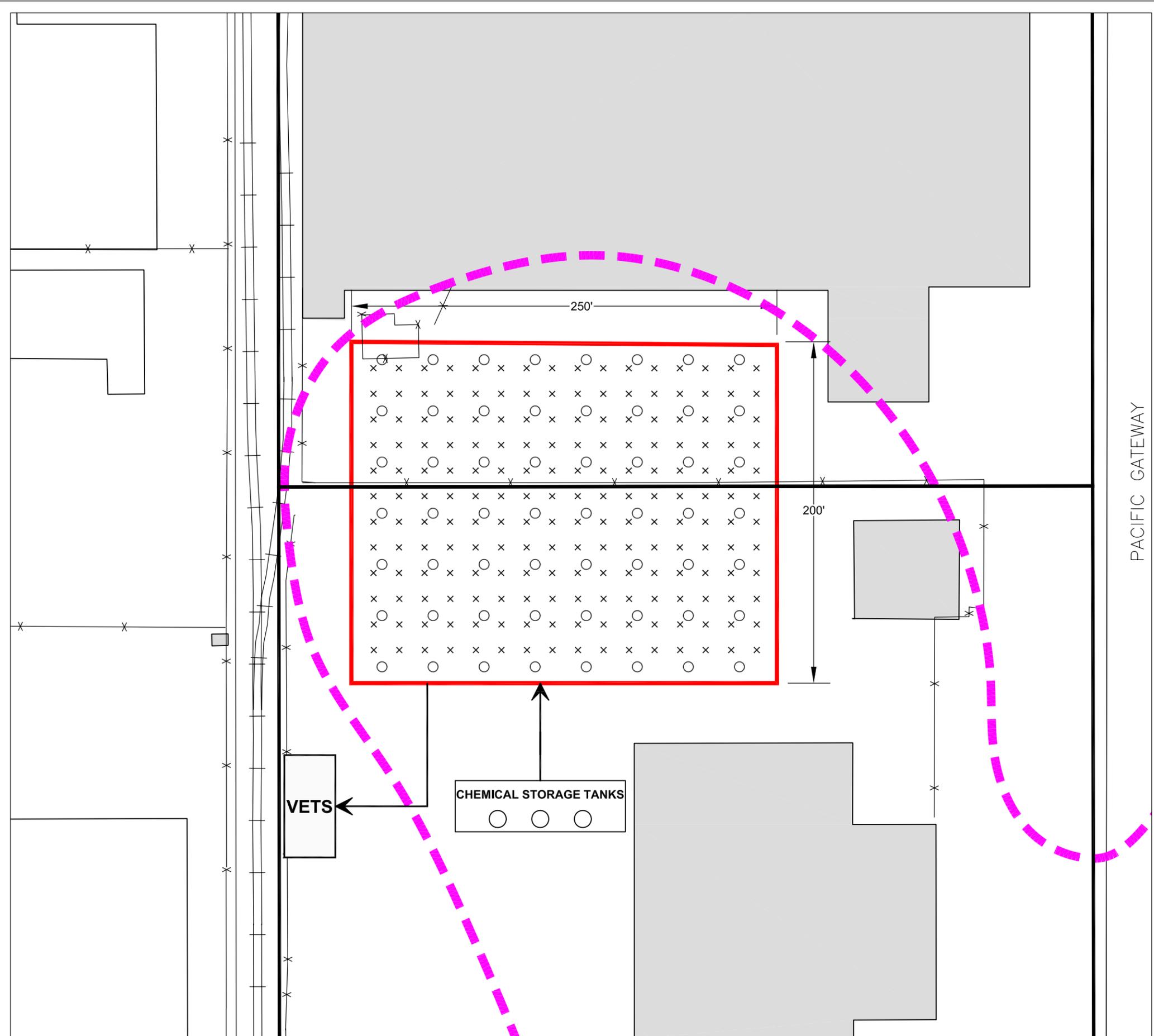


FIGURE 7.3-3

Alternative 4
HYDRAULIC EXTRACTION, SVE/BV,
ICS AND MONITORING
 Parcels Nos. 7351-034-056 and 7351-034-057
 Source Area 3
 Del Amo Soil + NAPL FS



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Legend

- Assumed extent of NAPL source area based on:
 1. Visible LNAPL accumulations occur within one or more water table monitoring wells or temporary well points, or
 2. Laboratory measurements of hydrocarbon saturation (Dean Stark testing)
- Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
- Parcel boundary
- ISCO injection well (15-foot spacing)
- SVE interior well, dual screen (30-foot spacing)
- VETS Vapor Extraction Treatment System

Notes:

- (1) Temperature monitoring points are not shown on the figure. These points would typically be distributed throughout the source area at a 50-75 foot spacing.
- (2) SVE radius of influence circles are not shown for each well due to the large number of closely spaced wells in the figure.

PACIFIC GATEWAY

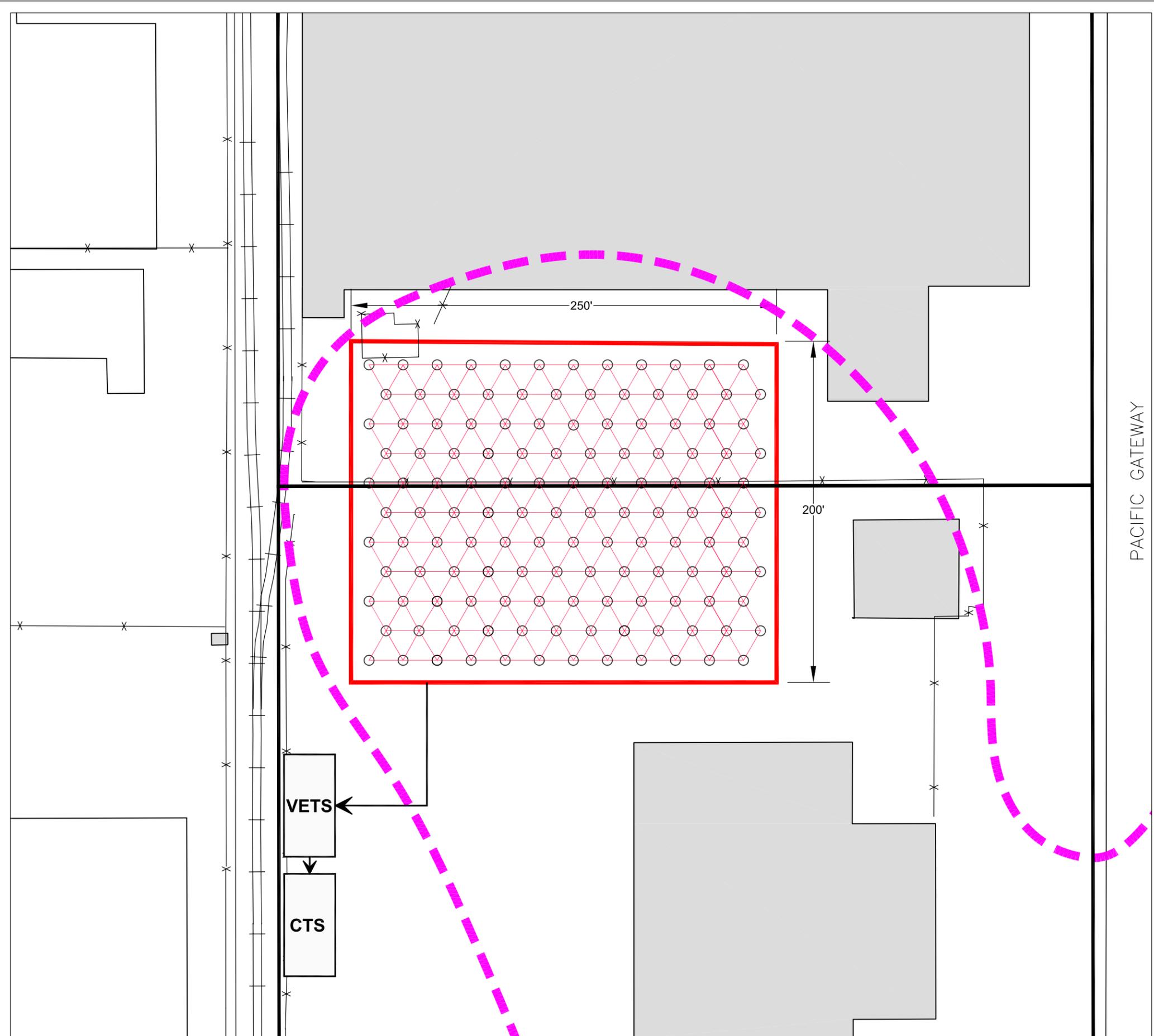


FIGURE 7.3-4

Alternative 5
IN-SITU CHEMICAL OXIDATION, SVE,
ICS AND MONITORING
 Parcels Nos. 7351-034-056 and 7351-034-057
 Source Area 3
 Del Amo Soil + NAPL FS



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Legend



Assumed extent of NAPL source area based on:

1. Visible LNAPL accumulations occur within one or more water table monitoring wells or temporary well points, or
2. Laboratory measurements of hydrocarbon saturation (Dean Stark testing)



Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)



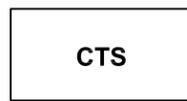
Parcel boundary



ERH electrode and SVE interior well, dual screen (20-foot spacing)



VETS
Vapor Extraction Treatment System



CTS
Condensate Treatment System

Notes:

- (1) Temperature monitoring points are not shown on the figure. These points would typically be distributed throughout the source area at a 50-75 foot spacing.
- (2) SVE radius of influence circles are not shown for each well due to the large number of closely spaced wells in the figure.



Scale in Feet

FIGURE 7.3-5

Alternative 6
IN-SITU SOIL HEATING, SVE,
ICS AND MONITORING
Parcels Nos. 7351-034-056 and 7351-034-057

TABLE E.2-1
SOURCE AREA 3 - REMEDIAL ALTERNATIVE 2
ICs + MONITORING COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	ICs Design, Documentation, Implementation	1	ls	\$ 34,110	\$ 34,110
Direct Capital Total					\$ 34,000
Item No.	Indirect Capital Costs				
1	Project Management	10%	of	\$ 34,000	\$ 3,400
Indirect Capital Subtotal					\$ 3,400
Total Direct + Indirect Capital Cost					\$ 37,400
Item No.	Operation and Maintenance Costs				
1	Institutional Controls, Inspections, Monitoring	1	year	\$ 3,275	\$ 3,275
2	Groundwater Monitoring	1	year	\$ 15,000	\$ 15,000
ICs Annual Operation and Maintenance Subtotal					\$ 18,275
Present Worth of ICs Operation and Maintenance Costs (5%, 100 Years)					\$ 363,000
Contingency (20% of total project cost)					\$ 80,000
Total Capital and ICs O&M Cost					\$ 481,000

NOTES/ASSUMPTIONS

1. ICs include IC layers 1, 2, 3, 4A and 5.
2. ICs capital and O&M costs are estimated based on applicable IC layers per parcel as shown in Tables D3-1 and D3-2.

TABLE E.2-2
SOURCE AREA 3 - REMEDIAL ALTERNATIVE 3
SVE/BV COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 220,000	\$ 220,000
2	Mobilization/Demobilization	50,000	sf	\$ 1.25	\$ 63,000
3	Electrical Service/ hookup/Utilities	1	ls	\$ 30,000	\$ 30,000
4	Site Preparation/Geophysical	50,000	sf	\$ 0.8	\$ 40,000
5	SVE Wells	12	ea	\$ 5,500	\$ 66,000
6	Well Headworks/Vault (24" traffic rated)	12	ea	\$ 3,000	\$ 36,000
7	VETS Installation and Startup	1	ls	\$ 100,000	\$ 100,000
8	SVE Blower + Thermal Oxidizer; 600 cfm	1	ls	\$ 90,000	\$ 90,000
9	Controls and Instrumentation	1	ls	\$ 7,000	\$ 7,000
10	Misc Treat System: Tanks, Piping, Pumps, Fittings	1	ls	\$ 25,000	\$ 25,000
11	Trenching, Piping, Backfill and Resurfacing	1,000	lf	\$ 30	\$ 30,000
12	Equipment Pad/Enclosure/Fence	1	ea	\$ 30,000	\$ 30,000
13	Post Treatment Sampling + Analysis	20	borings	\$ 5,000	\$ 100,000
Direct Capital Total					\$ 837,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	12%	of	\$ 837,000	\$ 101,000
2	Project Management, Agency Reporting/Coordination	6%	of	\$ 837,000	\$ 51,000
3	Construction Management	8%	of	\$ 837,000	\$ 67,000
Indirect Capital Subtotal					\$ 219,000
Total Direct + Indirect Capital Cost					\$ 1,056,000
Item No.	Operation and Maintenance Cost				
1	Fuel: Natural Gas (Thermal Oxidizer)	12	mths	\$ 10,000	\$ 120,000
2	Electricity: SVE blower, misc equip	12	mths	\$ 3,600	\$ 43,200
3	Operations & Maintenance	12	mths	\$ 8,000	\$ 96,000
4	Maintenance (hardware, filters, monitoring equipment)	12	mths	\$ 3,000	\$ 36,000
5	Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 6,000	\$ 72,000
6	Project Management/Consultant support/Reports	12	mths	\$ 6,000	\$ 72,000
7	Waste/NAPL/Water Disposal	12	mths	\$ 3,000	\$ 36,000
8	Health & Safety/Air Monitoring	1	ls	\$ 5,000	\$ 5,000
9	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 4,000	\$ 48,000
SVE Annual Operation and Maintenance Subtotal					\$ 529,000
SVE Present Worth of Operation and Maintenance Costs (5%, 4 Years)					\$ 1,876,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (20% of SVE)					\$ 587,000
Total Capital and O&M Cost Present Worth					\$ 4,000,000

NOTES/ASSUMPTIONS

1. SVE (OS) system: Uses 12 V-SVE wells, 30-50 feet bgs screens.
2. Vapor treatment system uses thermal oxidizer, 600 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.

TABLE E-2-3
SOURCE AREA 3 - REMEDIAL ALTERNATIVE 4
HYDRAULIC EXTRACTION AND SVE/BV COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 220,000	\$ 220,000
2	Mobilization/Demobilization	50,000	sf	\$ 1.25	\$ 63,000
3	Electrical Service/ hookup	1	ls	\$ 40,000	\$ 40,000
4	Site Preparation/Geophysical	50,000	sf	\$ 0.8	\$ 40,000
5	SVE Vertical Wells	12	ea	\$ 6,000	\$ 72,000
6	Groundwater Extraction Wells	56	ea	\$ 9,500	\$ 532,000
7	Well Headworks/Vault/Extraction Pumps (24" traffic rated)	68	ea	\$ 3,000	\$ 204,000
8	Treatment System Installation and Startup (SVE + Hyd Ext)	1	ls	\$ 150,000	\$ 150,000
9	SVE Blower + Thermal Oxidizer; 1,500 cfm	1	ls	\$ 130,000	\$ 130,000
10	Control and Instrumentation	1	ls	\$ 47,000	\$ 47,000
11	Advanced Oxidation Treatment system (56 gpm) (HiPOx)	1	ls	\$ 555,000	\$ 555,000
12	Air Stripping Unit+Blower (STAT 180)	1	ls	\$ 30,000	\$ 30,000
13	Carbon Adsorption Vessels - VPGAC and LPGAC	4	ls	\$ 10,000	\$ 40,000
14	Misc Treat System: OWS, Tanks, Piping, Pumps	1	ls	\$ 60,000	\$ 60,000
15	Trenching, Piping, Cables, Backfill and Resurfacing	2,500	lf	\$ 30	\$ 75,000
16	Equipment Pad/Enclosure/Fence	1	ea	\$ 50,000	\$ 50,000
17	Post Treatment Sampling + Analysis	20	borings	\$ 5,000	\$ 100,000
Direct Capital Total					\$ 2,408,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	8%	of	\$ 2,408,000	\$ 193,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 2,408,000	\$ 121,000
3	Construction Management	6%	of	\$ 2,408,000	\$ 145,000
Indirect Capital Subtotal					\$ 459,000
Total Direct+Indirect Cost					\$ 2,867,000
Item No.	Operation and Maintenance Cost				
1	Fuel:Natural Gas (Thermal oxidizer)	12	mths	\$ 21,000	\$ 252,000
2	Electricity (SVE blower, HiPOx, Air Stripper blower)	12	mths	\$ 21,400	\$ 256,800
3	Operations & Maintenance	12	mths	\$ 12,000	\$ 144,000
4	Chemicals for HiPOx: H2O2	12	mths	\$ 6,600	\$ 79,200
5	Carbon - Liquid Phase	12	mths	\$ 2,000	\$ 24,000
6	Carbon - Vapor Phase (post-thermal/catox)	12	mths	\$ 4,000	\$ 48,000
7	Groundwater/Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 12,000	\$ 144,000
8	Project Management/Consultant support/Reports	12	mths	\$ 8,000	\$ 96,000
9	Waste/NAPL/Water Disposal	12	mths	\$ 5,000	\$ 60,000
10	Health & Safety/Air Monitoring	1	ls	\$ 8,000	\$ 8,000
11	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 10,000	\$ 120,000
SVE Annual Operation and Maintenance Subtotal					\$ 675,000
Present Worth of SVE Operation and Maintenance Costs (5%, 4 Years)					\$ 2,394,000
Hydraulic Extraction Annual Operation and Maintenance Subtotal					\$ 558,000
Present Worth of Hydraulic Extraction Operation and Maintenance Costs (5%, 10 Years)					\$ 4,309,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (20% of Hydraulic Extraction)					\$ 1,914,000
Total Capital and O&M Cost Present Worth					\$ 11,965,000

NOTES/ASSUMPTIONS

1. SVE (OS) system: Uses 12 V-SVE wells, 30-50 feet bgs screens.
2. Vapor treatment system uses thermal oxidizer, 1,500 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.
4. Hydraulic extraction system: Uses 56 groundwater extraction wells, 50-90 feet bgs screens with a max extraction flow rate of 56 gpm.
5. Water is treated by oil-water separator (OWS), APT's HiPOx (H2O2+Ozone) system and air stripping with discharge to storm drain.
6. Liquid phase carbon is used as a backup or polishing treatment process. Assumes 2 carbon changeouts per month.
7. Assume hydraulic extraction operation for 10 years.
8. Vapor phase carbon is used after SVE operation is completed to treat air stripper discharge. Assumes 1 carbon changeout/month.
9. Groundwater is extracted from UBF/MBF and some wells are expected to go dry.

TABLE E.2-4
SOURCE AREA 3 - REMEDIAL ALTERNATIVE 5
IN-SITU CHEMICAL OXIDATION AND SVE COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 535,000	\$ 535,000
2	Mobilization/Demobilization	50,000	sf	\$ 1.5	\$ 75,000
3	Electrical Service/Hookup	1	ls	\$ 40,000	\$ 40,000
4	Site Preparation/Geophysical survey	50,000	sf	\$ 0.8	\$ 40,000
5	Chemical Injection Points/Wells	768	ea	\$ 4,200	\$ 3,225,600
6	Vapor Extraction Interior Wells (outdoor)	56	ea	\$ 6,500	\$ 364,000
7	Vapor Extraction Sentry Wells (outdoor)	0	ea	\$ 6,500	\$ -
8	Temperature Monitoring Points/Wells (outdoor)	10	ea	\$ 10,000	\$ 100,000
9	Well Headworks/Vault (24" traffic rated)	258	ea	\$ 3,000	\$ 774,000
10	Treatment System Installation and Startup (ChemOx + SVE)	1	ls	\$ 200,000	\$ 200,000
11	Misc. Treatment Sys Equipment: tanks, piping	1	ls	\$ 100,000	\$ 100,000
12	SVE Equipment : 1,500 CFM Blower+ThermOx	1	ls	\$ 130,000	\$ 130,000
13	Chemicals: H2O2, Fentons/Acids, Misc. (First event, all wells)	192	wells	\$ 10,000	\$ 1,920,000
14	Control and Instrumentation	1	ls	\$ 30,000	\$ 30,000
15	Trenching, Piping, Backfill and Resurfacing	2,400	lf	\$ 50	\$ 120,000
16	Equipment Pad/Enclosure/Fence	1	ea	\$ 40,000	\$ 40,000
17	Post Treatment Sampling + Analysis	20	borings	\$ 5,000	\$ 100,000
				Direct Capital Total	\$ 7,794,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	8%	of	\$ 7,794,000	\$ 624,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 7,794,000	\$ 390,000
3	Construction Management	6%	of	\$ 7,794,000	\$ 468,000
				Indirect Capital Subtotal	\$ 1,482,000
				Total Direct + Indirect Capital Cost	\$ 9,276,000
Item No.	Operation and Maintenance Cost				
1	Fuel: Natural Gas (Thermal oxidizer)	12	mths	\$ 21,000	\$ 252,000
2	Electricity: (SVE Blower and misc elec equip)	12	mths	\$ 7,900	\$ 94,800
3	SVE System Operation and Monitoring Labor	12	units	\$ 8,000	\$ 96,000
4	SVE Maintenance Materials and Expenses	12	mths	\$ 4,000	\$ 48,000
5	ISCO Fentons Chemicals: H2O2, Acids, Iron (refer note 5, 6)	192	wells	\$ 10,000	\$ 1,920,000
6	ISCO Vendor Labor+Equipment rental	12	units	\$ 10,000	\$ 120,000
7	ISCO Consultant Oversight	12	mths	\$ 10,000	\$ 120,000
8	SVE Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 5,000	\$ 60,000
9	ISCO Soil and Groundwater Monitoring/Sampling Analytical Lab Costs (semi annually)	2	rounds	\$ 50,000	\$ 100,000
10	Project Management/Consultant support/Reports	12	mths	\$ 10,000	\$ 120,000
11	Waste Disposal	12	mths	\$ 5,000	\$ 60,000
12	H&S/Air Monitoring	1	ls	\$ 8,000	\$ 8,000
13	Miscellaneous: Equipment Rentals, PID/FID	12	mths	\$ 10,000	\$ 120,000
				SVE Annual Operation and Maintenance Subtotal	\$ 715,000
				SVE Present Worth of Operation and Maintenance Costs (5%, 4 Years)	\$ 2,536,000
				ISCO Annual Operation and Maintenance Subtotal	\$ 2,405,000
				Present Worth of ISCO Operation and Maintenance Costs (5%, 2 Years)	\$ 4,472,000
				Present Worth of ICs + Monitoring (5%, 100 Years) Costs	\$ 481,000
				Contingency (40% of ISCO)	\$ 6,514,000
				Total Capital and O&M Cost Present Worth	\$ 23,279,000

NOTES/ASSUMPTIONS

1. Assume 56 SVE wells with dual screens 15-30 and 30-50 feet bgs and no SVE sentry wells.
2. Vapor treatment system uses thermal oxidizer, 1,500 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.
4. ISCO uses 192 direct push injection wells, each well a cluster of four 3/4"-SS injection points screened at 4 depths between 50-90 feet bgs.
5. Assume acidified Fenton's process, injection of 5,000 gal of oxidants (20% H2O2, acids)/well per cycle for total injection of 2,880,000 gals.
6. Assume ISCO operation for 2 years, including one initial injection in all wells and 2 subsequent injections per year in 50% of inject. wells.

TABLE E.2-5
SOURCE AREA 3 - REMEDIAL ALTERNATIVE 6
IN-SITU SOIL HEATING AND SVE COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

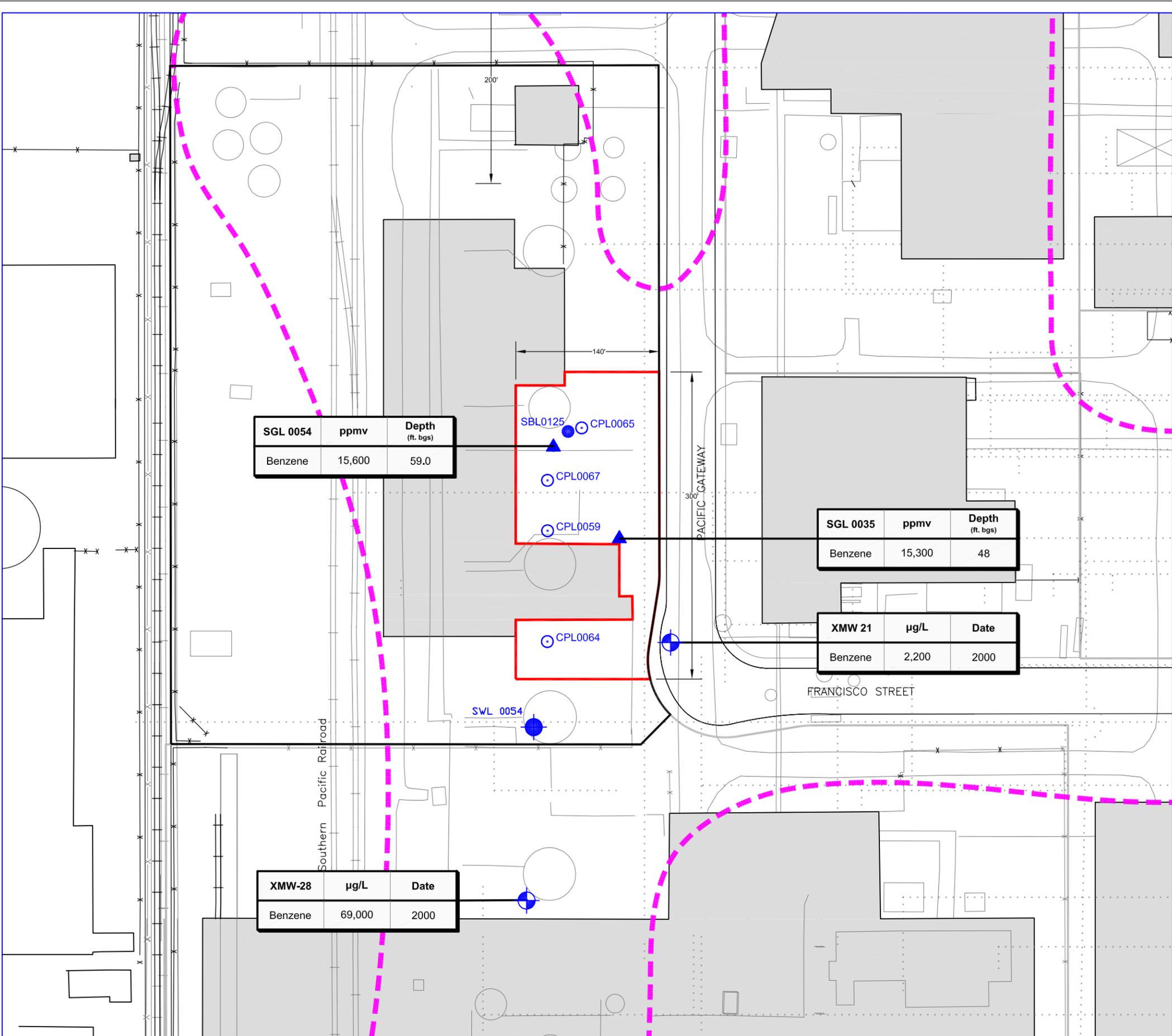
	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 535,000	\$ 535,000
2	Mobilization/Demobilization	50,000	sf	\$ 1.5	\$ 75,000
3	Electrical Service/ hookup 12kV, 60A, 3Φ	2	ls	\$ 50,000	\$ 100,000
4	Site Preparation/Geophysical	50,000	sf	\$ 0.8	\$ 40,000
5	Transformers/Power Controls	2	ls	\$ 120,000	\$ 240,000
6	Electrode/Vapor Extraction Wells	132	ea	\$ 13,000	\$ 1,716,000
7	Vapor Extraction Wells - Sentry	0	ea	\$ 6,000	\$ -
8	Monitoring Wells	20	ea	\$ 10,000	\$ 200,000
9	Temperature Monitoring Points/Thermocouples	20	ea	\$ 10,000	\$ 200,000
10	Well Headworks/Vault (24" traffic rated)	172	ea	\$ 3,000	\$ 516,000
11	Treatment System Installation and Startup (Vapor and Liquid)	1	ls	\$ 160,000	\$ 160,000
12	High Vac Blower + Thermal Oxidizer; 4,000 cfm	1	unit	\$ 300,000	\$ 300,000
13	Control and Instrumentation	1	ls	\$ 101,000	\$ 101,000
14	Condensate Water Treatment System, 20 gpm (HiPOx, LPGAC)	1	ls	\$ 475,000	\$ 475,000
15	Trenching, Piping, Cables, Backfill and Resurfacing	4,000	lf	\$ 50	\$ 200,000
16	Equipment Pad/Enclosure/Fence/Berms/Trailer	1	ea	\$ 50,000	\$ 50,000
17	PreTreatment Sampling+Analysis (Sampling during well installation)	1	ls	\$ 150,000	\$ 150,000
18	Post Treatment Sampling + Analysis	20	boring	\$ 5,000	\$ 100,000
Direct Capital Total					\$ 5,158,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	8%	of	\$ 5,158,000	\$ 413,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 5,158,000	\$ 258,000
3	Construction Management	6%	of	\$ 5,158,000	\$ 310,000
Indirect Capital Subtotal					\$ 981,000
Total Direct + Indirect Capital Cost					\$ 6,139,000
Item No.	Operation and Maintenance Cost				
1	Electricity - ERH for soil heating	12	units	\$ 217,000	\$ 2,604,000
2	Electricity - SVE, HiPOx and misc elec equip	12	units	\$ 25,400	\$ 304,800
3	Operations & Maintenance	12	mths	\$ 30,000	\$ 360,000
4	Fuel: Natural Gas (Thermal Oxidizer)	12	mths	\$ 50,000	\$ 600,000
5	Liquid Phase Carbon	12	mths	\$ 4,000	\$ 48,000
6	Chemicals for water treatment: H2O2	12	mths	\$ 3,550	\$ 42,600
7	Labor - Groundwater/Vapor Treatment System Influent/Effluent Monitoring	12	mths	\$ 15,000	\$ 180,000
8	Project Management/Consultant Support/Reports	12	mths	\$ 15,000	\$ 180,000
9	Waste/NAPL/Water Disposal	12	mths	\$ 8,000	\$ 96,000
10	Health & Safety/Air Monitoring	12	mths	\$ 10,000	\$ 120,000
11	Miscellaneous: Equipment Rentals, PID/FID	12	mths	\$ 14,000	\$ 168,000
SVE + ERH Annual Operation and Maintenance Subtotal					\$ 4,704,000
Present Worth of SVE+ERH Annual Operation and Maintenance Costs (5%, 2 Years)					\$ 8,747,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (40% of ERH)					\$ 5,955,000
Total Capital and O&M Cost Present Worth					\$ 21,322,000

NOTES/ASSUMPTIONS

1. Assume 132 electrode SVE wells with dual conductive interval 25-55 and 60-90 ft bgs, dual-completed SVE with 15-30 and 30-50 ft bgs screens.
2. No SVE sentry wells included.
3. Vapor treatment system uses thermal oxidizer, 4,000 scfm, positive displacement (PD) blower.
4. Condensate treatment system designed to treat 20 gpm using APT's HiPOx (H2O2+O3) system and LPGAC with discharge to storm drain.
5. Assume ERH+SVE operation for 2 years.
6. Assume average power usage 1,446,000 KWhr/month and total electrical energy of 34.7 million KWhr for soil heating.
7. Assume system heating time on average of 50% of days in year.
8. Power conditioning unit (transformer) assumed to be rented.

SOURCE AREA 6

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SGL 0054	ppmv	Depth (ft. bgs)
Benzene	15,600	59.0

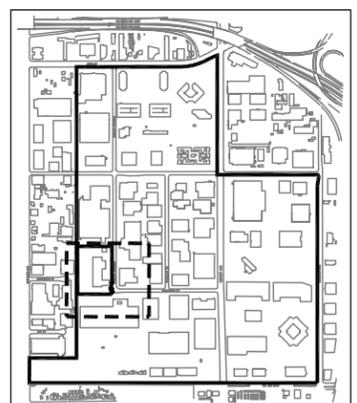
SGL 0035	ppmv	Depth (ft. bgs)
Benzene	15,300	48

XMW 21	µg/L	Date
Benzene	2,200	2000

XMW-28	µg/L	Date
Benzene	69,000	2000

Legend

- Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
- Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
- Approximate location of former underground pipelines with a potential to have transported VOC-containing fluids
- Parcel boundary
- Outlines of historical features with use/contents indicated
- ROST/CPT borings location where hydrocarbon signatures were detected (1998)
- Deep soil gas sampling point with contaminant concentrations and depth of sample
- Continuous core soil boring with observed LNAPL and hydrocarbon saturation confirmation data (1997)
- Monitoring well location in water table zone with contaminant concentration and date of sample
- Monitoring well location in Middle Bellflower C-sand zone.



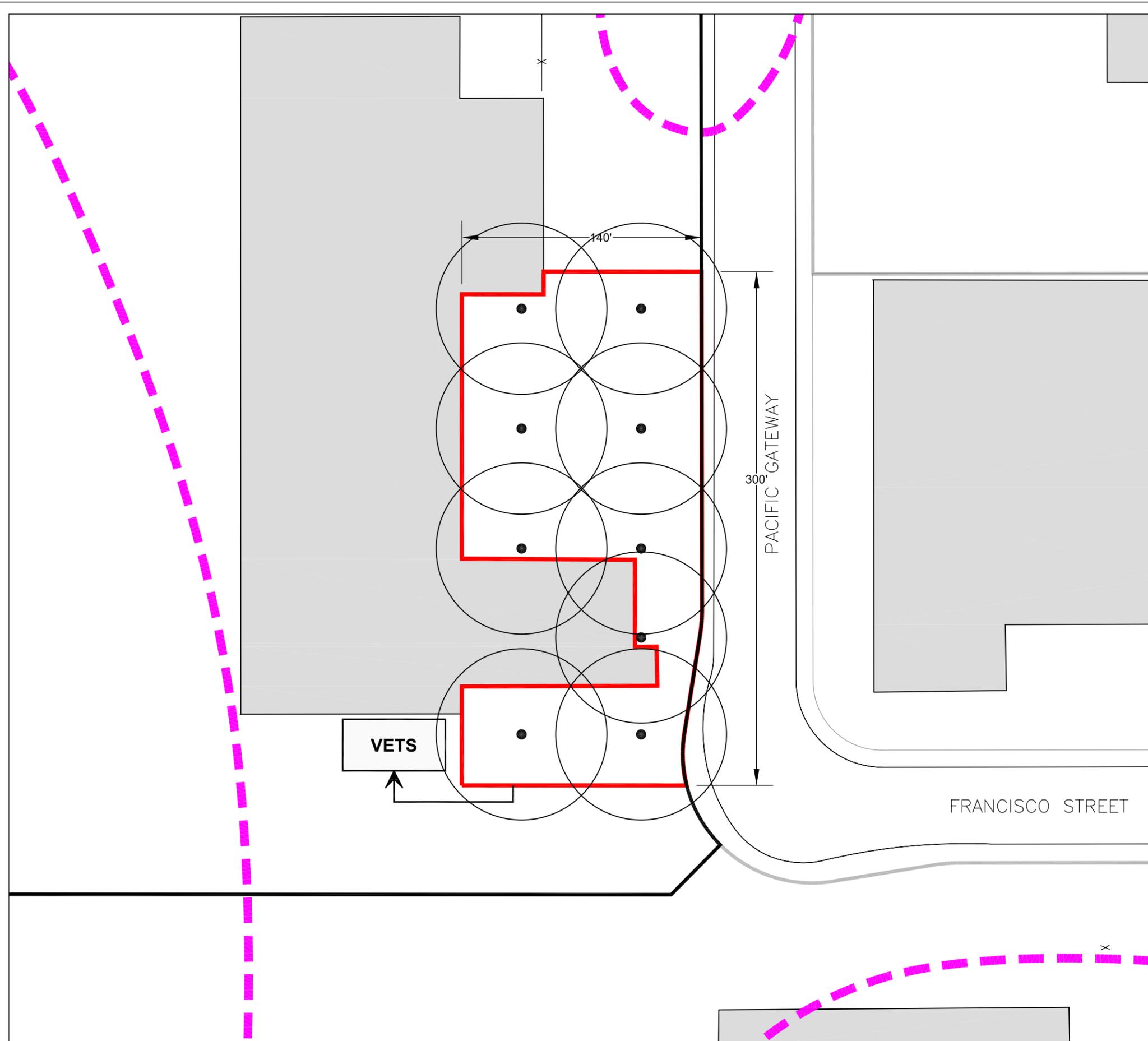
Area shown in this map



FIGURE 7.4-1
ASSUMED EXTENT OF NAPL CONTAMINATION
Parcel No. 7351-034-057

Source Area 6
 Del Amo Soil + NAPL FS

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Legend

-  Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  SVE/BV vertical well (70-foot spacing), circle denotes assumed 50-foot radius of influence
-  Vapor Extraction Treatment System

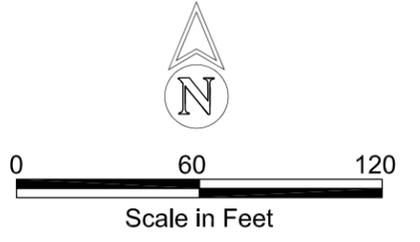


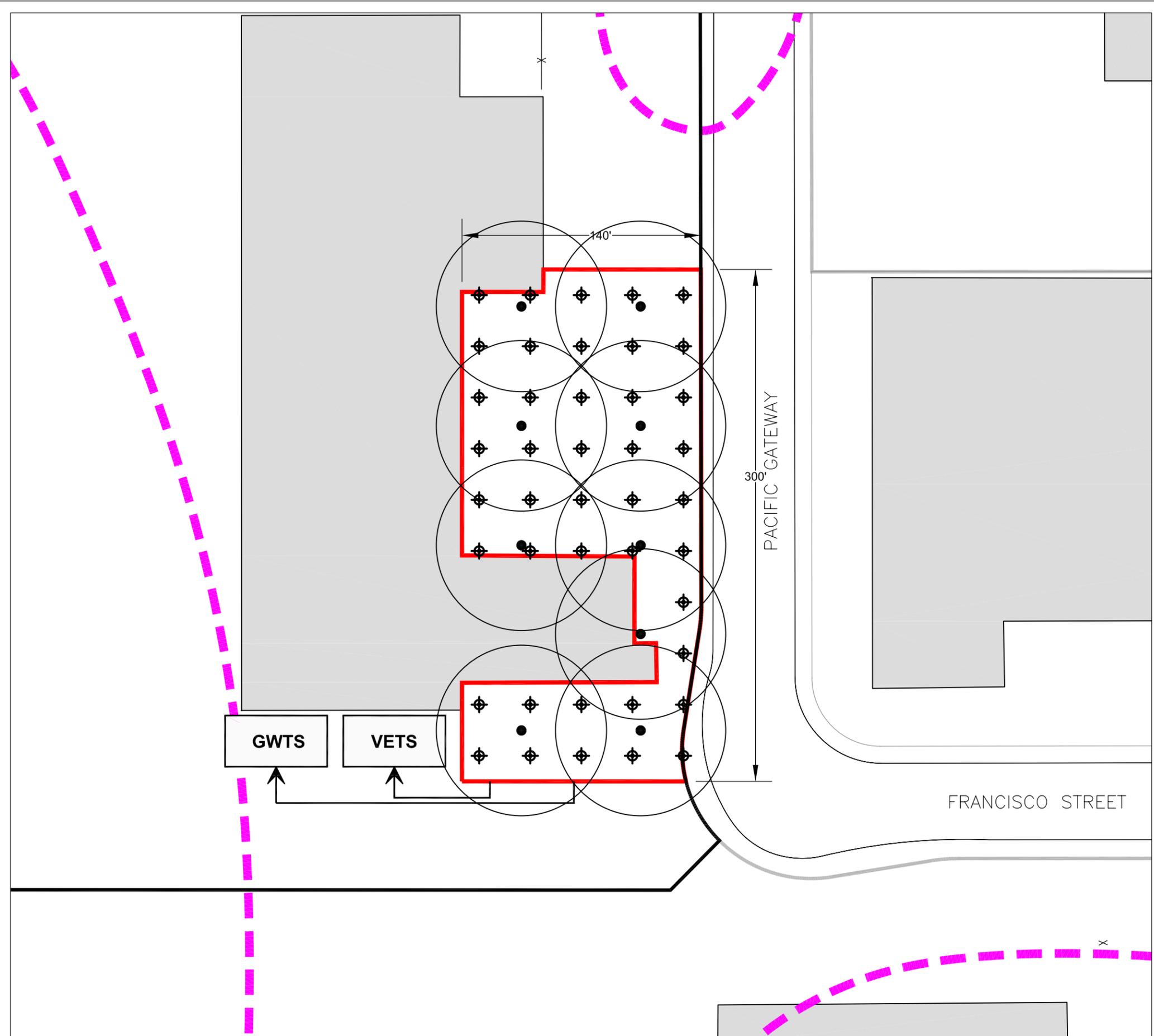
FIGURE 7.4-2

Alternative 3
SOIL VAPOR EXTRACTION/BIOVENTING,
ICS AND MONITORING
Parcel No. 7351-034-057

Source Area 6
 Del Amo Soil + NAPL FS



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Legend

-  Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  Groundwater Extraction Well (30-foot spacing)
-  SVE/BV vertical well (approximately 70-foot spacing)
-  VETS
Vapor Extraction Treatment System
-  GWTS
Groundwater Treatment System

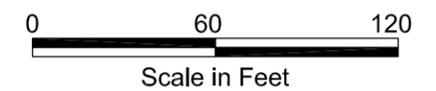
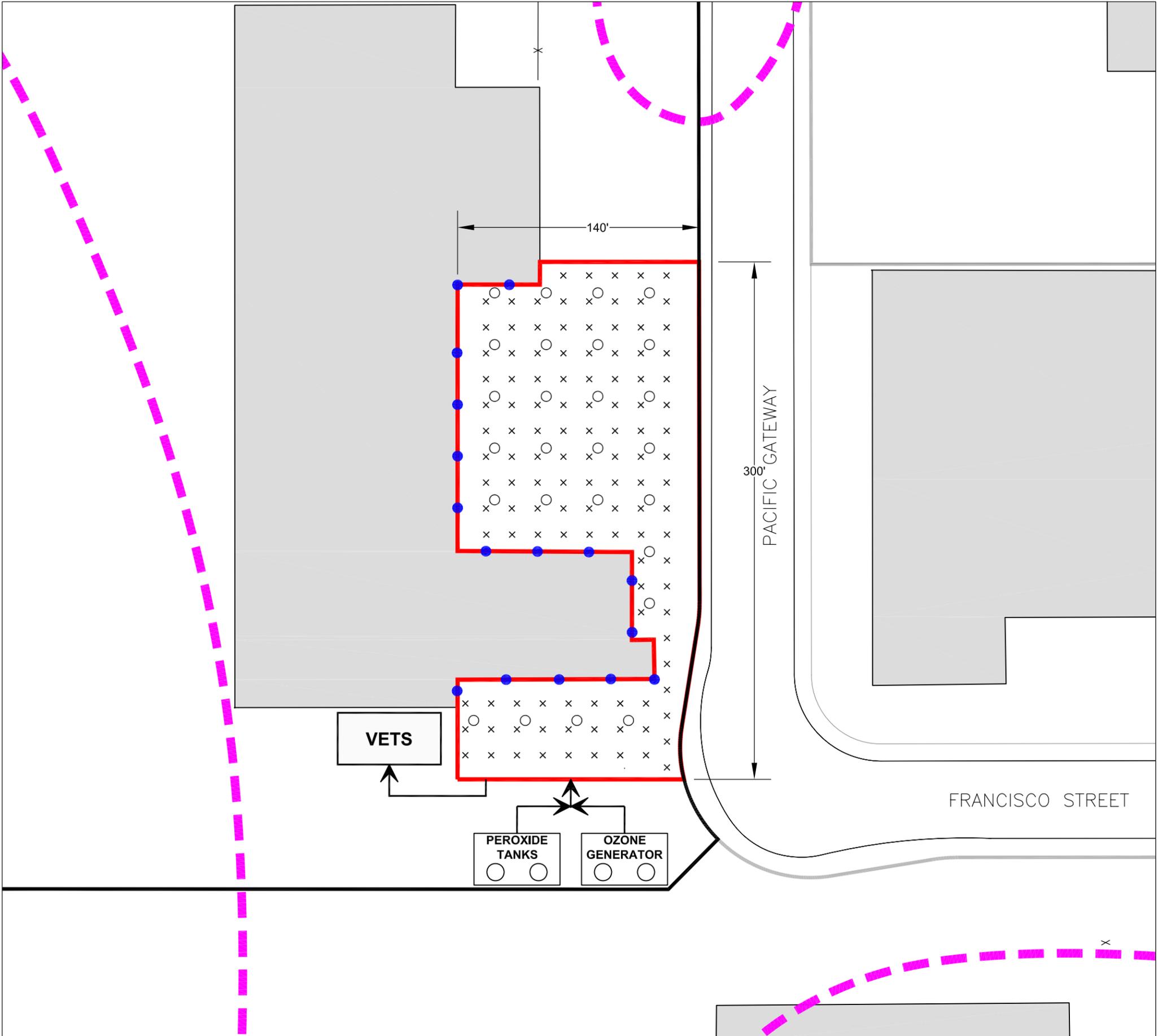


FIGURE 7.4-3
Alternative 4
HYDRAULIC EXTRACTION, SVE/BV,
ICS AND MONITORING
Parcels No. 7351-034-057

Source Area 6
 Del Amo Soil + NAPL FS



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Legend

-  Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  ISCO injection well (15-foot spacing)
-  SVE sentry well (30-foot spacing)
-  SVE interior well, dual screen (30-foot spacing)
-  VETS Vapor Extraction Treatment System

Notes:

- (1) Temperature monitoring points are not shown on the figure. These points would typically be distributed throughout the source area at a 50-75 foot spacing.
- (2) SVE radius of influence circles are not shown for each well due to the large number of closely spaced wells in the figure.

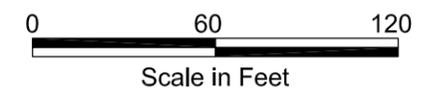
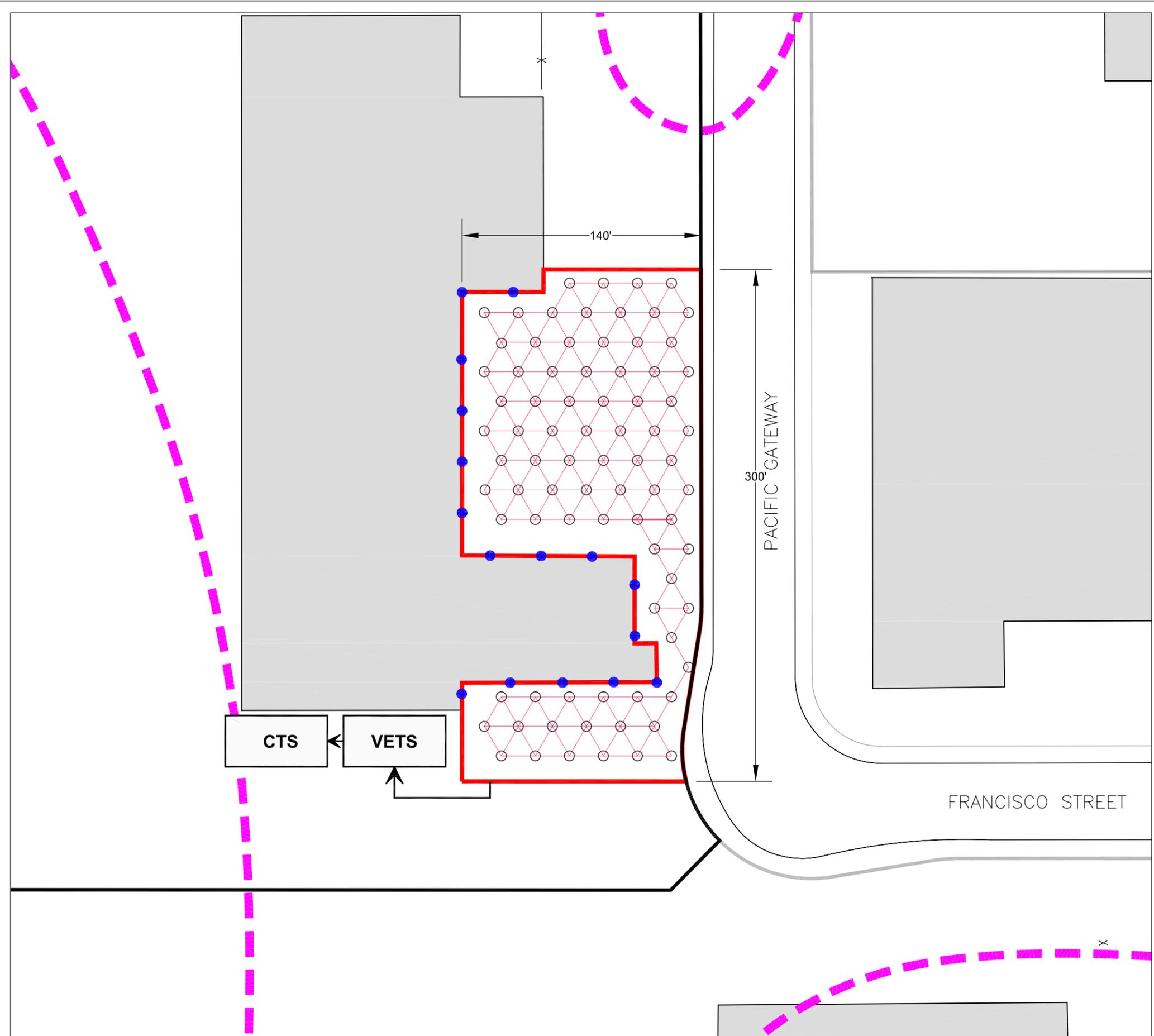


FIGURE 7.4-4
Alternative 5
IN-SITU CHEMICAL OXIDATION, SVE,
ICS AND MONITORING
Parcels No. 7351-034-057

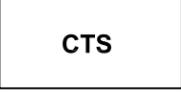
Source Area 6
 Del Amo Soil + NAPL FS



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Legend

-  Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  SVE sentry well (30-foot spacing)
-  ERH electrode and SVE interior well, dual screen (20-foot spacing)
-  VETS Vapor Extraction Treatment System
-  CTS Condensate Treatment System

Notes:

- (1) Temperature monitoring points are not shown on the figure. These points would typically be distributed throughout the source area at a 50-75 foot spacing.
- (2) SVE radius of influence circles are not shown for each well due to the large number of closely spaced wells in the figure.



FIGURE 7.4-5
Alternative 6
IN-SITU SOIL HEATING, SVE,
ICS AND MONITORING
Parcels No. 7351-034-057

Source Area 6
 Del Amo Soil + NAPL FS



TABLE E.3-1
SOURCE AREA 6 - REMEDIAL ALTERNATIVE 2
ICs + MONITORING COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	ICs Design, Documentation, Implementation	1	ls	\$ 34,110	\$ 34,110
Direct Capital Total					\$ 34,000
Item No.	Indirect Capital Costs				
1	Project Management	10%	of	\$ 34,000	\$ 3,400
Indirect Capital Subtotal					\$ 3,400
Total Direct + Indirect Capital Cost					\$ 37,400
Item No.	Operation and Maintenance Costs				
1	Institutional Controls, Inspections, Monitoring	1	year	\$ 3,275	\$ 3,275
2	Groundwater Monitoring	1	year	\$ 15,000	\$ 15,000
ICs Annual Operation and Maintenance Subtotal					\$ 18,275
Present Worth of ICs Operation and Maintenance Costs (5%, 100 Years)					\$ 363,000
Contingency (20% of total project cost)					\$ 80,000
Total Capital and ICs O&M Cost					\$ 481,000

NOTES/ASSUMPTIONS

1. ICs include IC layers 1, 2, 3, 4A and 5.
2. ICs capital and O&M costs are estimated based on applicable IC layers per parcel as shown in Tables D3-1 and D3-2.

TABLE E.3-2
SOURCE AREA 6 - REMEDIAL ALTERNATIVE 3
SVE/BV COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 152,000	\$ 152,000
2	Mobilization/Demobilization	33,000	sf	\$ 1.25	\$ 42,000
3	Electrical Service/ hookup/Utilities	1	ls	\$ 25,000	\$ 25,000
4	Site Preparation/Geophysical	33,000	sf	\$ 0.8	\$ 27,000
5	SVE Wells	9	ea	\$ 6,000	\$ 54,000
6	Well Headworks/Vault (24" traffic rated)	9	ea	\$ 3,000	\$ 27,000
7	VETS Installation and Startup	1	ls	\$ 90,000	\$ 90,000
8	SVE Blower + Thermal Oxidizer; 400 cfm	1	ls	\$ 80,000	\$ 80,000
9	Control and Instrumentation	1	ls	\$ 6,000	\$ 6,000
10	Misc Treat System: Tanks, Piping, Pumps, Fittings	1	ls	\$ 15,000	\$ 15,000
11	Trenching, Piping, Backfill and Resurfacing	600	lf	\$ 30	\$ 18,000
12	Equipment Pad/Enclosure/Fence	1	ea	\$ 20,000	\$ 20,000
13	Post Treatment Sampling + Analysis	14	borings	\$ 5,000	\$ 70,000
Direct Capital Total					\$ 626,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	12%	of	\$ 626,000	\$ 76,000
2	Project Management, Agency Reporting/Coordination	6%	of	\$ 626,000	\$ 38,000
3	Construction Management	8%	of	\$ 626,000	\$ 51,000
Indirect Capital Subtotal					\$ 165,000
Total Direct + Indirect Capital Cost					\$ 791,000
Item No.	Operation and Maintenance Cost				
1	Fuel: Natural Gas (Thermal Oxidizer)	12	mths	\$ 8,000	\$ 96,000
2	Electricity: SVE blower, misc equip	12	mths	\$ 2,700	\$ 32,400
3	Operations & Maintenance	12	mths	\$ 5,000	\$ 60,000
4	Maintenance (hardware, filters, monitoring equipment)	12	mths	\$ 1,000	\$ 12,000
5	Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 4,500	\$ 54,000
6	Project Management/Consultant support/Reports	12	mths	\$ 5,000	\$ 60,000
7	Waste/NAPL/Water Disposal	12	mths	\$ 2,000	\$ 24,000
8	Health & Safety/Air Monitoring	1	ls	\$ 3,000	\$ 3,000
9	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 3,000	\$ 36,000
SVE Annual Operation and Maintenance Subtotal					\$ 378,000
SVE Present Worth of Operation and Maintenance Costs (5%, 4 Years)					\$ 1,341,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (20% of SVE)					\$ 427,000
Total Capital and O&M Cost Present Worth					\$ 3,040,000

NOTES/ASSUMPTIONS

1. SVE (OS) system: Uses 9 V-SVE wells, 30-50 feet bgs screens.
2. Vapor treatment system uses thermal oxidizer, 400 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.

TABLE E.3-3
SOURCE AREA 6 - REMEDIAL ALTERNATIVE 4
HYDRAULIC EXTRACTION AND SVE/BV COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 152,000	\$ 152,000
2	Mobilization/Demobilization	33,000	sf	\$ 1.25	\$ 42,000
3	Electrical Service/Hookup	1	ls	\$ 40,000	\$ 40,000
4	Site Preparation/Geophysical	33,000	sf	\$ 0.8	\$ 27,000
5	SVE Vertical Wells	9	ea	\$ 6,000	\$ 54,000
6	Groundwater Extraction Wells	42	ea	\$ 9,500	\$ 399,000
7	Well Headworks/Vault/Extraction Pumps (24" traffic rated)	51	ea	\$ 3,000	\$ 153,000
8	Treatment System Installation and Startup (SVE + Hyd Ext)	1	ls	\$ 125,000	\$ 125,000
9	SVE Blower + Thermal Oxidizer; 850 cfm	1	ls	\$ 110,000	\$ 110,000
10	Control and Instrumentation	1	ls	\$ 34,000	\$ 34,000
11	Advanced Oxidation Treatment system (42 gpm) (HiPOx)	1	ls	\$ 365,000	\$ 365,000
12	Air Stripping Unit+Blower (STAT 80)	1	ls	\$ 17,000	\$ 17,000
13	Carbon Adsorption Vessels - VPGAC and LPGAC	4	ls	\$ 10,000	\$ 40,000
14	Misc Treat System: OWS, Tanks, Piping, Pumps	1	ls	\$ 60,000	\$ 60,000
15	Trenching, Piping, Cables, Backfill and Resurfacing	2,300	lf	\$ 30	\$ 69,000
16	Equipment Pad/Enclosure/Fence	1	ea	\$ 30,000	\$ 30,000
17	Post Treatment Sampling + Analysis	14	borings	\$ 5,000	\$ 70,000
Direct Capital Total					\$ 1,787,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	12%	of	\$ 1,787,000	\$ 215,000
2	Project Management, Agency Reporting/Coordination	6%	of	\$ 1,787,000	\$ 108,000
3	Construction Management	8%	of	\$ 1,787,000	\$ 143,000
Indirect Capital Subtotal					\$ 466,000
Total Direct+Indirect Cost					\$ 2,253,000
Item No.	Operation and Maintenance Cost				
1	Fuel:Natural Gas (Thermal oxidizer)	12	mths	\$ 13,000	\$ 156,000
2	Electricity (SVE blower, HiPOx, Air Stripper blower)	12	mths	\$ 14,700	\$ 176,400
3	Operations & Maintenance	12	mths	\$ 10,000	\$ 120,000
4	Chemicals for HiPOx: H2O2	12	mths	\$ 2,200	\$ 26,400
5	Carbon - Liquid Phase	12	mths	\$ 2,000	\$ 24,000
6	Carbon - Vapor Phase (post-thermal/catox)	12	mths	\$ 4,000	\$ 48,000
7	Groundwater/Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 10,000	\$ 120,000
8	Project Management/Consultant support/Reports	12	mths	\$ 8,000	\$ 96,000
9	Waste/NAPL/Water Disposal	12	mths	\$ 4,000	\$ 48,000
10	Health & Safety/Air Monitoring	1	ls	\$ 6,000	\$ 6,000
11	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 5,000	\$ 60,000
SVE Annual Operation and Maintenance Subtotal					\$ 484,000
Present Worth of SVE Operation and Maintenance Costs (5%, 4 Years)					\$ 1,717,000
Hydraulic Extraction Annual Operation and Maintenance Subtotal					\$ 398,000
Present Worth of Hydraulic Extraction Operation and Maintenance Costs (5%, 10 Years)					\$ 3,074,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (20% of Hydraulic Extraction)					\$ 1,409,000
Total Capital and O&M Cost Present Worth					\$ 8,934,000

NOTES/ASSUMPTIONS

- SVE (OS) system: Uses 9 V-SVE wells, 30-50 feet bgs screens.
- Vapor treatment system uses thermal oxidizer, 850 scfm, positive displacement (PD) blower.
- Assume SVE operation for 4 years.
- Hydraulic extraction system: Uses 42 groundwater extraction wells, 50-80 feet bgs screens with a max extraction flow rate of 42 gpm.
- Water is treated by oil-water separator (OWS), APT's HiPOx (H2O2+Ozone) system and air stripping with discharge to storm drain.
- Liquid phase carbon is used as a backup or polishing treatment process. Assumes 2 carbon changeouts per month.
- Assume hydraulic extraction operation for 10 years.
- Vapor phase carbon is used after SVE operation is completed to treat air stripper discharge. Assumes 1 carbon changeout/month.
- Groundwater is extracted from UBF/MBF and some wells are expected to go dry.

TABLE E.3-4
SOURCE AREA 6 - REMEDIAL ALTERNATIVE 5
IN-SITU CHEMICAL OXIDATION AND SVE COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost	
Direct Capital Costs					
1	Site Investigation/Delineation	1	ls	\$ 367,000	\$ 367,000
2	Mobilization/Demobilization	33,000	sf	\$ 1.5	\$ 50,000
3	Electrical Service/Hookup	1	ls	\$ 40,000	\$ 40,000
3	Site Preparation/Geophysical survey	33,000	sf	\$ 0.8	\$ 27,000
4	Chemical Injection Well Points	363	ea	\$ 4,200	\$ 1,525,000
5	Vapor Extraction Interior Wells (outdoor)	26	ea	\$ 6,500	\$ 169,000
6	Vapor Extraction Sentry Wells (outdoor)	16	ea	\$ 6,500	\$ 104,000
7	Temperature Monitoring Points/Wells (outdoor)	15	ea	\$ 10,000	\$ 150,000
8	Well Headworks/Vault - Injection Wells (36-inch traffic rated)	121	ea	\$ 4,000	\$ 484,000
9	Well Headworks/Vault - SVE/Monit. Wells (24-inch traffic rated)	57	ea	\$ 3,000	\$ 171,000
10	Treatment System Installation and Startup	1	ls	\$ 150,000	\$ 150,000
11	Misc. Treatment Sys Equipment: tanks, piping..	1	ls	\$ 60,000	\$ 60,000
12	SVE Equipment : 1,000 CFM Blower+ThermOx	1	ls	\$ 100,000	\$ 100,000
13	Ozone Generation System, 80 ppd (air supply, generator, and manifold system)	1	units	\$ 280,000	\$ 280,000
14	Control and Instrumentation (includes ozone / peroxide distribution manifold and controls)	1	ls	\$ 57,200	\$ 58,000
15	Trenching, Piping, Backfill and Resurfacing	2,600	lf	\$ 50	\$ 130,000
16	Equipment Pad/Enclosure/Fence	1	ea	\$ 40,000	\$ 40,000
17	Post Treatment Sampling + Analysis	14	borings	\$ 5,000	\$ 70,000
Direct Capital Total				\$	\$ 3,975,000
Indirect Capital Costs					
1	Engineering, Design, and Permitting	8%	of	\$ 3,975,000	\$ 318,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 3,975,000	\$ 199,000
3	Construction Management	6%	of	\$ 3,975,000	\$ 239,000
Indirect Capital Subtotal				\$	\$ 756,000
Total Direct + Indirect Capital Cost				\$	\$ 4,731,000
Operation and Maintenance Cost					
1	Fuel: Natural Gas (Thermal oxidizer)	12	mths	\$ 15,000	\$ 180,000
2	Electricity: (SVE Blower, Ozone Gen, misc electrical equip)	12	mths	\$ 12,000	\$ 144,000
3	SVE System Operation and Monitoring Labor	12	units	\$ 10,000	\$ 120,000
4	SVE Maintenance Materials and Expenses	12	mths	\$ 4,000	\$ 48,000
5	Chemicals: H2O2 (refer to note 5)	121	wells	\$ 4,000	\$ 484,000
6	ISCO Consultant Oversight	12	mths	\$ 8,000	\$ 96,000
7	SVE Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 5,000	\$ 60,000
8	SVE / ISCO Soil and Groundwater Monitoring/Sampling Analytical Lab Costs (semi annually)	2	rounds	\$ 50,000	\$ 100,000
9	Project Management/Consultant support/Reports	12	mths	\$ 8,000	\$ 96,000
10	Waste Disposal	12	mths	\$ 5,000	\$ 60,000
11	H&S/Air Monitoring	1	ls	\$ 8,000	\$ 8,000
12	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 8,000	\$ 96,000
SVE Annual Operation and Maintenance Subtotal				\$	\$ 671,000
Present Worth of SVE Operation and Maintenance Costs (5%, 4 Years)				\$	\$ 2,380,000
ISCO Annual Operation and Maintenance Subtotal				\$	\$ 822,000
Present Worth of ISCO Operation and Maintenance Costs (5%, 2 Years)				\$	\$ 1,529,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs				\$	\$ 481,000
Contingency (40% of ISCO)				\$	\$ 3,456,000
Total Capital and O&M Cost Present Worth				\$	\$ 12,577,000

NOTES/ASSUMPTIONS

1. Assume 26 SVE wells with dual screens 15-30 and 30-50 feet bgs and 16 SVE sentry wells with 15-30 feet bgs screens.
2. Vapor treatment system uses thermal oxidizer, 1,000 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.
4. ISCO uses 121 direct push injection wells, each well a cluster of 3 3/4"-SS injection points screened at 3 depths between 50-80 feet bgs.
5. Assume injection of 4,000 gal of 20% H2O2 per well for 2 year treatment for total of 484,000 gal of H2O2.
6. Assume injection of 300 lbs of O3 per well for 2 year treatment for total of 36,000 lbs. of O3.
7. Assume ISCO treatment system operates continuously for 2-year treatment with a 70% up time equivalent to 511 days.

TABLE E.3-5
SOURCE AREA 6 - REMEDIAL ALTERNATIVE 6
IN-SITU SOIL HEATING AND SVE COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

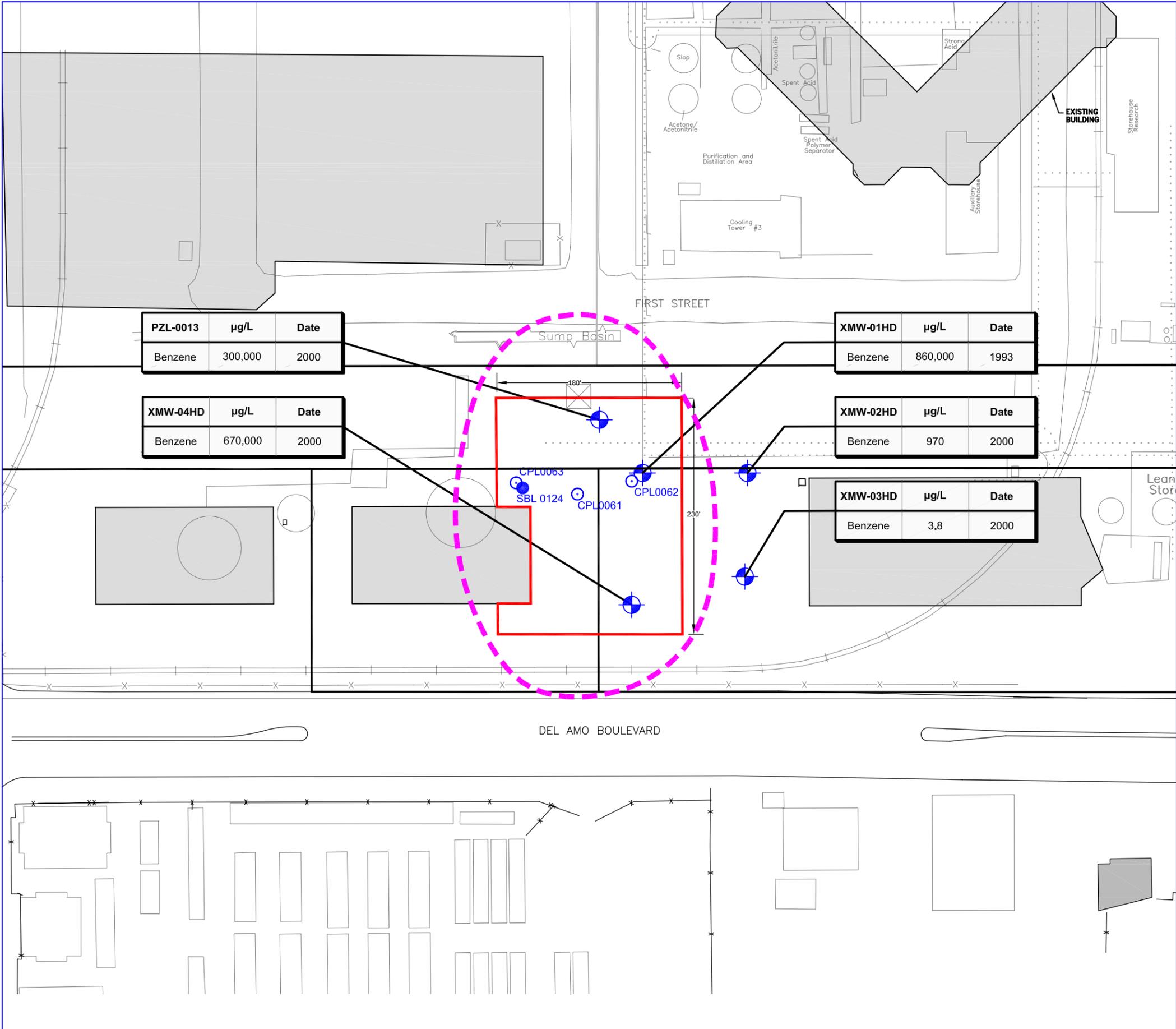
Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost	
Direct Capital Costs					
Item No.					
1	Site Investigation/Delineation	1	ls	\$ 367,000	\$ 367,000
2	Mobilization/Demobilization	33,000	sf	\$ 1.5	\$ 50,000
3	Electrical Service/ hookup 12kV, 60A, 3Φ	2	ls	\$ 50,000	\$ 100,000
4	Site Preparation/Geophysical	33,000	sf	\$ 0.8	\$ 27,000
5	Transformers/Power Controls	2	ls	\$ 120,000	\$ 240,000
6	Electrode/Vapor Extraction Wells	81	ea	\$ 13,000	\$ 1,053,000
7	Vapor Extraction Wells - Sentry	16	ea	\$ 6,000	\$ 96,000
8	Monitoring Wells	15	ea	\$ 10,000	\$ 150,000
9	Temperature Monitoring Points/Thermocouples	17	ea	\$ 10,000	\$ 165,000
10	Well Headworks/Vault (24" traffic rated)	129	ea	\$ 3,000	\$ 386,000
11	Treatment System Installation and Startup (Vapor and Liquid)	1	ls	\$ 150,000	\$ 150,000
12	High Vac Blower + Thermal Oxidizer; 2,500 scfm	1	unit	\$ 160,000	\$ 160,000
13	Control and Instrumentation	1	ls	\$ 49,000	\$ 49,000
14	Condensed Water Treatment System, 10 gpm (HiPOx, LPGAC)	1	ls	\$ 210,000	\$ 210,000
15	Trenching, Piping, Cables, Backfill and Resurfacing	4,200	lf	\$ 50	\$ 210,000
16	Equipment Pad/Enclosure/Fence/Berms/Trailer	1	ea	\$ 50,000	\$ 50,000
17	Pre-Treatment Sampling+Analysis (Sampling during well installation)	1	ls	\$ 150,000	\$ 150,000
18	Post Treatment Sampling + Analysis	14	borings	\$ 5,000	\$ 70,000
Direct Capital Total				\$	\$ 3,683,000
Indirect Capital Costs					
Item No.					
1	Engineering, Design, and Permitting	8%	of	\$ 3,683,000	\$ 295,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 3,683,000	\$ 185,000
3	Construction Management	6%	of	\$ 3,683,000	\$ 221,000
Indirect Capital Subtotal				\$	\$ 701,000
Total Direct + Indirect Capital Cost				\$	\$ 4,384,000
Operation and Maintenance Cost					
Item No.					
1	Electricity - ERH for soil heating	12	units	\$ 86,100	\$ 1,033,200
2	Electricity - SVE, HiPOx and misc elec equip	12	units	\$ 16,300	\$ 196,000
3	Operations & Maintenance	12	mths	\$ 50,000	\$ 600,000
4	Fuel: Natural Gas (Thermal Oxidizer)	12	mths	\$ 33,000	\$ 396,000
5	Liquid Phase Carbon	12	mths	\$ 4,000	\$ 48,000
6	Chemicals for water treatment: H2O2	12	mths	\$ 375	\$ 5,000
7	Labor - Groundwater/Vapor Treatment System Influent/Effluent Monitoring	12	mths	\$ 20,000	\$ 240,000
8	Project Management/Consultant Support/Reports	12	mths	\$ 15,000	\$ 180,000
9	Waste/NAPL/Water Disposal	12	mths	\$ 6,000	\$ 72,000
10	Health & Safety/Air Monitoring	12	mths	\$ 8,000	\$ 96,000
11	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 10,000	\$ 120,000
SVE + ERH Annual Operation and Maintenance Subtotal				\$	\$ 2,987,000
Present Worth of SVE Operation and Maintenance Costs (5%, 2 Years)				\$	\$ 5,555,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs				\$	\$ 481,000
Contingency (40% of ERH)				\$	\$ 3,976,000
Total Capital and O&M Cost Present Worth				\$	\$ 14,396,000

NOTES/ASSUMPTIONS

1. Assume 81 electrode SVE wells with dual conductive interval 25-55 and 60-80 ft bgs, dual-completed SVE with 15-30 and 30-50 ft bgs screens.
2. Assume 16 SVE sentry wells with 15-30 feet bgs screens.
3. Vapor treatment system uses thermal oxidizer, 2,500 scfm, positive displacement (PD) blower.
4. Condensate treatment system designed to treat 10 gpm using APT's HiPOx (H2O2+O3) system and LPGAC with discharge to storm drain.
5. Assume ERH+SVE operation for 2 years.
6. Assume average power usage of 574,000 KWhr/month and total electrical energy of 13.8 million KWhr for soil heating.
7. Assume system heating time on average of 50% of days in year.
8. Power conditioning unit (transformer) assumed to be rented.

SOURCE AREA 11

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PZL-0013	µg/L	Date
Benzene	300,000	2000

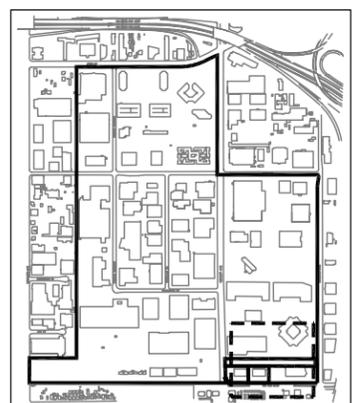
XMW-04HD	µg/L	Date
Benzene	670,000	2000

XMW-01HD	µg/L	Date
Benzene	860,000	1993

XMW-02HD	µg/L	Date
Benzene	970	2000

XMW-03HD	µg/L	Date
Benzene	3.8	2000

- ### Legend
- Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
 - Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
 - Approximate location of former underground pipelines with a potential to have transported VOC-containing fluids
 - Parcel boundary
 - Outlines of historical features with use/contents indicated
 - ROST/CPT boring location where hydrocarbon signatures were detected (1998)
 - Continuous core soil borings with observed LNAPL and hydrocarbon saturation confirmation data (1997)
 - ⊕ Monitoring well location in water table zone with contaminant concentration and date of sample



Area shown in this map

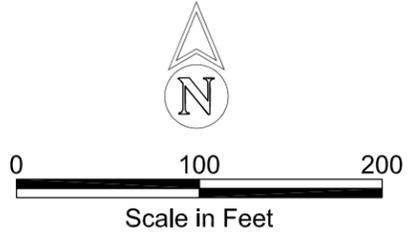


FIGURE 7.5-1
ASSUMED EXTENT OF NAPL CONTAMINATION
 Parcel Nos. 7351-033-022, -027 & -900
 Source Area 11
 Del Amo Soil + NAPL FS



Legend

-  Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  SVE/BV vertical well (70-foot spacing), circle denotes assumed 50-foot radius of influence
-  Vapor Extraction Treatment System

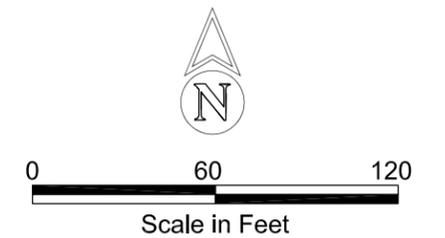
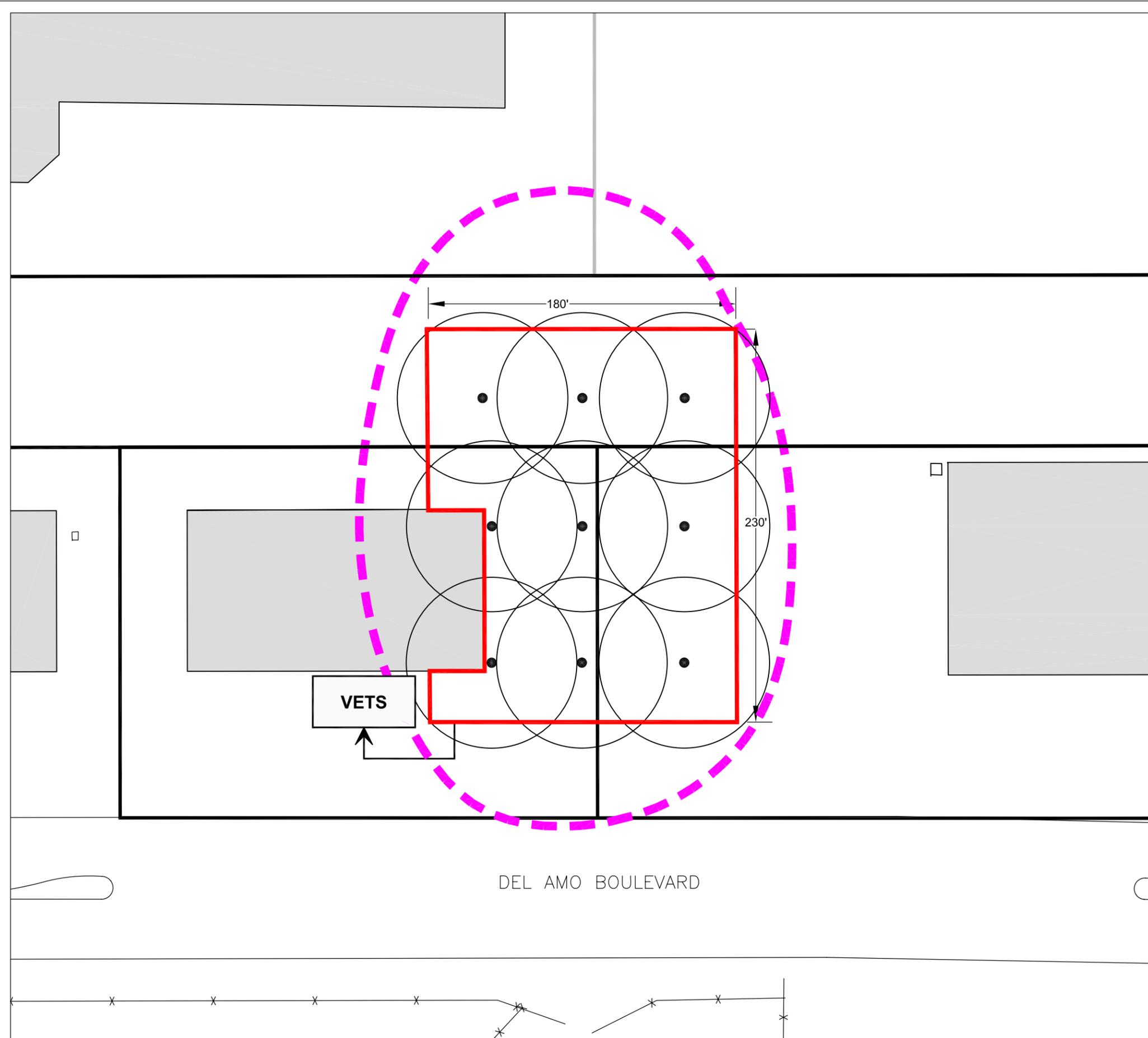
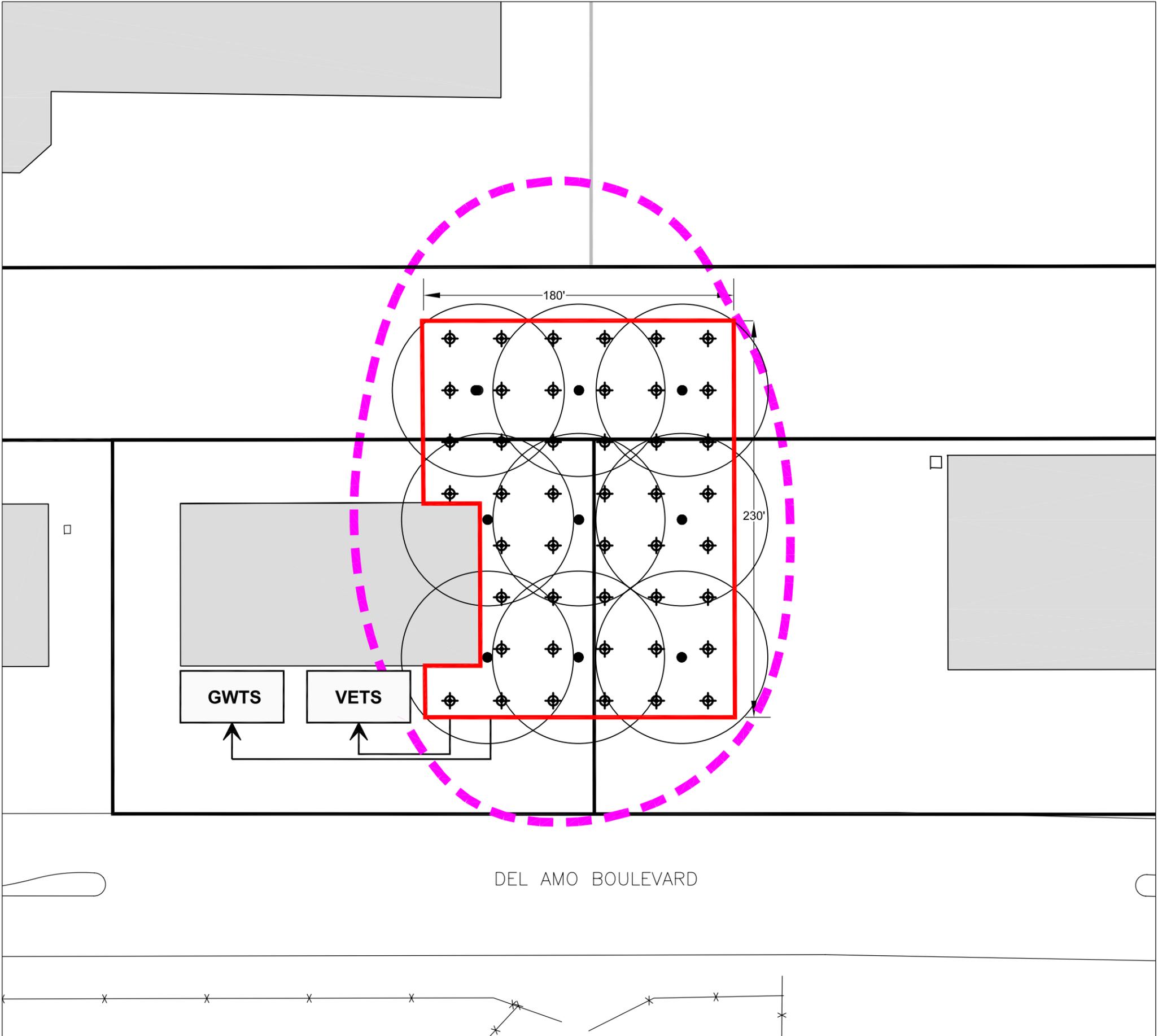


FIGURE 7.5-2
Alternative 3
SOIL VAPOR EXTRACTION/BIOVENTING,
ICS AND MONITORING
Parcel Nos. 7351-033-022, -027 & -900
Source Area 11
Del Amo Soil + NAPL FS



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T:\Del_Amo\2007\treatment_system\figs_7-5_V4.dwg 7.5-3 (0308) 7/11/08 (Santa Barbara Office)



Legend

-  Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  Groundwater Extraction Well (30-foot spacing)
-  SVE/BV vertical well (approximate 70-foot spacing)
-  Vapor Extraction Treatment System
-  Groundwater Treatment System

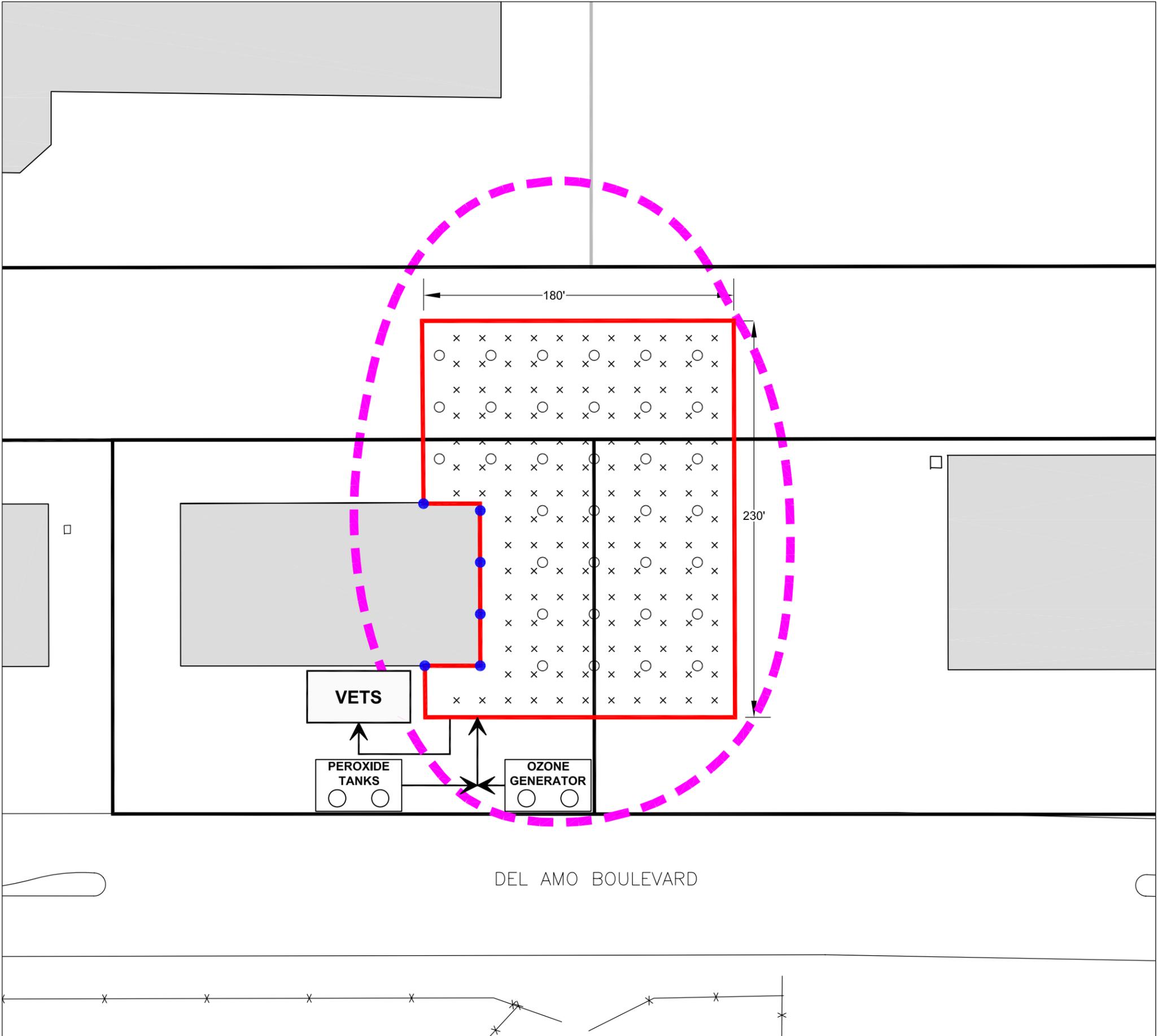


FIGURE 7.5-3
Alternative 4
HYDRAULIC EXTRACTION, SVE/BV,
ICS AND MONITORING
Parcel Nos. 7351-033-022, -027 & -900

Source Area 11
 Del Amo Soil + NAPL FS



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Legend

-  Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  ISCO injection well (15-foot spacing)
-  SVE sentry well (30-foot spacing)
-  SVE interior well, dual screen (30-foot spacing)
-  Vapor Extraction Treatment System

Notes:

- (1) Temperature monitoring points are not shown on the figure. These points would typically be distributed throughout the source area at a 50-75 foot spacing.
- (2) SVE radius of influence circles are not shown for each well due to the large number of closely spaced wells in the figure.

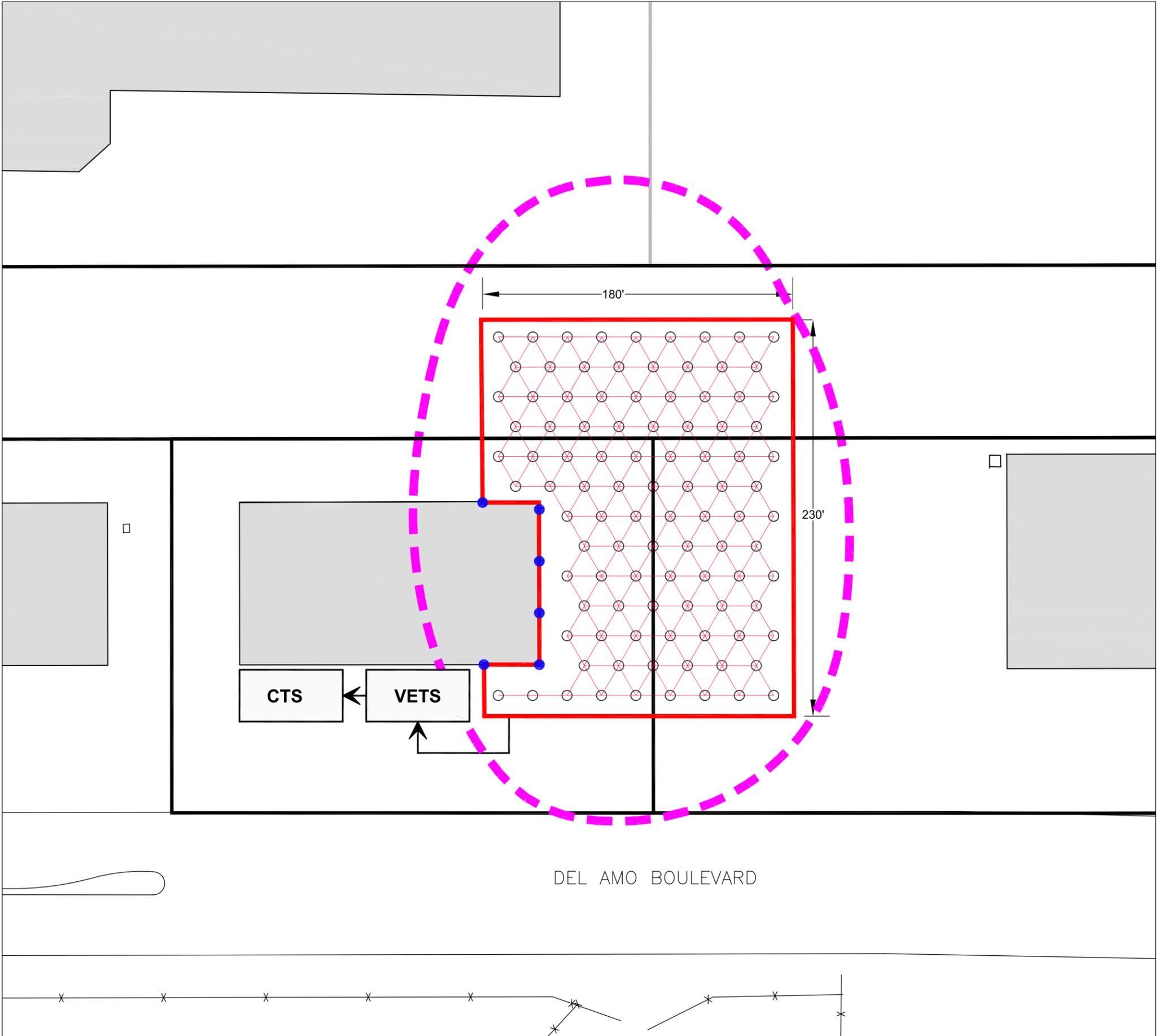


FIGURE 7.5-4
Alternative 5
IN-SITU CHEMICAL OXIDATION, SVE,
ICS AND MONITORING
Parcel Nos. 7351-033-022, -027 & -900

Source Area 11
 Del Amo Soil + NAPL FS



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Legend

-  Assumed extent of NAPL source area based on ROST signatures in CPT borings and hydrocarbon saturation data in soil boring core samples
-  Area where LNAPL could potentially be present based on dissolved concentrations in groundwater (>5% of solubility)
-  Parcel boundary
-  SVE sentry well (30-foot spacing)
-  ERH electrode and SVE interior well, dual screen (20-foot spacing)
-  VETS Vapor Extraction Treatment System
-  CTS Condensate Treatment System

Notes:

- (1) Temperature monitoring points are not shown on the figure. These points would typically be distributed throughout the source area at a 50-75 foot spacing.
- (2) SVE radius of influence circles are not shown for each well due to the large number of closely spaced wells in the figure.



 Scale in Feet

FIGURE 7.5-5
Alternative 6
IN-SITU SOIL HEATING, SVE,
ICS AND MONITORING
Parcel Nos. 7351-033-022, -027 & -900

Source Area 11
 Del Amo Soil + NAPL FS



TABLE E.4-1
SOURCE AREA 11 - REMEDIAL ALTERNATIVE 2
ICs + MONITORING COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	ICs Design, Documentation, Implementation	1	ls	\$ 34,110	\$ 34,110
Direct Capital Total					\$ 34,000
Item No.	Indirect Capital Costs				
1	Project Management	10%	of	\$ 34,000	\$ 3,400
Indirect Capital Subtotal					\$ 3,400
Total Direct + Indirect Capital Cost					\$ 37,400
Item No.	Operation and Maintenance Costs				
1	Institutional Controls, Inspections, Monitoring	1	year	\$ 3,275	\$ 3,275
2	Groundwater Monitoring	1	year	\$ 15,000	\$ 15,000
ICs Annual Operation and Maintenance Subtotal					\$ 18,275
Present Worth of ICs Operation and Maintenance Costs (5%, 100 Years)					\$ 363,000
Contingency (20% of total project cost)					\$ 80,000
Total Capital and ICs O&M Cost					\$ 481,000

NOTES/ASSUMPTIONS

1. ICs include IC layers 1, 2, 3, 4A and 5.
2. ICs capital and O&M costs are estimated based on applicable IC layers per parcel as shown in Tables D3-1 and D3-2.

TABLE E.4-2
SOURCE AREA 11 - REMEDIAL ALTERNATIVE 3
SVE/BV COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 172,000	\$ 172,000
2	Mobilization/Demobilization	38,000	sf	\$ 1.25	\$ 48,000
3	Electrical Service/ hookup/Utilities	1	ls	\$ 30,000	\$ 30,000
4	Site Preparation/Geophysical	38,000	sf	\$ 0.8	\$ 31,000
5	SVE Wells	9	ea	\$ 5,500	\$ 50,000
6	Well Headworks/Vault (24" traffic rated)	9	ea	\$ 3,000	\$ 27,000
7	VETS Installation and Startup	1	ls	\$ 90,000	\$ 90,000
8	SVE Blower + Thermal Oxidizer; 300 cfm	1	ls	\$ 75,000	\$ 75,000
9	Control and Instrumentation	1	ls	\$ 6,000	\$ 6,000
10	Misc Treat System: Tanks, Piping, Pumps, Fittings	1	ls	\$ 15,000	\$ 15,000
11	Trenching, Piping, Backfill and Resurfacing	700	lf	\$ 30	\$ 21,000
12	Equipment Pad/Enclosure/Fence	1	ea	\$ 20,000	\$ 20,000
13	Post Treatment Sampling + Analysis	16	borings	\$ 5,000	\$ 80,000
Direct Capital Total					\$ 665,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	12%	of	\$ 665,000	\$ 80,000
2	Project Management, Agency Reporting/Coordination	6%	of	\$ 665,000	\$ 40,000
3	Construction Management	8%	of	\$ 665,000	\$ 54,000
Indirect Capital Subtotal					\$ 174,000
Total Direct + Indirect Capital Cost					\$ 839,000
Item No.	Operation and Maintenance Cost				
1	Fuel: Natural Gas (Thermal Oxidizer)	12	mths	\$ 7,000	\$ 84,000
2	Electricity: SVE blower, misc equip	12	mths	\$ 2,200	\$ 26,400
3	Operations & Maintenance	12	mths	\$ 5,000	\$ 60,000
4	Maintenance (hardware, filters, monitoring equipment)	12	mths	\$ 1,500	\$ 18,000
5	Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 5,000	\$ 60,000
6	Project Management/Consultant support/Reports	12	mths	\$ 5,000	\$ 60,000
7	Waste/NAPL/Water Disposal	12	mths	\$ 2,000	\$ 24,000
8	Health & Safety/Air Monitoring	1	ls	\$ 3,000	\$ 3,000
9	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 3,000	\$ 36,000
SVE Annual Operation and Maintenance Subtotal					\$ 372,000
SVE Present Worth of Operation and Maintenance Costs (5%, 4 Years)					\$ 1,320,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (20% of SVE)					\$ 432,000
Total Capital and O&M Cost Present Worth					\$ 3,072,000

NOTES/ASSUMPTIONS

1. SVE (OS) system: Uses 9 V-SVE wells, 30-40 feet bgs screens.
2. Vapor treatment system uses thermal oxidizer, 300 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.

TABLE E.4-3
SOURCE AREA 11 - REMEDIAL ALTERNATIVE 4
HYDRAULIC EXTRACTION AND SVE/BV COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 172,000	\$ 172,000
2	Mobilization/Demobilization	38,000	sf	\$ 1.25	\$ 48,000
3	Electrical Service/Hookup	1	ls	\$ 40,000	\$ 40,000
4	Site Preparation/Geophysical	38,000	sf	\$ 0.8	\$ 31,000
5	SVE Vertical Wells	9	ea	\$ 6,000	\$ 54,000
6	Groundwater Extraction Wells	45	ea	\$ 9,500	\$ 427,500
7	Well Headworks/Vault/Extraction Pumps (24" traffic rated)	54	ea	\$ 3,000	\$ 162,000
8	Treatment System Installation and Startup (SVE + Hyd Ext)	1	ls	\$ 150,000	\$ 150,000
9	SVE Blower + Thermal Oxidizer; 750 cfm	1	ls	\$ 100,000	\$ 100,000
10	Control and Instrumentation	1	ls	\$ 34,000	\$ 34,000
11	Advanced Oxidation Treatment system (45 gpm) (HiPOx)	1	ls	\$ 377,000	\$ 377,000
12	Air Stripping Unit+Blower (STAT 80)	1	ls	\$ 17,000	\$ 17,000
13	Carbon Adsorption Vessels - VPGAC and LPGAC	4	ls	\$ 10,000	\$ 40,000
14	Misc Treat System: OWS, Tanks, Piping, Pumps	1	ls	\$ 60,000	\$ 60,000
15	Trenching, Piping, Cables, Backfill and Resurfacing	2,500	lf	\$ 30	\$ 75,000
16	Equipment Pad/Enclosure/Fence	1	ea	\$ 30,000	\$ 30,000
17	Post Treatment Sampling + Analysis	16	borings	\$ 5,000	\$ 80,000
Direct Capital Total					\$ 1,726,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	12%	of	\$ 1,726,000	\$ 208,000
2	Project Management, Agency Reporting/Coordination	6%	of	\$ 1,726,000	\$ 104,000
3	Construction Management	8%	of	\$ 1,726,000	\$ 139,000
Indirect Capital Subtotal					\$ 451,000
Total Direct+Indirect Cost					\$ 2,177,000
Item No.	Operation and Maintenance Cost				
1	Fuel:Natural Gas (Thermal oxidizer)	12	mths	\$ 12,000	\$ 144,000
2	Electricity (SVE blower, HiPOx, Air Stripper blower)	12	mths	\$ 14,200	\$ 170,400
3	Operations & Maintenance	12	mths	\$ 10,000	\$ 120,000
4	Chemicals for HiPOx: H2O2	12	mths	\$ 12,000	\$ 144,000
5	Carbon - Liquid Phase	12	mths	\$ 2,000	\$ 24,000
6	Carbon - Vapor Phase (post-thermal/catox)	12	mths	\$ 4,000	\$ 48,000
7	Groundwater/Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 10,000	\$ 120,000
8	Project Management/Consultant support/Reports	12	mths	\$ 8,000	\$ 96,000
9	Waste/NAPL/Water Disposal	12	mths	\$ 4,000	\$ 48,000
10	Health & Safety/Air Monitoring	1	ls	\$ 6,000	\$ 6,000
11	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 5,000	\$ 60,000
SVE Annual Operation and Maintenance Subtotal					\$ 469,000
Present Worth of SVE Operation and Maintenance Costs (5%, 4 Years)					\$ 1,664,000
Hydraulic Extraction Annual Operation and Maintenance Subtotal					\$ 512,000
Present Worth of Hydraulic Extraction Operation and Maintenance Costs (5%, 10 Years)					\$ 3,954,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (20% of Hydraulic Extraction)					\$ 1,559,000
Total Capital and O&M Cost Present Worth					\$ 9,835,000

NOTES/ASSUMPTIONS

- SVE (OS) system: Uses 9 V-SVE wells, 30-40 feet bgs screens.
- Vapor treatment system uses thermal oxidizer, 750 scfm, positive displacement (PD) blower.
- Assume SVE operation for 4 years.
- Hydraulic extraction system: Uses 45 groundwater extraction wells, 40-80 feet bgs screens with a max extraction flow rate of 45 gpm.
- Water is treated by oil-water separator (OWS), APT's HiPOx (H2O2+Ozone) system and air stripping with discharge to storm drain.
- Liquid phase carbon is used as a backup or polishing treatment process. Assumes 2 carbon changeouts per month.
- Assume hydraulic extraction operation for 10 years.
- Vapor phase carbon is used after SVE operation is completed to treat air stripper discharge. Assumes 1 carbon changeout/month.
- Groundwater is extracted from UBF/MBF and some wells are expected to go dry.

TABLE E.4-4
SOURCE AREA 11 - REMEDIAL ALTERNATIVE 5
IN-SITU CHEMICAL OXIDATION AND SVE COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description		Estimated Quantity	Unit	Unit Cost	Estimated Cost
Item No.	Direct Capital Costs				
1	Site Investigation/Delineation	1	ls	\$ 416,200	\$ 416,200
2	Mobilization/Demobilization	38,000	sf	\$ 1.5	\$ 57,000
3	Electrical Service/ hookup	1	ls	\$ 40,000	\$ 40,000
4	Site Preparation/Geophysical survey	38,000	sf	\$ 0.8	\$ 31,000
5	Ozone / Peroxide Injection Points/Wells	604	ea	\$ 4,200	\$ 2,537,000
6	Vapor Extraction Interior Wells (outdoor)	34	ea	\$ 6,500	\$ 221,000
7	Vapor Extraction Sentry Wells (outdoor)	6	ea	\$ 6,500	\$ 39,000
8	Temperature Monitoring Points/Wells (outdoor)	10	ea	\$ 10,000	\$ 100,000
9	Well Headworks/Vault - Injection Wells (36-inch traffic rated)	151	ea	\$ 4,000	\$ 604,000
10	Well Headworks/Vault - SVE/Monit. Wells (24-inch traffic rated)	50	ea	\$ 3,000	\$ 150,000
11	Treatment System Installation and Startup	1	ls	\$ 150,000	\$ 150,000
12	Misc. Treatment Sys Equipment: tanks, piping..	1	ls	\$ 60,000	\$ 60,000
13	SVE Equipment : 1,000 CFM Blower+ThermOx	1	ls	\$ 100,000	\$ 100,000
14	Ozone Generation System, 100 ppd (air supply, generator, and manifold system)	1	units	\$ 350,000	\$ 350,000
15	Control and Instrumentation (includes ozone / peroxide distribution manifold and controls)	1	ls	\$ 66,300	\$ 67,000
16	Trenching, Piping, Backfill and Resurfacing	2,900	lf	\$ 50	\$ 145,000
17	Equipment Pad/Enclosure/Fence	1	ea	\$ 40,000	\$ 40,000
18	Post Treatment Sampling + Analysis	16	borings	\$ 5,000	\$ 80,000
Direct Capital Total					\$ 5,187,000
Item No.	Indirect Capital Costs				
1	Engineering, Design, and Permitting	8%	of	\$ 5,187,000	\$ 415,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 5,187,000	\$ 260,000
3	Construction Management	6%	of	\$ 5,187,000	\$ 312,000
Indirect Capital Subtotal					\$ 987,000
Total Direct + Indirect Capital Cost					\$ 6,174,000
Item No.	Operation and Maintenance Cost				
1	Fuel: Natural Gas (Thermal oxidizer)	12	mths	\$ 15,000	\$ 180,000
2	Electricity: (SVE Blower, Ozone Gen, misc electrical equip)	12	mths	\$ 12,000	\$ 144,000
3	SVE System Operation and Monitoring Labor	12	units	\$ 10,000	\$ 120,000
4	SVE Maintenance Materials and Expenses	12	mths	\$ 4,000	\$ 48,000
5	Chemicals: H2O2 (refer to note 5)	151	wells	\$ 4,000	\$ 604,000
6	ISCO Consultant Oversight	12	mths	\$ 10,000	\$ 120,000
7	SVE Vapor Treatment System Influent/Effluent Monitoring/Lab Costs	12	mths	\$ 8,000	\$ 96,000
8	SVE / ISCO Soil and Groundwater Monitoring/Sampling Analytical Lab Costs (semi annually)	2	rounds	\$ 80,000	\$ 160,000
9	Project Management/Consultant support/Reports	12	mths	\$ 8,000	\$ 96,000
10	Waste Disposal	12	mths	\$ 5,000	\$ 60,000
11	H&S/Air Monitoring	1	ls	\$ 8,000	\$ 8,000
12	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 8,000	\$ 96,000
SVE Annual Operation and Maintenance Subtotal					\$ 737,000
Present Worth of SVE Operation and Maintenance Costs (5%, 4 Years)					\$ 2,614,000
ISCO Annual Operation and Maintenance Subtotal					\$ 996,000
Present Worth of ISCO Operation and Maintenance Costs (5%, 2 Years)					\$ 1,852,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs					\$ 481,000
Contingency (40% of ISCO)					\$ 4,256,000
Total Capital and O&M Cost Present Worth					\$ 15,377,000

NOTES/ASSUMPTIONS

1. Assume 34 SVE wells with dual screens 15-30 and 30-50 feet bgs and 6 SVE sentry wells with 15-30 feet bgs screens.
2. Vapor treatment system uses thermal oxidizer, 1,000 scfm, positive displacement (PD) blower.
3. Assume SVE operation for 4 years.
4. ISCO uses 151 direct push injection wells, each well a cluster of four 3/4"-SS injection points screened at 4 depths between 40-80 feet bgs.
5. Assume injection of 4,000 gal of 20% H2O2 per well for 2 year treatment for total of 604,000 gal of H2O2.
6. Assume injection of 300 lbs of O3 per well for 2 year treatment for total of 45,000 lbs. of O3.
7. Assume ISCO treatment system operates continuously for 2-year treatment with a 70% up time equivalent to 511 days.

TABLE E.4-5
SOURCE AREA 11 - REMEDIAL ALTERNATIVE 6
IN-SITU SOIL HEATING AND SVE COST ESTIMATE
Soil and NAPL FS
Del Amo Superfund Site

Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost	
Direct Capital Costs					
1	Site Investigation/Delineation	1	ls	\$ 417,000	\$ 417,000
2	Mobilization/Demobilization	38,000	sf	\$ 1.5	\$ 57,000
3	Electrical Service/Hookup 12kV, 60A, 3Φ	2	ls	\$ 50,000	\$ 100,000
4	Site Preparation/Geophysical	38,000	sf	\$ 0.8	\$ 31,000
5	Transformers/Power Controls	2	ls	\$ 120,000	\$ 240,000
6	Electrode/Vapor Extraction Wells	99	ea	\$ 13,000	\$ 1,287,000
7	Vapor Extraction Wells - Sentry	6	ea	\$ 6,000	\$ 36,000
8	Monitoring Wells	17	ea	\$ 10,000	\$ 173,000
9	Temperature Monitoring Points/Thermocouples	19	ea	\$ 10,000	\$ 190,000
10	Well Headworks/Vault (24" traffic rated)	141	ea	\$ 3,000	\$ 424,000
11	Treatment System Installation and Startup (Vapor and Liquid)	1	ls	\$ 175,000	\$ 175,000
12	High Vac Blower + Thermal Oxidizer; 2,500 scfm	1	unit	\$ 160,000	\$ 160,000
13	Control and Instrumentation	1	ls	\$ 49,000	\$ 49,000
14	Condensed Water Treatment System, 10 gpm (HiPOx, LPGAC)	1	ls	\$ 210,000	\$ 210,000
15	Trenching, Piping, Cables, Backfill and Resurfacing	4,700	lf	\$ 50	\$ 235,000
16	Equipment Pad/Enclosure/Fence/Berms/Trailer	1	ea	\$ 50,000	\$ 50,000
17	PreTreatment Sampling+Analysis (Sampling during well installation)	1	ls	\$ 150,000	\$ 150,000
18	Post Treatment Sampling + Analysis	16	borings	\$ 5,000	\$ 80,000
Direct Capital Total				\$	4,064,000
Indirect Capital Costs					
1	Engineering, Design, and Permitting	8%	of	\$ 4,064,000	\$ 326,000
2	Project Management, Agency Reporting/Coordination	5%	of	\$ 4,064,000	\$ 204,000
3	Construction Management	6%	of	\$ 4,064,000	\$ 244,000
Indirect Capital Subtotal				\$	774,000
Total Direct + Indirect Capital Cost				\$	4,838,000
Operation and Maintenance Cost					
1	Electricity - ERH for soil heating	12	units	\$ 106,000	\$ 1,272,000
2	Electricity - SVE, HiPOx and misc elec equip	12	units	\$ 15,900	\$ 191,000
3	Operations & Maintenance	12	mths	\$ 30,000	\$ 360,000
4	Fuel: Natural Gas (Thermal Oxidizer)	12	mths	\$ 33,000	\$ 396,000
5	Liquid Phase Carbon	12	mths	\$ 4,000	\$ 48,000
6	Chemicals for water treatment: H2O2	12	mths	\$ 375	\$ 5,000
7	Labor - Groundwater/Vapor Treatment System Influent/Effluent Monitoring	12	mths	\$ 20,000	\$ 240,000
8	Project Management/Consultant Support/Reports	12	mths	\$ 15,000	\$ 180,000
9	Waste/NAPL/Water Disposal	12	mths	\$ 6,000	\$ 72,000
10	Health & Safety/Air Monitoring	12	mths	\$ 8,000	\$ 96,000
11	Miscellaneous: Equipment rentals, PID/FID	12	mths	\$ 10,000	\$ 120,000
SVE + ERH Annual Operation and Maintenance Subtotal				\$	2,980,000
Present Worth of SVE Operation and Maintenance Costs (5%, 2 Years)				\$	5,542,000
Present Worth of ICs + Monitoring (5%, 100 Years) Costs				\$	481,000
Contingency (40% of ERH)				\$	4,152,000
Total Capital and O&M Cost Present Worth				\$	15,013,000

NOTES/ASSUMPTIONS

1. Assume 99 electrode SVE wells with dual conductive interval 25-50 and 50-80 ft bgs, dual-completed SVE with 15-30 and 30-40 ft bgs screens.
2. Assume 6 SVE sentry wells with 15-30 feet bgs screens.
3. Vapor treatment system uses thermal oxidizer, 2,500 scfm, positive displacement (PD) blower.
4. Condensate treatment system designed to treat 10 gpm using APT's HiPOx (H2O2+O3) system and LPGAC with discharge to storm drain.
5. Assume ERH+SVE operation for 2 years.
6. Assume average power usage of 704,000 KWhr/month and total electrical energy of 17 million KWhr for soil heating.
7. Assume system heating time on average of 50% of days in year.
8. Power conditioning unit (transformer) assumed to be rented.