DRAFT EVALUATION REPORT
PILOT SOIL VAPOR EXTRACTION AND TREATMENT OPERABLE UNIT CARBON TETRACHLORIDE PLUME FORMER FORT ORD, CALIFORNIA

TOTAL ENVIRONMENTAL RESTORATION CONTRACT
CONTRACT NO. DACW05-96-D-0011

Submitted to:

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Revision C

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List of Acronyms and Abbreviations

3D	three-dimensional
Army	U.S. Department of the Army
bgs	below ground surface
cfm	cubic feet per minute
CT	Carbon Tetrachloride
CTP	Carbon Tetrachloride Plume
EPA	U.S. Environmental Protection Agency
FWV	Field Work Variance
GAC	granular activated carbon
OU	Operable Unit
ppb	parts per billion
ppbv	parts per billion by volume
SAP	Sampling and Analysis Plan
SVE	Soil Vapor Extraction
VOC	volatile organic compound

1.0 Introduction

This report describes the operation of a pilot soil vapor extraction (SVE) and treatment system that was installed to remediate vadose zone soils in a suspected source area for the Operable Unit Carbon Tetrachloride Plume (OU CTP) at former Fort Ord, Marina, California. This report was prepared for the U.S. Department of the Army (Army) by Shaw Environmental, Inc. (Shaw) under the Total Environmental Restoration Contract II No. DACW05-96-D-0011.

The pilot SVE was implemented because analytical results from soil gas and groundwater samples collected in the vicinity of Lexington Court and Ready Court suggested that a source of carbon tetrachloride (CT) was present in the vadose zone soils in this area (Mactec, 2004). These previous investigations showed that soil gas concentrations were higher in proximity to the water table than at shallow depths. The suspected source area for the OU CTP is located in the northern portion of former Fort Ord, generally south of the city of Marina and north of Imjin Parkway (Figure 1-1). Figure 1-2 shows the estimated concentration of CT prior to the operation of the pilot SVE.

The objectives for the pilot SVE were established in the *Final Work Plan and Sampling and Analysis Plan, Pilot Soil Vapor Extraction and Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, Marina, California* (Work Plan/SAP), (Shaw 2004a). The Work Plan/SAP has been provided as Appendix A. All field work variances (FWV) associated with this plan are additionally provided in Appendix A. The Army directed Shaw to design a mitigation that would:

- Provide source control for the CT groundwater plume, and
- Reduce or minimize potential for vapor intrusion into the nearby housing area.

As described in this report, Shaw installed three new SVE wells and converted two existing monitoring wells to extraction wells. The extraction wells were tied in via pipeline to a vapor treatment system installed in an unused garage at Lexington Court. The treatment system used granulated activated carbon (GAC) to remove CT and other volatile organic compounds (VOCs) from the extracted soil vapor. Sixteen new nested monitoring probes, plus three existing shallow probes, were used to monitor system performance. This report documents that the pilot SVE has been successful in removing CT and other VOCs that were contained in the vadose zone to non-detectable or low estimated concentrations below the reporting limits in a majority of the probes measured.

Prior to operation of the pilot SVE, Shaw conducted indoor air sampling at a building in Lexington Court (Photograph 1-1). The results showed that the concentrations of VOCs present in indoor air samples were within the range of background concentrations measured during ambient air monitoring activities conducted at various other locations at the former Fort Ord. These results suggested that even before the pilot SVE was operated the subsurface vapors from the

CT plume were not contributing to low-level VOC concentrations measured in indoor air. The potential for vapor emissions has been further reduced by operation of the pilot SVE. The indoor air sampling results are presented in the *Draft Final Report, March 2004 Indoor Air Sampling, Lexington Court, Former Fort Ord, California, Revision 0* (Shaw, 2004b).

2.0 Operations Summary

A chronology of the work conducted for the pilot SVE is presented in Table 2-1. Construction began on February 10, 2004. The pilot SVE was operated in two periods, from April 6 to June 14, 2004 (Phase I), and from September 9 to November 8, 2004 (Phase II).

Construction operations included the installation of three new pilot SVE wells and the conversion of two existing monitoring wells to extraction wells. The extraction wells were tied in via pipeline to the vapor treatment system installed in an unused garage at Lexington Court. Figure 2-1 shows the site layout, the location of the extraction wells, and the collection header system layout. The construction details for the extraction wells, wellheads, and vaults are shown in Figure 2-2. Twelve new nested monitoring probes and three existing shallow probes were used during Phase I to monitor system performance. Four additional monitoring probes were added prior to Phase II. Figure 2-1 shows the location of the monitoring probes. The construction and installation details for the monitoring probes are shown in Figure 2-3. Table 2-2 is a summary of completion depths of all wells and probes. Photographs 2-1 through 2-3 show construction of the wells, pipelines and vaults. Appendix B contains the well logs for installed wells.

The blower unit for the treatment system was located inside the garage at 6277 Lexington Court (Photograph 2-4). Soundproofing was added to reduce noise (Photograph 2-5). The treatment system used two 2000-pound GAC units to remove CT and other VOCs from the extracted soil vapor. These units were installed outside the garage within a security fence (Photograph 2-6).

System shakedown occurred in early April 2004. Phase I system operation started April 6, 2004. The system had some initial down time as adjustments were made to increase the operational efficiency. Sampling initially followed the schedule in the Work Plan/SAP (Shaw, 2004a). A significant reduction in the VOC concentrations was observed after initial results were received from the samples collected from the system, extraction wells, and probes. Based on this information, FWV TII-077 was implemented on May 18, 2004, in order to modify which probes and depths required sampling.

After a significant reduction in concentrations was observed in all sampling locations, which demonstrated the efficacy of the system, the pilot SVE was shut down on June 14, 2004. The monitoring data was evaluated to determine if additional operation was justified. While the system was shut down, four additional probes, approved by FWV TII-082, were installed to provide monitoring data to the north of the area originally evaluated. Also while the pilot SVE was shut down, three rounds of sampling were conducted in two probes to monitor for rebound.

Based on the monitoring data it was determined that the pilot SVE would be operated for an additional period. Phase II operation of the pilot SVE began on September 9, 2004, and concluded on November 8, 2004. A continued reduction of VOC concentrations in all sampling locations was observed during Phase II operations. The system was shut down on November 8, 2004, because influent CT concentrations had been reduced to an asymptotical low level [approximately 2 parts per billion (ppb)], and low concentrations were recorded in all the monitoring probes.

Following an informal data presentation to the regulatory agencies, the blower and GAC vessels were removed. The wells, pipelines and probes remain in place.

One final round of sampling occurred in May 2005 to confirm that there had been no significant changes in concentrations since the system was shutdown. No significant increases in VOC concentrations were observed.

3.0 *Pilot Soil Vapor Extraction System Operation*

As previously stated, the system began Phase I operations on April 6, 2004. Initially some adjustments had to be made to the system for optimal performance. In addition, throughout Phase I operations periodic maintenance was required on the generator that was used to power the pilot SVE, and the blower unit. The initial adjustments and maintenance reduced system performance only slightly. Phase I operations of the pilot SVE were shutdown on June 14, 2004.

Phase II operations began on September 9, 2004. Except for minor maintenance on the system, during Phase II the system operated at very close to 100 percent efficiency. Figure 3-1 presents the daily operating hours of the pilot SVE for both Phase I and II operations.

The following table provides an operating statistics summary for Phases I and II of the pilot SVE:

Phase I	System stopped 06/14/04
Total Available Hours Since Start (to 06/14/04 shutdown)	1704 (10.1 weeks)
Total Hours of Operation	1410.1 (8.4 weeks equivalent)
Percent Utilization (hours operated / Total available hours)	82.8%
Phase II	System stopped 11/08/04
Total Available Hours Since Start (09/09/04)	1464 (8.7 weeks)
Total Hours of Operation	1440.6 (8.6 weeks equivalent)
Percent Utilization (hours operated / Total available hours)	98.4%
Combined Phase I and II	
Total Available Hours for Operation Since Start (06/14/04)	3168 (18.8 weeks equivalent)*
Total hours of Operation (Phase I + Phase II)	2850.7 (17 weeks equivalent)
Percent Utilization (hours operated / Total available hours)	90%

**does not include shutdown between 6/14/04 and 9/9/04*

4.0 Pressure and Radius of Influence

Pressure measurements were taken at the extraction wells and monitoring probes following the schedule outlined in the work plan. Applied pressure and flow rate measurements were made on the extraction wells using a GEM-500™ Landfill Gas analyzer. More sensitive measurements of induced pressure at the probes were made using a Druck DPI 740, precision pressure indicator. Appendix C presents the completed field data forms for the measurements that were made of the system.

The measurements were made to confirm that the pilot SVE would meet the design objective for induced vacuum [0.1 in water column vacuum within the pre-pilot SVE 20 ppb CT contour]. Calculated flow rate at the system ranged from 680 to 790 cubic feet per minute (cfm). The average flow rate for both Phase I and II was approximately 760 cfm. The calculation used to determine flow rate is described in Section 7.0.

Figure 4-1 shows the measured vacuum contours in the deep probes (85 feet depth). Figure 4-2 shows the measured vacuum contours in the intermediate depth probes (60 feet). As can be seen from these figures, the design goal was generally achieved. The induced vacuums at the new probes (SGP-63, -64 and -65) installed to the north of the original probes were at or slightly below 0.1 in water column goal, indicating that the pilot SVE was less effective at these locations.

The effectiveness of the pilot SVE was confirmed by the results from monitoring probes presented in Section 5.0. Concentrations of VOCs were reduced to low levels in all the original probes installed in Phase I. Less reduction was observed in the probes installed in Phase II.

The flows of the extraction wells were maximized through Phase I operations, and most of Phase II operations. A summary of the measured flow rates is provided in Table 4-1. During October 2004, flow rates were reduced in extraction wells MW-BW-62-A, MW-BW-63-A, and MW-BW-70-A thus increasing the overall flows in MW-BW-68-A, and MW-BW-69-A. This was performed to focus the vapor extraction in areas that had higher remaining CT concentrations.

5.0 Volatile Organic Compound Analytical Results

Samples were collected from the treatment system [influent, between GAC beds (midstream), effluent], monitoring probes, and extraction wells. The chemicals of concern were four VOCs that had been detected in the soil gas and the underlying groundwater plume:

- Carbon Tetrachloride
- Chloroform
- Trichloroethene
- Tetrachloroethene

Samples were analyzed per the requirements of the Work Plan/SAP (presented in Appendix A). The samples were analyzed by U. S. Environmental Protection Agency (EPA) Method TO-15 (EPA, 1999a), which is a procedure for sampling and analysis of VOCs in gas. The VOCs are separated by gas chromatography and measured by a mass spectrometer or by multi-detector techniques. The method presents procedures for sampling into canisters to final pressures both above and below atmospheric pressure (respectively referred to as pressurized and sub-atmospheric pressure sampling). Analysis of samples was performed by Air Toxics Ltd., Folsom, California.

Data review was performed in accordance with the *Chemical Data Quality Management Plan, Former Fort Ord, California* (IT, 2001) and *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA, 1999b). All sample results from the sampling period were subjected to Level III data review, which comprises an evaluation of quality control summary results for sample holding times, initial and continuing calibrations, surrogates, laboratory duplicates, laboratory control samples, method blanks, and field duplicate samples.

A Level IV evaluation of the quality control summary forms as well as the raw data, to confirm sample quantitation and identification was performed on 11 percent (Phase I), 12 percent (Phase II), and 12 percent (Phase III additional sampling) of the VOCs by EPA Method TO-15. No results from either Phase I, II, or III required qualification based on the Level III/IV performed on the data. Data review was performed by Laboratory Data Consultants, Carlsbad, California.

5.1 Soil Vapor Extraction System Monitoring

Analytical results for Phase I and Phase II analysis of influent, midstream, and effluent results are presented in Table 5-1. Figure 5-1 shows the concentration of CT in the influent samples versus time. As can be seen from this plot, the concentration decays exponentially over time; the largest reductions were seen in the first weeks of operation. Figure 5-2 shows the concentration of the other VOCs measured in the influent versus time. The data demonstrates that these concentrations also decreased as the pilot SVE was operated. Figure 5-3 presents a plot of the extraction well CT concentration versus the total cumulative operation time of the pilot SVE.

Results for all VOCs in the midstream and effluent samples collected during Phase I and Phase II operation were non-detectable indicating no breakthrough.

5.2 Monitoring Probe and Extraction Well Monitoring

Analytical results for Phase I, II, and III analysis of the monitoring probes and extraction wells are presented in Tables 5-2A and 5-2B. All monitoring probe and extraction well concentrations decreased over time. The decrease in concentrations observed in monitoring probes correlates to the location of the probe relative to the extraction wells. The closer a probe was to the location of an extraction well, the more induced vacuum was created, and consequently the greater amount of VOCs that were removed from that location.

After Phase I operations were terminated on June 14, 2004, three rounds of additional probe sampling occurred over a period of 3 months in the deep probes of SGP-55 and SGP-62 to evaluate for potential rebound that might occur after the pilot SVE was shut down. Figure 5-4 presents a plot of the data for these two deep probes. As can be seen from the plot, there was a small concentration increase in both probes after Phase I operation shutdown.

Figures 5-5, 5-6, and 5-7 present the concentration of CT that was measured in the deep, intermediate and shallow monitoring probes. Figure 5-8 presents the CT results for samples collected from the near-surface monitoring probes. Figures 5-9, 5-10, and 5-11 present results for chloroform, trichloroethene, and tetrachloroethene in the deep monitoring probes.

Figure 5-12 presents the results from sampling SGP-66 located near Preston Drive approximately 1,200 feet north of the center of the SVE area. This probe was installed at a location where the CT concentration in groundwater has been observed to be approximately one order of magnitude higher than in the SVE area. There were no detectable VOCs in SGP-66.

An additional round of sampling was conducted in May 2005 to confirm that there had been no significant changes in concentrations since the system was shutdown. Table 5-3 presents the CT concentrations for all probes sampled during this period. In addition, the CT concentration measured during the previous round of sampling is presented. This data demonstrates that only minor variations (slightly positive or negative) in concentrations have occurred, and there is no evidence of any significant rebound over a 6-month period after the system was shut down in November 2004.

6.0 *Modeling of Volatile Organic Compound Results*

In order to obtain a more complete visualization of the CT vapor impacted soil volume, analytical results obtained from the extraction wells and monitoring probes were modeled using three-dimensional (3D) visualization software (Environmental Visualization System, developed by C Tech Development Corporation). The 3D visualization modeling also provided additional estimates of the mass of CT present in the subsurface (Section 7.0). Table 6-1 summarizes CT mass estimates prior to and after Phase I operation of the pilot SVE. In modeling the pre-Phase I volume of impacted soil some control points were required with an assigned concentration of 1 parts per billion by volume (ppbv) to constrain the interpolation/extrapolation of the soil volume. These were strategically located around the impacted soil volume to present the 1-pbbv contour. Post-Phase I modeling did not require control points because concentrations had been reduced significantly so that the 1-ppbv contour was delineated by existing sampling points. Figures 6-1 through 6-3 present horizontal slices through deep [80 feet below ground surface (bgs)], intermediate (50 feet bgs), and shallow (20 feet bgs) zones of the CT impacted soil volume. Figure 6-4 presents 3D vertical cross sections by combining Figures 6-1 through 6-3.

Three-dimensional visualization modeling was also used to examine possible correlation between the underlying CT groundwater plume and the soil vapor. Using the 3D modeling software the location of the center of mass of the CT impacted soil volume was calculated for 10-foot depth intervals. Figure 6-5 presents the results of the center of mass location calculations for the soil volume impacted at concentrations exceeding 1 ppbv and 20 ppbv. The center of mass shifts north for deeper intervals (90-100 and 100-110 feet bgs) by about 50 and 30 feet for the soil volumes exceeding 1 ppbv and 20 ppbv, respectively. In both cases, the center of mass also shifts from east to west by approximately 30 feet with increasing depth. The observed shift in the center of mass is consistent with a hypothesis that the impacted soil vapor was a source for contamination that entered the groundwater and then moved down gradient towards the north.

7.0 Contaminant Mass Removed by Soil Vapor Extraction

The amount of CT removed by the pilot SVE was calculated from influent analytical results, flow rates, and operation times. Figure 7-1 presents a plot of influent CT concentration versus cumulative operating hours showing the exponential decay equation used to calculate mass. Flow rate (cfm) was determined by the measurement of temperature, barometric pressure, pipe diameter, and pitot tube pressure at the pilot SVE and was calculated following the manufacturers guidelines presented in *Bulletin No. 11, Air Velocities with the Dwyer Pitot Tube* (Dwyer, 1992). These guidelines are provided as Appendix D.

Measurements were made periodically for these parameters at the system, and interpolated between data points. Figure 7-2 presents the cumulative mass of CT removed versus cumulative operating hours (for Phases I and II operations). By this methodology, the calculated mass of CT removed by the pilot SVE is approximately 0.73 pounds.

As stated in the previous section, 3D computer modeling of the monitoring probe results was used to determine the mass of CT contained in the soil vapor prior to pilot SVE operation. This calculation was made for the volume enclosed by the 1 ppb CT contour. The mass calculated by this methodology was 0.31 pounds CT. It would be expected that this method would yield a lower mass since the model was artificially truncated to the north of the pilot SVE due to the limited number of data points in that area.

8.0 Conclusions

As evidenced by the reduction in VOCs in the influent, monitoring probes, and extraction wells, the pilot SVE was very effective in removing VOCs, specifically CT from the soil gas.

The objectives for the pilot SVE were stated in the Work Plan/SAP as follows:

> *Implement a pilot mitigation that will:*
>
> – *Provide source control for the CT groundwater plume, and*
> – *Alleviate the potential for vapor intrusion into the nearby housing area.*
>
> *At the end of 3 months the effectiveness of the mitigation will be evaluated. If the system is efficiently removing CT, operation will continue at the discretion of the Army until either: a) cleanup levels have been attained, or b) removal of CT is low and continued operation is not cost effective.*

Evaluation of the pilot SVE results shows that these objectives were met:

- Remaining concentration VOCs above the groundwater are low, and will be addressed in the CT Remedial Investigation/Feasibility Study.
- Shallow soil concentrations are very low and are not a significant source for vapor intrusion.

9.0 References

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Shaw, 2004b, *Draft Final Report, March 2004 Indoor Air Sampling, Lexington Court, Former Fort Ord, California, Revision 0*

Tables

Table 2-1

Project Chronology

Date	Activity
02/10/04	Start of building modifications at 6277 Lexington Court
02/10/04	Start of piping installation (surveying, grubbing, etc.)
03/01/04	Start of drilling operation
03/05/04	Completion of drilling of new probes
03/23/04	Completion of security fence
03/29/04	Completion of modification to garage including sound walls
04/06/04	Installation of blowers and GAC units complete
03/25/04	Completion of piping installation
3/25 - 4/5/04	Baseline probe/extraction well sampling
04/06/04	System shakedown test
04/06/04	Phase I System startup
04/06/04	System sampling
04/07/04	System sampling
04/13/04	System sampling
04/16/04	System sampling
4/27 - 4/28/04	System/Probe/Extraction well sampling
05/18/04	Implementation of FWV 077 (Schedule change)
5/18 - 5/19/04	System/Probe/Extraction well sampling
06/14/04	System/Extraction well sampling
06/14/04	Phase I system shutdown
6/15 - 6/18/04	Probe sampling
07/02/04	Round I rebound sampling
07/20/04	Round II rebound sampling
08/04/04	Round III rebound sampling
08/06/04	Implementation of FWV 082 (New well installation)
9/1 - 9/2/04	Probe sampling (new baseline)
09/02/04	Installation of 4 new probes completed (63,64,65, & 66)
09/09/04	Phase II system startup
09/09/04	System sampling
09/12/04	Implementation of FWV 084 (revised operation and sampling schedule)
09/23/04	Probe/System sampling
10/07/04	Probe/System sampling
10/14/04	Probe sampling
10/23/04	Probe sampling
11/08/04	Extraction Well/System sampling
11/08/04	Phase II system shutdown
05/09/05	Implementation of FWV 093 (Additional sampling)
5/24 - 5/25/05	Probe sampling

Table 2-2

SVE Extraction Wells and Probes
Summary of Completion Depths

Probe/Well Identification	Date Completed	Probe Type	Completion Depth (feet) BGS[1]	Top of Screen (feet) BGS	Bottom of Screen (feet) BGS
CTP-SGP-51	3/1/2004	Shallow	86	24	26
CTP-SGP-51	3/1/2004	Intermediate	86	54	59
CTP-SGP-51	3/1/2004	Deep	86	79	84
CTP-SGP-52	3/2/2004	Shallow	86	24	30
CTP-SGP-52	3/2/2004	Intermediate	86	54	58
CTP-SGP-52	3/2/2004	Deep	86	79	84
CTP-SGP-53	3/4/2004	Shallow	86	24	29
CTP-SGP-53	3/4/2004	Intermediate	86	54	60
CTP-SGP-53	3/4/2004	Deep	86	80	85
CTP-SGP-54	3/4/2004	Shallow	86	25	30
CTP-SGP-54	3/4/2004	Intermediate	86	55	60
CTP-SGP-54	3/4/2004	Deep	86	80	85
CTP-SGP-55	3/4/2004	Shallow	86	25	30
CTP-SGP-55	3/4/2004	Intermediate	86	55	60
CTP-SGP-55	3/4/2004	Deep	86	80	84
CTP-SGP-56	3/3/2004	Shallow	86	25	29
CTP-SGP-56	3/3/2004	Intermediate	86	55	60
CTP-SGP-56	3/3/2004	Deep	86	80	85
CTP-SGP-57	3/2/2004	Shallow	86	25	30
CTP-SGP-57	3/2/2004	Intermediate	86	55	59
CTP-SGP-57	3/2/2004	Deep	86	80	84
CTP-SGP-58	3/2/2004	Shallow	86	25	29
CTP-SGP-58	3/2/2004	Intermediate	86	55	59
CTP-SGP-58	3/2/2004	Deep	86	80	84
CTP-SGP-59	3/1/2004	Shallow	86	24	30
CTP-SGP-59	3/1/2004	Intermediate	86	54	60
CTP-SGP-59	3/1/2004	Deep	86	80	84
CTP-SGP-60	3/5/2004	Shallow	86	25	30
CTP-SGP-60	3/5/2004	Intermediate	86	55	60
CTP-SGP-60	3/5/2004	Deep	86	80	85
CTP-SGP-61	3/3/2004	Shallow	86	25	29
CTP-SGP-61	3/3/2004	Intermediate	86	55	60
CTP-SGP-61	3/3/2004	Deep	86	80	84
CTP-SGP-62	3/5/2004	Shallow	86	24	28
CTP-SGP-62	3/5/2004	Intermediate	86	54	60
CTP-SGP-62	3/5/2004	Deep	86	79	84
MW-BW-68-A	3/1/2004	Extraction Well	92	60	90
MW-BW-69-A	3/2/2004	Extraction Well	92	60	89
MW-BW-70-A	3/1/2004	Extraction Well	92	60	90
MW-BW-62-A[2]	5/29/2003	Extraction Well	128	57.5	89.5
MW-BW-63-A[2]	6/3/2003	Extraction Well	128	57.5	87.5

[1]Below ground surface

[2]Probe is dual screened; upper screened interval is presented. The lower screened interval extends into the groundwater (approximately 98' bgs), however there is small part of this section (approximately 5-10 feet) that is above the groundwater.

Table 4-1
Extraction Well Flow Rates

Extraction Well[1]	4/7/2004	4/12/2004	4/13/2004	4/14/2004	4/15/2004	4/16/2004	4/22/2004	4/29/2004	6/3/2004	9/14/2004	10/7/2004	10/14/2004	11/2/2004
MW-BW-62-A	183	190	190	195	175	194	189	183	177	182	177	176	100
MW-BW-63-A	155	145	149	153	151	153	151	144	134	133	129	166	57
MW-BW-68-A	175	161	163	161	160	132	155	152	152	152	149	145	236
MW-BW-69-A	168	168	166	166	168	156	169	160	162	155	155	157	228
MW-BW-70-A	127	130	131	128	126	122	114	118	110	120	110	108	96

Notes

[1] Flow rate at extraction wells was measured using a GEM-500™ LFG analyzer

Table 5-1

Analytical Results
Carbon Tetrachloride Soil Vapor Extraction System

Location:	**INFLUENT**	**BETWEEN GAC BEDS**	**EFFLUENT**	**INFLUENT**	**EFFLUENT**	**INFLUENT**	**EFFLUENT**	**INFLUENT**	**EFFLUENT**	**INFLUENT**
Sample Number:	CTP-INF-056	CTP-MID-057	CTP-EFF-058	CTP-INF-059	CTP-EFF-060	CTP-INF-061	CTP-EFF-062	CTP-INF-063	CTP-EFF-064	CTP-INF-065
Date Collected:	4/6/2004	4/6/2004	4/6/2004	4/7/2004	4/7/2004	4/13/2004	4/13/2004	4/16/2004	4/16/2004	4/27/2004
Sample Delivery Group:	0404115	0404115	0404115	0404178	0404178	0404236	0404236	0404344	0404344	0404552
Result Units:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Chloroform, (TO-15)	8.5	<0.82[1]	<0.84	7.3	<0.76	6.8	<0.79	6.2	<0.79	4.0
Carbon Tetrachloride, (TO-15)	180	<0.82	<0.84	150	<0.76	110	<0.79	85	<0.79	24
Trichloroethene, (TO-15)	7.4	<0.82	<0.84	5.6	<0.76	4.2	<0.79	3.8	<0.79	1.0
Tetrachloroethene, (TO-15)	10	<0.82	<0.84	7.8	<0.76	6.6	<0.79	6.9	<0.79	2.5

Table 5-1

Analytical Results
Carbon Tetrachloride Soil Vapor Extraction System

Location:	**EFFLUENT**	**INFLUENT**	**INFLUENT**	**BETWEEN GAC BEDS**	**EFFLUENT**	**INFLUENT**	**BETWEEN GAC BEDS**	**EFFLUENT**	**INFLUENT**	**INFLUENT**
Sample Number:	CTP-EFF-066	CTP-INF-082	CTP-INF-107	CTP-MID-108	CTP-EFF-109	CTP-INF-181	CTP-MID-182	CTP-EFF-183	CTP-INF-192	CTP-INF-193
Date Collected:	4/27/2004	5/18/2004	6/14/2004	6/14/2004	6/14/2004	9/9/2004	9/9/2004	9/9/2004	9/23/2004	9/23/2004
Sample Delivery Group:	0404552	0405368	0406376	0406376	0406376	0409255	0409255	0409255	0409506	0409506
Result Units:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Chloroform, (TO-15)	<0.76	4.1	4.2	<0.80	<0.80	3.4	<0.80	<0.80	3.9	4.0
Carbon Tetrachloride, (TO-15)	<0.76	7.8	4.7	<0.80	<0.80	5.9	<0.80	<0.80	4.0	4.0
Trichloroethene, (TO-15)	<0.76	0.46J[2]	0.32J	<0.80	<0.80	0.50J	<0.80	<0.80	0.38J	<0.79
Tetrachloroethene, (TO-15)	<0.76	1.8	1.2	<0.80	<0.80	1.5	<0.80	<0.80	1.3	1.2

Table 5-1

Analytical Results
Carbon Tetrachloride Soil Vapor Extraction System

Location:	EFFLUENT	INFLUENT	INFLUENT	BETWEEN GAC BEDS	EFFLUENT
Sample Number:	CTP-EFF-194	CTP-INF-200	CTP-INF-207	CTP-MID-208	CTP-EFF-209
Date Collected:	9/23/2004	10/7/2004	11/8/2004	11/8/2004	11/8/2004
Sample Delivery Group:	0409506	0410171	0411172	0411172	0411172
Result Units:	PPBV	PPBV	PPBV	PPBV	PPBV
	Result	Result	Result	Result	Result
Chloroform, (TO-15)	<0.80	2.7	2.1	1.0	<0.84
Carbon Tetrachloride, (TO-15)	<0.80	2.1	1.9	<0.82	<0.84
Trichloroethene, (TO-15)	<0.80	0.14J	<0.82	<0.82	<0.84
Tetrachloroethene, (TO-15)	<0.80	0.71J	0.51J	<0.82	<0.84

Notes:

[1] Non-detectable to the reporting limit specified.

[2] Estimated concentration lower then the reporting limit, and greater then the method detection limit

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-35**	**CTP-SGP-35**	**CTP-SGP-37**	**CTP-SGP-37**	**CTP-SGP-37**	**CTP-SGP-37**	**CTP-SGP-40**	**CTP-SGP-41**	**CTP-SGP-42**	**CTP-SGP-44**	**CTP-SGP-45**
SAMPLE NUMBER:	CTP-35-047	CTP-35-157	CTP-37-048	CTP-37-074	CTP-37-155	CTP-37-156	CTP-40-238	CTP-41-241	CTP-42-240	CTP-44-239	CTP-45-243
SAMPLE DATE	3/31/2004	6/18/2004	3/31/2004	4/28/2004	6/18/2004	6/18/2004	11/23/2004	11/23/2004	11/23/2004	11/23/2004	11/23/2004
DEPTH OF PROBE:	6	6	6	6	6	6	6	6	6	6	6
PURPOSE:	REG	REG	REG	REG	PRIMARY[4]	FIELD DUP[5]	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.44J[2]	0.080J	1.1	0.26J	0.070J	0.068J	<0.74	0.17J	0.27J	0.58J	0.32J
CARBON TETRACHLORIDE, (TO-15)	8.2	0.54J	13	<0.79	0.093J	0.10J	<0.74	<0.79	<0.74	<0.78	<0.78
TRICHLOROETHENE, (TO-15)	<0.80[3]	0.15J	<0.82	2.4	0.17J	0.18J	<0.74	<0.79	<0.74	<0.78	<0.78
TETRACHLOROETHENE, (TO-15)	0.54J	0.12J	0.70J	4.0	0.035J	0.16J	0.21J	<0.79	<0.74	<0.78	<0.78
ACETONE[1], (TO-15)	1.5J	--	1.4J	--	--	--	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-48**	**CTP-SGP-48**	**CTP-SGP-48**	**CTP-SGP-49**	**CTP-SGP-49**	**CTP-SGP-50**	**CTP-SGP-50**	**CTP-SGP-50**	**CTP-SGP-51**	**CTP-SGP-51**	**CTP-SGP-51**
SAMPLE NUMBER:	CTP-48-049	CTP-48-073	CTP-48-154	CTP-49-075	CTP-49-158	CTP-50-072	CTP-50-153	CTP-50-269	CTP-51-031	CTP-51-032	CTP-51-033
SAMPLE DATE	3/31/2004	4/28/2004	6/18/2004	4/28/2004	6/18/2004	4/28/2004	6/18/2004	5/25/2005	3/30/2004	3/30/2004	3/30/2004
DEPTH OF PROBE:	6	6	6	6	6	6	6	6	30	60	85
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	SHALLOW	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	3.5	0.49J	0.65J	<0.79	<0.82	0.26J	0.23J	<0.82	0.28J	0.63J	1
CARBON TETRACHLORIDE, (TO-15)	11	0.28J	0.21J	0.17J	0.22J	0.20J	0.13J	<0.82	7.2	22	31
TRICHLOROETHENE, (TO-15)	<0.84	<0.79	<0.82	<0.79	<0.82	<0.78	0.069J	<0.82	<0.80	<0.82	0.41J
TETRACHLOROETHENE, (TO-15)	0.46J	<0.79	0.064J	<0.79	0.070J	<0.78	0.079J	<0.82	0.18J	0.53J	0.72J
ACETONE[1], (TO-15)	1.5J	--	--	--	--	--	--	--	3.7	1.5J	1.1J

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-51**	**CTP-SGP-51**	**CTP-SGP-51**	**CTP-SGP-51**	**CTP-SGP-51**	**CTP-SGP-51**	**CTP-SGP-51**	**CTP-SGP-51**	**CTP-SGP-51**	**CTP-SGP-52**	**CTP-SGP-52**
SAMPLE NUMBER:	CTP-51-092	CTP-51-093	CTP-51-127	CTP-51-128	CTP-51-129	CTP-51-228	CTP-51-229	CTP-51-255	CTP-51-256	CTP-52-044	CTP-52-046
SAMPLE DATE	5/18/2004	5/18/2004	6/16/2004	6/16/2004	6/16/2004	11/22/2004	11/22/2004	5/24/2005	5/24/2005	3/31/2004	3/31/2004
DEPTH OF PROBE:	30	85	30	60	85	30	85	30	85	30	60
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.34J	0.33J	0.17J	0.12J	0.24J	<0.80	0.18J	<0.80	<0.79	2.7	5.4
CARBON TETRACHLORIDE, (TO-15)	0.091J	1.0	0.082J	0.084J	0.55J	<0.80	0.27J	<0.80	0.66J	39	180
TRICHLOROETHENE, (TO-15)	<0.80	<0.79	<0.84	0.089J	0.15J	<0.80	<0.79	<0.80	<0.79	0.16J	0.52J
TETRACHLOROETHENE, (TO-15)	<0.80	<0.79	<0.84	0.048J	0.076J	<0.80	<0.79	<0.80	<0.79	0.95	3.1
ACETONE[1], (TO-15)	--	--	--	--	--	--	--	--	--	6.7	8.5

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-52**	**CTP-SGP-52**	**CTP-SGP-52**	**CTP-SGP-52**	**CTP-SGP-52**	**CTP-SGP-52**	**CTP-SGP-52**	**CTP-SGP-52**	**CTP-SGP-52**	**CTP-SGP-52**	**CTP-SGP-52**
SAMPLE NUMBER:	CTP-52-045	CTP-52-094	CTP-52-095	CTP-52-130	CTP-52-131	CTP-52-132	CTP-52-133	CTP-52-176	CTP-52-188	CTP-52-230	CTP-52-231
SAMPLE DATE	3/31/2004	5/19/2004	5/19/2004	6/16/2004	6/16/2004	6/16/2004	6/16/2004	9/2/2004	9/23/2004	11/22/2004	11/22/2004
DEPTH OF PROBE:	85	30	85	30	60	85	85	85	85	30	85
PURPOSE:	REG	REG	REG	REG	REG	PRIMARY	FIELD DUP	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	8.8	1.4	2.8	0.64J	2.2	1.9	2.0	1.8	2.1	0.27J	2.5
CARBON TETRACHLORIDE, (TO-15)	290	0.43J	10	0.18J	0.68J	2.9	3.4	5.6	2.7	0.14J	0.62J
TRICHLOROETHENE, (TO-15)	0.95	<0.80	<0.80	<0.82	0.28J	0.14J	<0.76	<0.82	<0.76	<0.80	<0.79
TETRACHLOROETHENE, (TO-15)	5.2	0.21J	<0.80	0.14J	0.29J	0.28J	0.28J	0.44J	0.28J	<0.80	<0.79
ACETONE[1], (TO-15)	8.8	--	--	--	--	--	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	CTP-SGP-52	CTP-SGP-52	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53
SAMPLE NUMBER:	CTP-52-253	CTP-52-254	CTP-53-040	CTP-53-041	CTP-53-042	CTP-53-043	CTP-53-090	CTP-53-091	CTP-53-134	CTP-53-135	CTP-53-136
SAMPLE DATE	5/24/2005	5/24/2005	3/31/2004	3/31/2004	3/31/2004	3/31/2004	5/18/2004	5/18/2004	6/16/2004	6/16/2004	6/16/2004
DEPTH OF PROBE:	30	85	30	60	85	85	30	85	30	60	85
PURPOSE:	REG	REG	REG	REG	PRIMARY	FIELD DUP	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.62J	2.0	3.5	5.1	5	5.5	0.88	4.0	0.94	9.1	3.8
CARBON TETRACHLORIDE, (TO-15)	0.32J	5.0	24	64	70	78	0.18J	27	<0.84	0.22J	16
TRICHLOROETHENE, (TO-15)	<0.79	<0.80	0.24J	0.35J	0.19J	0.20J	<0.80	<0.80	<0.84	<0.86	<0.86
TETRACHLOROETHENE, (TO-15)	<0.79	0.42J	0.74J	1.7	1.8	2.1	<0.80	0.84	<0.84	<0.86	0.53J
ACETONE[1], (TO-15)	--	--	25	110	8.8	5.2	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-53	CTP-SGP-54	CTP-SGP-54	CTP-SGP-54	CTP-SGP-54	CTP-SGP-54
SAMPLE NUMBER:	CTP-53-175	CTP-53-187	CTP-53-232	CTP-53-233	CTP-53-251	CTP-53-252	CTP-54-037	CTP-54-038	CTP-54-039	CTP-54-088	CTP-54-089
SAMPLE DATE	9/2/2004	9/23/2004	11/22/2004	11/22/2004	5/24/2005	5/24/2005	3/31/2004	3/31/2004	3/31/2004	5/18/2004	5/18/2004
DEPTH OF PROBE:	85	85	30	85	30	85	30	60	85	30	85
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	4.4	4.5	1.2	2.9	2.8	2.2	2.3	4	5	1.2	1.2
CARBON TETRACHLORIDE, (TO-15)	12	14	0.11J	6.8	0.79	5.2	8.2	41	57	<0.80	3.2
TRICHLOROETHENE, (TO-15)	<0.80	<0.73	<0.79	<0.79	<0.78	<0.78	<0.80	<0.79	<0.80	<0.80	<0.79
TETRACHLOROETHENE, (TO-15)	0.49J	0.54J	<0.79	0.24J	<0.78	0.34J	1.8	3.9	4.8	0.30J	3.8
ACETONE[1], (TO-15)	--	--	--	--	--	--	78	17	71	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	CTP-SGP-54	CTP-SGP-54	CTP-SGP-54	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55
SAMPLE NUMBER:	CTP-54-137	CTP-54-138	CTP-54-139	CTP-55-028	CTP-55-029	CTP-55-030	CTP-55-140	CTP-55-141	CTP-55-142	CTP-55-143	CTP-55-160
SAMPLE DATE	6/16/2004	6/16/2004	6/16/2004	3/30/2004	3/30/2004	3/30/2004	6/17/2004	6/17/2004	6/17/2004	6/17/2004	7/2/2004
DEPTH OF PROBE:	30	60	85	30	60	85	30	30	60	85	85
PURPOSE:	REG	REG	REG	REG	REG	REG	PRIMARY	FIELD DUP	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	1.1	1.6	0.86	2.6	7.6	10	0.49J	0.40J	0.77J	4.6	6.3
CARBON TETRACHLORIDE, (TO-15)	<0.82	0.22J	2.2	47	140	180	0.18J	<0.86	<0.86	24	37
TRICHLOROETHENE, (TO-15)	<0.82	<0.84	<0.82	0.80J	3.2	4.3	<0.84	0.56J	<0.86	0.78J	1.2
TETRACHLOROETHENE, (TO-15)	<0.82	2.4	2.8	2.6	6.9	8.5	<0.84	<0.86	0.22J	3.1	4.3
ACETONE[1], (TO-15)	--	--	--	7.4	15	3.7	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55	CTP-SGP-55
SAMPLE NUMBER:	CTP-55-162	CTP-55-163	CTP-55-179	CTP-55-180	CTP-55-184	CTP-55-197	CTP-55-203	CTP-55-234	CTP-55-235	CTP-55-263	CTP-55-264
SAMPLE DATE	7/20/2004	8/4/2004	9/2/2004	9/2/2004	9/23/2004	10/7/2004	10/14/2004	11/22/2004	11/22/2004	5/25/2005	5/25/2005
DEPTH OF PROBE:	85	85	85	85	85	85	85	30	85	30	85
PURPOSE:	REG	REG	PRIMARY	FIELD DUP	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	6.2	6.2	4.9	5.1	4.3	1.8	3.5	1.2	3.3	0.67J	2.6
CARBON TETRACHLORIDE, (TO-15)	37	35	25	26	20	6.7	11	0.14J	9.2	0.63J	8.2
TRICHLOROETHENE, (TO-15)	1.3	1.3	0.94	1.0	0.69J	<0.80	0.35J	<0.79	0.33J	<0.86	0.55J
TETRACHLOROETHENE, (TO-15)	4.5	4.8	3.5	3.5	3.4	1.1	2.7	0.22J	2.2	<0.86	2.1
ACETONE[1], (TO-15)	--	--	--	--	--	--	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**
SAMPLE NUMBER:	CTP-56-025	CTP-56-026	CTP-56-027	CTP-56-096	CTP-56-097	CTP-56-144	CTP-56-145	CTP-56-146	CTP-56-178	CTP-56-185	CTP-56-198
SAMPLE DATE	3/30/2004	3/30/2004	3/30/2004	5/19/2004	5/19/2004	6/17/2004	6/17/2004	6/17/2004	9/2/2004	9/23/2004	10/7/2004
DEPTH OF PROBE:	30	60	85	30	85	30	60	85	85	85	85
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	PRIMARY
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.9	2.9	3.8	5.8	3.6	0.20J	0.19J	2.1	2.0	2.0	1.8
CARBON TETRACHLORIDE, (TO-15)	16	59	77	0.13J	27	<0.84	<0.84	10	9.0	9.4	6.7
TRICHLOROETHENE, (TO-15)	<0.86	1.2	1.2	<0.80	2.5	<0.84	<0.84	0.33J	<0.82	0.46J	0.18J
TETRACHLOROETHENE, (TO-15)	1.4	4.6	6.4	<0.80	0.55J	<0.84	0.17J	1.3	1.4	1.3	1
ACETONE[1], (TO-15)	3.4	12	6	--	--	--	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-56**	**CTP-SGP-57**	**CTP-SGP-57**	**CTP-SGP-57**	**CTP-SGP-57**	**CTP-SGP-57**
SAMPLE NUMBER:	CTP-56-199	CTP-56-204	CTP-56-236	CTP-56-237	CTP-56-267	CTP-56-268	CTP-57-022	CTP-57-023	CTP-57-024	CTP-57-098	CTP-57-099
SAMPLE DATE	10/7/2004	10/14/2004	11/22/2004	11/22/2004	5/25/2005	5/25/2005	3/29/2004	3/29/2004	3/29/2004	5/19/2004	5/19/2004
DEPTH OF PROBE:	85	85	30	85	30	85	30	60	85	30	85
PURPOSE:	FIELD DUP	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	2.8	2.2	0.23J	1.7	<0.84	1.1	6.6	4.6	4.2	1.1	4.2
CARBON TETRACHLORIDE, (TO-15)	9.4	7.2	<0.78	4.4	<0.84	3.8	5.3	51	58	0.10J	4.4
TRICHLOROETHENE, (TO-15)	0.33J	<0.82	<0.78	<0.78	<0.84	<0.79	<0.84	0.8	1.3	<0.78	<0.80
TETRACHLOROETHENE, (TO-15)	2.2	1.2	<0.78	0.87	<0.84	0.96	5.3	35	39	0.43J	36
ACETONE[1], (TO-15)	--	--	--	--	--	--	7.5	14	3.3	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	CTP-SGP-57	CTP-SGP-57	CTP-SGP-57	CTP-SGP-58	CTP-SGP-58	CTP-SGP-58	CTP-SGP-58	CTP-SGP-58	CTP-SGP-58	CTP-SGP-58	CTP-SGP-58
SAMPLE NUMBER:	CTP-57-150	CTP-57-151	CTP-57-152	CTP-58-019	CTP-58-020	CTP-58-021	CTP-58-102	CTP-58-103	CTP-58-118	CTP-58-119	CTP-58-120
SAMPLE DATE	6/17/2004	6/17/2004	6/17/2004	3/29/2004	3/29/2004	3/29/2004	5/19/2004	5/19/2004	6/15/2004	6/15/2004	6/15/2004
DEPTH OF PROBE:	30	60	85	30	60	85	30	85	30	60	85
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	2.1	19	3.6	0.76J	1.8	2.4	<0.78	1.0	0.83J	<0.84	0.80J
CARBON TETRACHLORIDE, (TO-15)	0.10J	0.084J	1.6	19	35	43	0.12J	0.54J	0.090J	0.13J	0.26J
TRICHLOROETHENE, (TO-15)	0.12J	0.18J	0.084J	0.69J	2.1	3.3	<0.78	<0.78	<0.84	<0.84	<0.86
TETRACHLOROETHENE, (TO-15)	0.37J	0.36J	24	9.6	19	26	<0.78	12	<0.84	0.63J	6.8
ACETONE[1], (TO-15)	--	--	--	26	25	2.6J	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	CTP-SGP-58	CTP-SGP-58	CTP-SGP-58	CTP-SGP-58	CTP-SGP-59	CTP-SGP-59	CTP-SGP-59	CTP-SGP-59	CTP-SGP-59	CTP-SGP-59	CTP-SGP-59
SAMPLE NUMBER:	CTP-58-224	CTP-58-225	CTP-58-257	CTP-58-258	CTP-59-010	CTP-59-011	CTP-59-012	CTP-59-100	CTP-59-101	CTP-59-121	CTP-59-122
SAMPLE DATE	11/18/2004	11/18/2004	5/24/2005	5/24/2005	3/25/2004	3/25/2004	3/25/2004	5/19/2004	5/19/2004	6/15/2004	6/15/2004
DEPTH OF PROBE:	60	85	30	85	30	60	85	30	85	30	60
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.29J	0.40J	0.32J	0.31J	0.95	3.2	3.9	<0.78	2.1	<0.82	0.99
CARBON TETRACHLORIDE, (TO-15)	<0.86	<0.76	<0.80	<0.82	7.4	28	30	0.086J	2.7	0.12J	0.25J
TRICHLOROETHENE, (TO-15)	<0.86	<0.76	<0.80	<0.82	3.8	9.6	10	0.30J	2.0	<0.82	1.0
TETRACHLOROETHENE, (TO-15)	<0.86	3.6	6.9	4.6	0.75J	2.7	3.1	<0.78	0.74J	<0.82	0.22J
ACETONE[1], (TO-15)	--	--	--	--	30	14	6.5	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	CTP-SGP-59	CTP-SGP-59	CTP-SGP-59	CTP-SGP-59	CTP-SGP-59	CTP-SGP-60	CTP-SGP-60	CTP-SGP-60	CTP-SGP-60	CTP-SGP-60	CTP-SGP-60
SAMPLE NUMBER:	CTP-59-123	CTP-59-222	CTP-59-223	CTP-59-259	CTP-59-260	CTP-60-013	CTP-60-014	CTP-60-015	CTP-60-104	CTP-60-105	CTP-60-106
SAMPLE DATE	6/15/2004	11/18/2004	11/18/2004	5/24/2005	5/24/2005	3/29/2004	3/29/2004	3/29/2004	5/19/2004	5/19/2004	5/19/2004
DEPTH OF PROBE:	85	30	85	30	85	30	60	85	30	85	85
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	PRIMARY	FIELD DUP
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	1.7	0.40J	1.1	0.25J	0.92	0.73J	2	2.9	0.63J	0.95	1.0
CARBON TETRACHLORIDE, (TO-15)	1.4	0.076J	0.47J	<0.80	0.44J	10	26	35	0.20J	1.5	1.6
TRICHLOROETHENE, (TO-15)	1.4	0.30J	0.65J	1.3	1.5	0.34J	1.5	2.6	<0.79	0.21J	0.16J
TETRACHLOROETHENE, (TO-15)	0.57J	<0.72	0.35J	<0.80	0.37J	0.46J	1.1	1.4	<0.79	0.54J	0.45J
ACETONE[1], (TO-15)	--	--	--	--	--	40	13	24	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	CTP-SGP-60	CTP-SGP-60	CTP-SGP-60	CTP-SGP-60	CTP-SGP-60	CTP-SGP-60	CTP-SGP-60	CTP-SGP-61	CTP-SGP-61	CTP-SGP-61	CTP-SGP-61
SAMPLE NUMBER:	CTP-60-124	CTP-60-125	CTP-60-126	CTP-60-226	CTP-60-227	CTP-60-261	CTP-60-262	CTP-61-016	CTP-61-017	CTP-61-018	CTP-61-076
SAMPLE DATE	6/15/2004	6/15/2004	6/15/2004	11/18/2004	11/18/2004	5/24/2005	5/24/2005	3/29/2004	3/29/2004	3/29/2004	4/28/2004
DEPTH OF PROBE:	30	60	85	30	85	30	85	30	60	85	30
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	PERIMETER	INTERIOR	INTERIOR	INTERIOR	INTERIOR
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.28J	0.41J	0.66J	0.34J	0.27J	0.30J	0.52J	1.1	9.8	8.2	4.7
CARBON TETRACHLORIDE, (TO-15)	0.13J	0.093J	0.68J	<0.74	0.36J	<0.80	0.78J	26	200	180	11
TRICHLOROETHENE, (TO-15)	<0.84	<0.82	0.45	<0.74	<0.76	<0.80	<0.82	0.93	13	11	2.8
TETRACHLOROETHENE, (TO-15)	<0.84	<0.82	0.15	<0.74	<0.76	<0.80	<0.82	2.6	16	14	9.4
ACETONE[1], (TO-15)	--	--	--	--	--	--	--	6.1	56	15	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-61**	**CTP-SGP-61**	**CTP-SGP-61**	**CTP-SGP-61**	**CTP-SGP-61**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**
SAMPLE NUMBER:	CTP-61-077	CTP-61-078	CTP-61-115	CTP-61-116	CTP-61-117	CTP-62-034	CTP-62-035	CTP-62-036	CTP-62-079	CTP-62-080	CTP-62-081
SAMPLE DATE	4/28/2004	4/28/2004	6/15/2004	6/15/2004	6/15/2004	3/30/2004	3/30/2004	3/30/2004	4/28/2004	4/28/2004	4/28/2004
DEPTH OF PROBE:	60	85	30	60	85	30	60	85	30	60	85
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.48J	2.4	0.40J	0.37J	0.15J	6.2	10	11	0.36J	3.5	8.6
CARBON TETRACHLORIDE, (TO-15)	0.46J	1.7	0.12J	0.32J	0.20J	67	230	260	0.44J	1.2	31
TRICHLOROETHENE, (TO-15)	<0.80	0.65J	0.32J	<0.84	<0.84	0.56J	3.7	5.2	<0.80	<0.82	1.4
TETRACHLOROETHENE, (TO-15)	0.26J	1.9	<0.84	1.1	0.20J	2.4	7	8	0.40J	0.68J	2.8
ACETONE[1], (TO-15)	--	--	--	--	--	2.7J	21	4.7	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-62**	**CTP-SGP-63**
SAMPLE NUMBER:	CTP-62-147	CTP-62-148	CTP-62-149	CTP-62-159	CTP-62-161	CTP-62-164	CTP-62-177	CTP-62-186	CTP-62-265	CTP-62-266	CTP-63-172
SAMPLE DATE	6/17/2004	6/17/2004	6/17/2004	7/2/2004	7/20/2004	8/4/2004	9/2/2004	9/23/2004	5/25/2005	5/25/2005	9/2/2004
DEPTH OF PROBE:	30	60	85	85	85	85	85	85	30	85	30
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	INTERIOR	NEW PROBE
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.61J	0.81J	1.2	1.7	2.3	2.8	2.9	2.5	3.7	2.5	0.12J
CARBON TETRACHLORIDE, (TO-15)	0.27J	0.35J	0.63J	3.5	7.6	10	11	0.68J	0.70J	3.1	1.1
TRICHLOROETHENE, (TO-15)	0.071J	0.098J	0.39J	0.46J	0.44J	<0.74	0.78J	<0.76	<0.86	0.36J	<0.79
TETRACHLOROETHENE, (TO-15)	0.19J	0.26J	0.40J	0.51J	0.70J	1.1	0.90	0.37J	<0.86	0.83J	<0.79
ACETONE[1], (TO-15)	--	--	--	--	--	--	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-63**	**CTP-SGP-63**	**CTP-SGP-63**	**CTP-SGP-63**	**CTP-SGP-63**	**CTP-SGP-63**	**CTP-SGP-63**	**CTP-SGP-63**	**CTP-SGP-63**	**CTP-SGP-63**	**CTP-SGP-64**
SAMPLE NUMBER:	CTP-63-173	CTP-63-174	CTP-63-189	CTP-63-195	CTP-63-201	CTP-63-205	CTP-63-215	CTP-63-216	CTP-63-244	CTP-63-245	CTP-64-165
SAMPLE DATE	9/2/2004	9/2/2004	9/23/2004	10/7/2004	10/14/2004	10/22/2004	11/17/2004	11/17/2004	5/24/2005	5/24/2005	9/1/2004
DEPTH OF PROBE:	60	85	85	85	85	85	30	85	30	85	30
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.24J	0.98	1.4	1.1	1.2	1	0.15J	1.1	<0.80	0.99	0.19J
CARBON TETRACHLORIDE, (TO-15)	3.1	33	42	29	34	26	0.44J	25	0.72J	24	0.36J
TRICHLOROETHENE, (TO-15)	<0.80	0.38J	0.64J	0.38J	0.54J	0.43J	<0.78	0.38J	<0.80	<0.84	<0.76
TETRACHLOROETHENE, (TO-15)	<0.80	0.49J	0.71J	0.48J	0.63J	0.47J	<0.78	0.55J	<0.80	0.53J	<0.76
ACETONE[1], (TO-15)	--	--	--	--	--	--	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	CTP-SGP-64	CTP-SGP-64	CTP-SGP-64	CTP-SGP-64	CTP-SGP-64	CTP-SGP-64	CTP-SGP-64	CTP-SGP-64	CTP-SGP-64	CTP-SGP-65	CTP-SGP-65
SAMPLE NUMBER:	CTP-64-166	CTP-64-167	CTP-64-190	CTP-64-219	CTP-64-220	CTP-64-221	CTP-64-246	CTP-64-247	CTP-64-248	CTP-65-168	CTP-65-170
SAMPLE DATE	9/1/2004	9/1/2004	9/23/2004	11/17/2004	11/17/2004	11/17/2004	5/24/2005	5/24/2005	5/24/2005	9/1/2004	9/1/2004
DEPTH OF PROBE:	60	85	85	30	85	85	30	85	85	30	60
PURPOSE:	REG	REG	REG	REG	PRIMARY	FIELD DUP	REG	PRIMARY	FIELD DUP	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	0.14J	0.21J	0.18J	<0.84	0.17J	0.16J	<0.80	<0.84	<0.84	0.96	1.2
CARBON TETRACHLORIDE, (TO-15)	1.8	4.8	3.4	0.097J	2.6	2.6	<0.80	2.2	2.3	2.9	17
TRICHLOROETHENE, (TO-15)	0.17J	<0.74	<0.88	<0.84	0.29J	<0.84	<0.80	<0.84	<0.84	<0.76	<0.80
TETRACHLOROETHENE, (TO-15)	<0.79	<0.74	<0.88	<0.84	<0.82	<0.84	<0.80	<0.84	<0.84	0.16J	0.30J
ACETONE[1], (TO-15)	--	--	--	--	--	--	--	--	--	--	--

Table 5-2A

Analytical Results
Monitoring Probes
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**CTP-SGP-65**	**CTP-SGP-65**	**CTP-SGP-65**	**CTP-SGP-65**	**CTP-SGP-65**	**CTP-SGP-65**	**CTP-SGP-65**	**CTP-SGP-65**	**CTP-SGP-65**	**CTP-SGP-66**
SAMPLE NUMBER:	CTP-65-169	CTP-65-191	CTP-65-196	CTP-65-202	CTP-65-206	CTP-65-217	CTP-65-218	CTP-65-249	CTP-65-250	CTP-66-171
SAMPLE DATE	9/1/2004	9/23/2004	10/7/2004	10/14/2004	10/22/2004	11/17/2004	11/17/2004	5/24/2005	5/24/2005	9/2/2004
DEPTH OF PROBE:	85	85	85	85	85	30	85	30	85	85
PURPOSE:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE	NEW PROBE
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	1.6	1.8	1.4	1.7	1.3	0.87	1.3	0.67J	1.0	<0.79
CARBON TETRACHLORIDE, (TO-15)	27	34	24	31	22	1.0	22	2.0	17	<0.79
TRICHLOROETHENE, (TO-15)	<0.76	<0.88	<0.80	<0.82	<0.84	<0.76	<0.84	<0.82	<0.82	<0.79
TETRACHLOROETHENE, (TO-15)	0.39J	0.60J	0.48J	0.47J	0.37J	<0.76	0.36J	<0.82	<0.82	<0.79
ACETONE[1], (TO-15)	--	--	--	--	--	--	--	--	--	--

Notes:

[1] Acetone was added to the list of analytes for samples collected 03-25 - 03-31, 2004 to provide data for the OU CTP RI/FS.

[2] Estimated concentration lower then the reporting limit, and greater then the method detection limit

[3] Non-detectable to the reporting limit specified.

[4] Primary of field duplicate pair.

[5] Field duplicate of the primary sample collected.

Table 5-2B

Analytical Results
Extraction Wells
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**MW-BW-62-A**	**MW-BW-62-A**	**MW-BW-62-A**	**MW-BW-62-A**	**MW-BW-62-A**	**MW-BW-63-A**	**MW-BW-63-A**
SAMPLE NUMBER:	CTP-MW-62-050	CTP-MW-62-067	CTP-MW-62-083	CTP-MW-62-110	CTP-MW-62-210	CTP-MW-63-052	CTP-MW-63-053
SAMPLE DATE	4/1/2004	4/28/2004	5/18/2004	6/14/2004	11/8/2004	4/1/2004	4/1/2004
DEPTH OF PROBE:	92	92	92	92	92	92	92
PURPOSE:	REG	REG	REG	REG	REG	PRIMARY[4]	FIELD DUP[5]
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL
	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	6.2	3.9	4.1	4.1	0.69J	7.7	8.2
CARBON TETRACHLORIDE, (TO-15)	140	20	7.5	4.9	<0.82[3]	200	210
TRICHLOROETHENE, (TO-15)	4.7	0.98	0.58J[2]	0.31J	0.17J	7.4	7.4
TETRACHLOROETHENE, (TO-15)	7.4	2.5	2.3	2.7	0.27J	14	14
ACETONE[1], (TO-15)	10	--	--	--	--	17	21

Table 5-2B

Analytical Results
Extraction Wells
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**MW-BW-63-A**	**MW-BW-63-A**	**MW-BW-63-A**	**MW-BW-63-A**	**MW-BW-68-A**	**MW-BW-68-A**	**MW-BW-68-A**
SAMPLE NUMBER:	CTP-MW-63-069	CTP-MW-63-085	CTP-MW-63-112	CTP-MW-63-212	CTP-MW-68-054	CTP-MW-68-070	CTP-MW-68-086
SAMPLE DATE	4/28/2004	5/18/2004	6/14/2004	11/8/2004	4/1/2004	4/28/2004	5/18/2004
DEPTH OF PROBE:	92	92	92	92	92	92	92
PURPOSE:	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL
	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	8.2	8.4	9.1	1.9	2.8	2.7	2.1
CARBON TETRACHLORIDE, (TO-15)	38	14	10	0.72J	120	21	5.9
TRICHLOROETHENE, (TO-15)	0.48J	0.30J	0.78J	<0.82	0.88	0.52J	<0.79
TETRACHLOROETHENE, (TO-15)	2.3	1.5	1.1	1.3	2.7	1.0	0.44J
ACETONE[1], (TO-15)	--	--	--	--	15	--	--

Table 5-2B

Analytical Results
Extraction Wells
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**MW-BW-68-A**	**MW-BW-68-A**	**MW-BW-69-A**	**MW-BW-69-A**	**MW-BW-69-A**	**MW-BW-69-A**	**MW-BW-69-A**
SAMPLE NUMBER:	CTP-MW-68-113	CTP-MW-68-213	CTP-MW-69-055	CTP-MW-69-071	CTP-MW-69-087	CTP-MW-69-114	CTP-MW-69-214
SAMPLE DATE	6/14/2004	11/8/2004	4/1/2004	4/28/2004	5/18/2004	6/14/2004	11/8/2004
DEPTH OF PROBE:	92	92	92	92	92	92	92
PURPOSE:	REG	REG	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL
	Result	Result	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	1.9	3.9	10	9.5	12	12	5.0
CARBON TETRACHLORIDE, (TO-15)	3.7	3.6	190	31	9.5	7.2	0.86
TRICHLOROETHENE, (TO-15)	<0.76	<0.80	0.73	0.41J	<0.80	<0.76	<0.84
TETRACHLOROETHENE, (TO-15)	0.26J	0.58J	5	2.1	1.0	1.7	0.32J
ACETONE[1], (TO-15)	--	--	40	--	--	--	--

Table 5-2B

Analytical Results
Extraction Wells
Carbon Tetrachloride Soil Vapor Extraction System

LOCATION:	**MW-BW-70-A**	**MW-BW-70-A**	**MW-BW-70-A**	**MW-BW-70-A**	**MW-BW-70-A**
SAMPLE NUMBER:	CTP-MW-70-051	CTP-MW-70-068	CTP-MW-70-084	CTP-MW-70-111	CTP-MW-70-211
SAMPLE DATE	4/1/2004	4/28/2004	5/18/2004	6/14/2004	11/8/2004
DEPTH OF PROBE:	92	92	92	92	92
PURPOSE:	REG	REG	REG	REG	REG
UNITS:	PPBV	PPBV	PPBV	PPBV	PPBV
TYPE:	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL	EXTRACTION WELL
	Result	Result	Result	Result	Result
CHLOROFORM, (TO-15)	2.4	4.2	5	5.2	2.6
CARBON TETRACHLORIDE, (TO-15)	84	15	3.1	1.9	<0.80
TRICHLOROETHENE, (TO-15)	2	0.93	<0.82	<0.78	<0.80
TETRACHLOROETHENE, (TO-15)	18	8.5	6.4	3.8	1.0
ACETONE[1], (TO-15)	20	--	--	--	--

Notes:

[1] Acetone was added to the list of analytes for samples collected 03-25 - 03-31, 2004 to provide data for the OU CTP RI/FS.

[2] Estimated concentration lower then the reporting limit, and greater then the method detection limit

[3] Non-detectable to the reporting limit specified.

[4] Primary of field duplicate pair.

[5] Field duplicate of the primary sample collected.

Table 5-3

Comparison Carbon Tetrachloride Concentrations
May 2005 and Previous Sampling Events

			Carbon Tetrachloride Concentration (ppbv)				
			Sampling Events				
PROBE ID	PROBE TYPE	DEPTH (ft)	Jun-04	Sep-04	Nov-04	May-05	**Difference since last sampled (ppbv)**
CTP-SGP-50	SURFACE	6	0.13J			<0.82	NC
CTP-SGP-51	SHALLOW	30			<0.8	<0.8	NC
CTP-SGP-52	SHALLOW	30			0.14J	0.32J	0.18
CTP-SGP-53	SHALLOW	30			0.11J	0.79	0.68
CTP-SGP-55	SHALLOW	30			0.14J	0.63J	0.49
CTP-SGP-56	SHALLOW	30			<0.78	<0.84	NC
CTP-SGP-58	SHALLOW	30			<0.86	<0.8	NC
CTP-SGP-59	SHALLOW	30			0.076J	<0.8	NC
CTP-SGP-60	SHALLOW	30			<0.74	<0.8	NC
CTP-SGP-62	SHALLOW	30	0.27J			0.70J	0.43
CTP-SGP-63	SHALLOW	30			0.44J	0.72J	0.28
CTP-SGP-64	SHALLOW	30			0.097J	<0.8	NC
CTP-SGP-65	SHALLOW	30			1	2	1
CTP-SGP-51	DEEP	85			0.27J	0.66J	0.39
CTP-SGP-52	DEEP	85			0.62J	5	4.38
CTP-SGP-53	DEEP	85			6.8	5.2	-1.6
CTP-SGP-55	DEEP	85			9.2	8.2	-1
CTP-SGP-56	DEEP	85			4.4	3.8	-0.6
CTP-SGP-58	DEEP	85			<0.76	<0.82	NC
CTP-SGP-59	DEEP	85			0.47J	0.44J	-0.03
CTP-SGP-60	DEEP	85			0.36J	0.78J	0.42
CTP-SGP-62	DEEP	85		0.68J		3.1	2.42
CTP-SGP-63	DEEP	85			25	24	-1
CTP-SGP-64	DEEP	85			2.6	2.2	-0.4
CTP-SGP-65	DEEP	85			22	17	-5

NC: Difference not calculated for not-detected data

Table 6-1
Carbon Tetrachloride Mass Estimates for Impacted Soil

Volume and Mass Estimates Pre-Phase 1 (with control points[3]) Using Shaw and Mactec Analytical Results

ANALYTE	CONTOUR CONCENTRATION (ppbv)	CONTOUR CONCENTRATION[1] (ug/L)	POROSITY[2]	SOIL VOLUME (CU FT)	CHEMICAL MASS ENCLOSED BY CONTOUR (LBS)	AVERAGE CONCENTRATION[5] (ug/L)
Carbon Tetrachloride	1	0.0064	0.3	69,895,900	0.325	0.248416
Carbon Tetrachloride	20	0.1279	0.3	27,767,800	0.296	0.57008
Carbon Tetrachloride	100	0.6394	0.3	9,106,290	0.185	1.08382
Carbon Tetrachloride	200	1.2789	0.3	2,559,600	0.073	1.51494

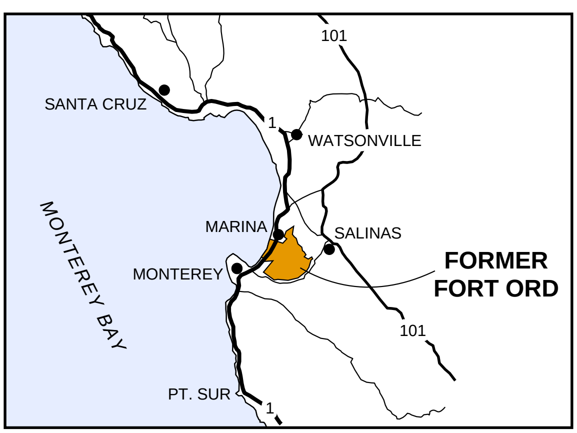
Volume and Mass Estimates Post-Phase 1 (without control points[4]) Using Shaw Analytical Results

ANALYTE	CONTOUR CONCENTRATION (ppbv)	CONTOUR CONCENTRATION[1] (ug/L)	POROSITY	SOIL VOLUME (CU FT)	CHEMICAL MASS ENCLOSED BY CONTOUR (LBS)	AVERAGE CONCENTRATION (ug/L)
Carbon Tetrachloride	1	0.0064	0.3	18,052,410	0.00583528	0.0173
Carbon Tetrachloride	5	0.0320	0.3	1,855,074	0.00164385	0.0473
Carbon Tetrachloride	10	0.0639	0.3	233,086	0.00034219	0.0784
Carbon Tetrachloride	15	0.0959	0.3	26,498	0.00005319	0.1072
Carbon Tetrachloride	20	0.1279	0.3	910	0.00000225	0.1320

Notes:

[1] ppbv concentration values required conversion to ug/L in order to determine mass
[2] Porosity value is assumed
[3] Pre-Phase I required control points with an assigned concentration of 1 ppbv to constrain the interpolation/extrapolation of the soil volume. These points were strategically located around the impacted soil volume to present the 1-pbbv contour.
[4] Post-Phase I did not require control points since concentrations had been reduced significantly. The 1-ppbv contour was delineated by the existing sampling points.
[5] Average concentration for any soil that exceeded the contour concentration value presented

Figures



N

0 2,000 4,000 FEET

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Shaw® Shaw Environmental, Inc.

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

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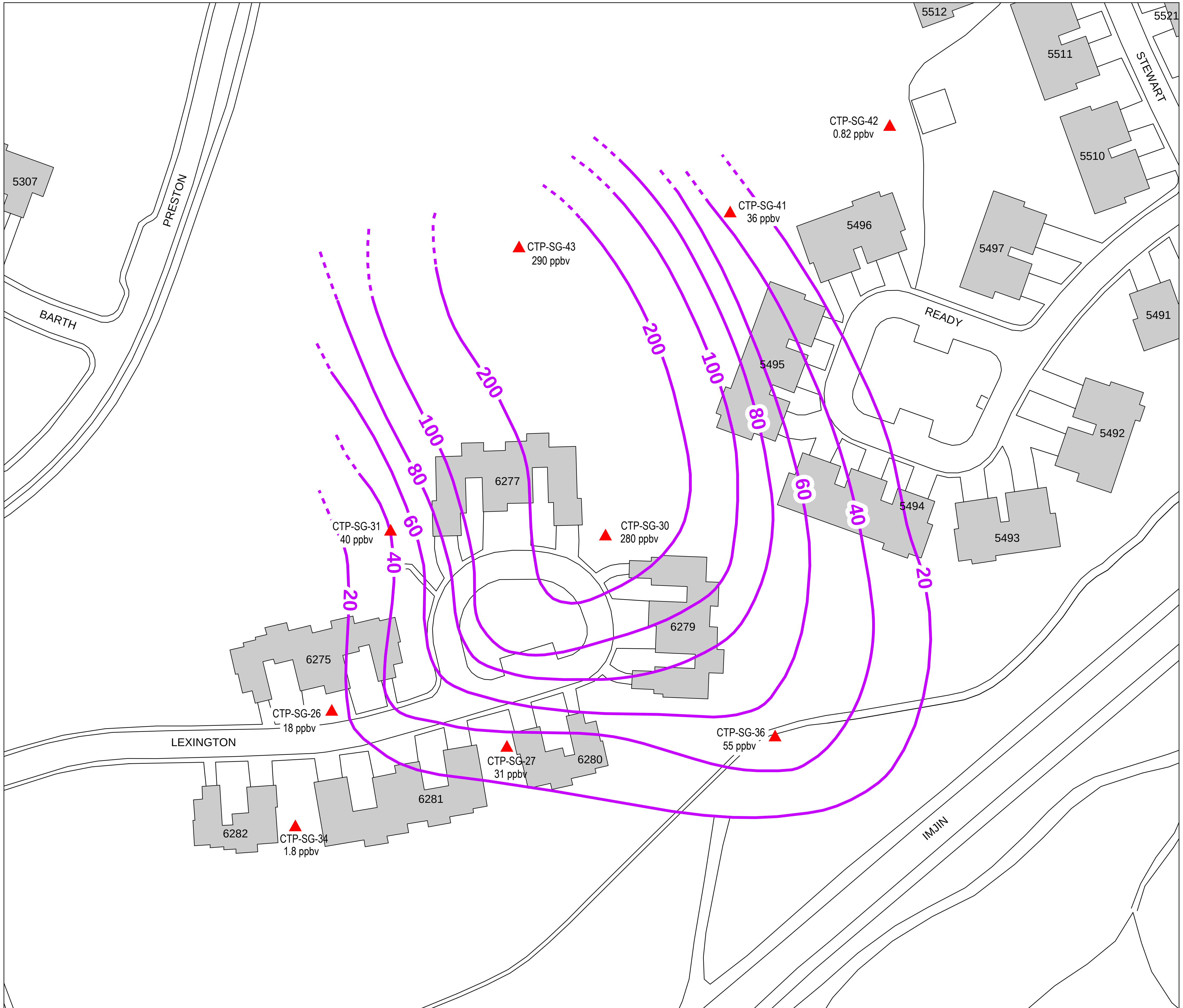
DRAWN: K. BLACK
CHECKED: P. KELSALL

FIGURE 1-1
LOCATION MAP
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SUBMITTED: DATE

SCALE: SPEC. No.

SHEET FILE No. CTP Location.mxd



LEGEND

- ▲ CTP-SG-36 55 A ppbv — SOIL GAS SAMPLE LOCATION, SAMPLE DESIGNATION, CONCENTRATION
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 66-FT. DEPTH (ppbv); DASHED WHERE INFERRED
- BUILDING

NOTE:
Carbon tetrachloride concentrations at depths below 66 ft., March to May 2003. Contours from Mactec. See Mactec 2004 for concentrations at shallower depths.

N

0 100 200 FEET

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Sacramento, California

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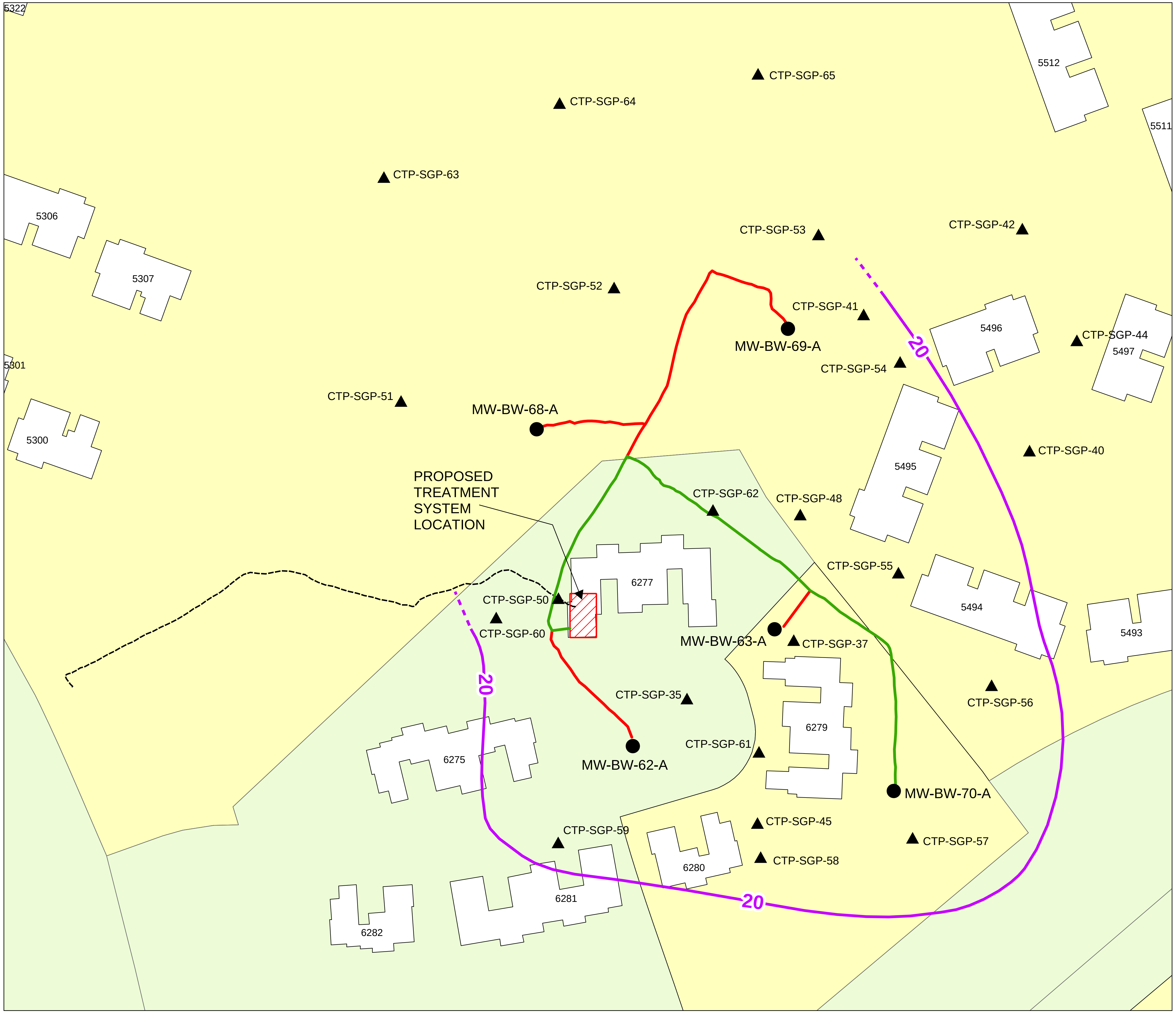
FIGURE 1-2
CARBON TETRACHLORIDE CONCENTRATIONS IN SOIL GAS AT 66-FT. DEPTH PRIOR TO SVE OPERATION, SVE PILOT TEST OPERABLE UNIT CARBON TETRACHLORIDE FORMER FORT ORD, CALIFORNIA

SUBMITTED: DATE

SCALE: SPEC. No.

SHEET

FILE No. CT_contours_66ft.mxd



LEGEND

- SOIL VAPOR EXTRACTION WELL
- SOIL VAPOR MONITORING PROBE
- 20 PPBV CARBON TETRACHLORIDE CONCENTRATION CONTOUR AT 66 FT. DEPTH; DASHED WHERE INFERRED
- 4-INCH HDPE PIPE
- 6-INCH HDPE PIPE
- ELECTRICAL CONDUIT
- TREATMENT SYSTEM
- PARCEL TRANSFER STATUS
  - NOT STARTED
  - TRANSFERRED
  - BUILDING

NOTE:
CARBON TETRACHLORIDE CONCENTRATIONS MEASURED MARCH TO JULY 2003.

N

0 100 200 FEET

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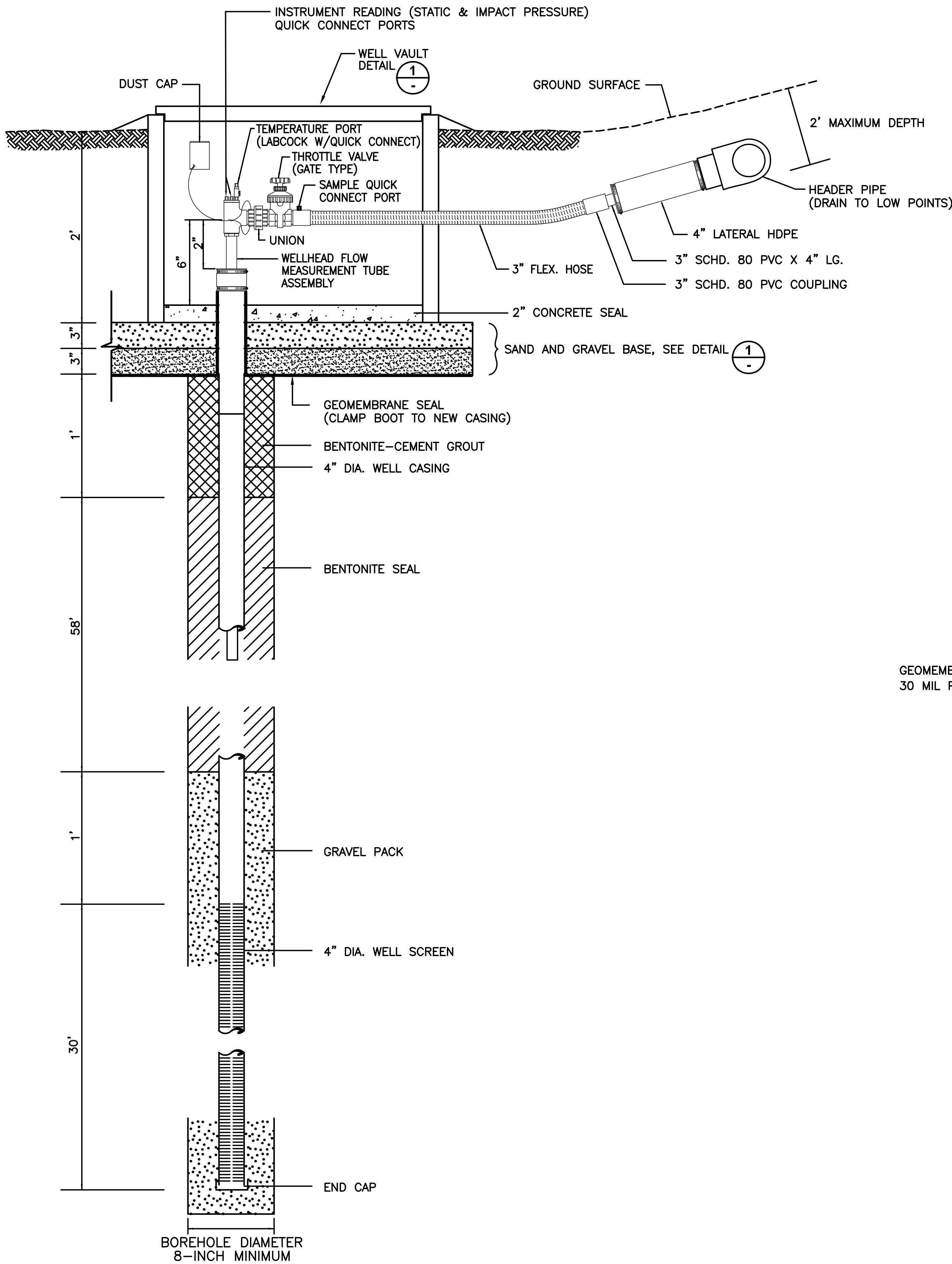
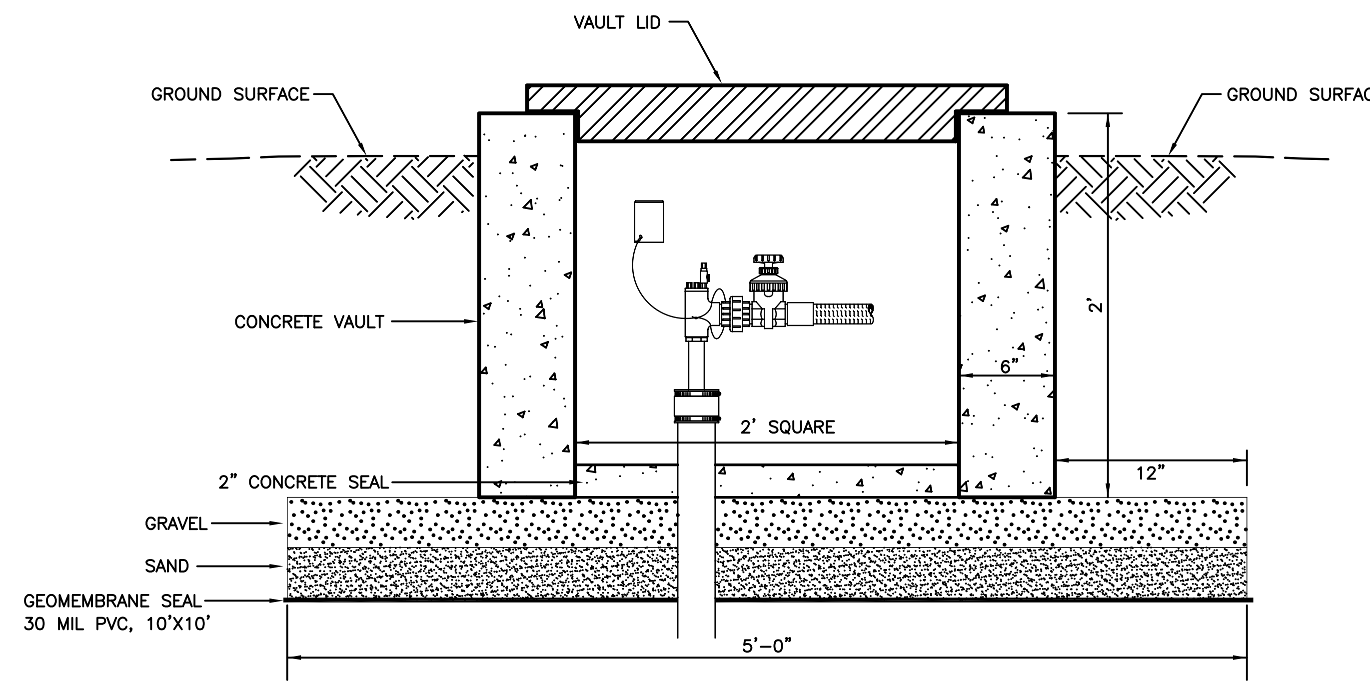
DATE

FIGURE 2-1
SVE COMPONENTS AND LOCATIONS
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

FORMER FORT ORD, CALIFORNIA

SCALE:
SPEC. No.
SHEET
FILE No. SVEcomponent.mxd





WELL VAULT DETAIL 1 -

NOT TO SCALE

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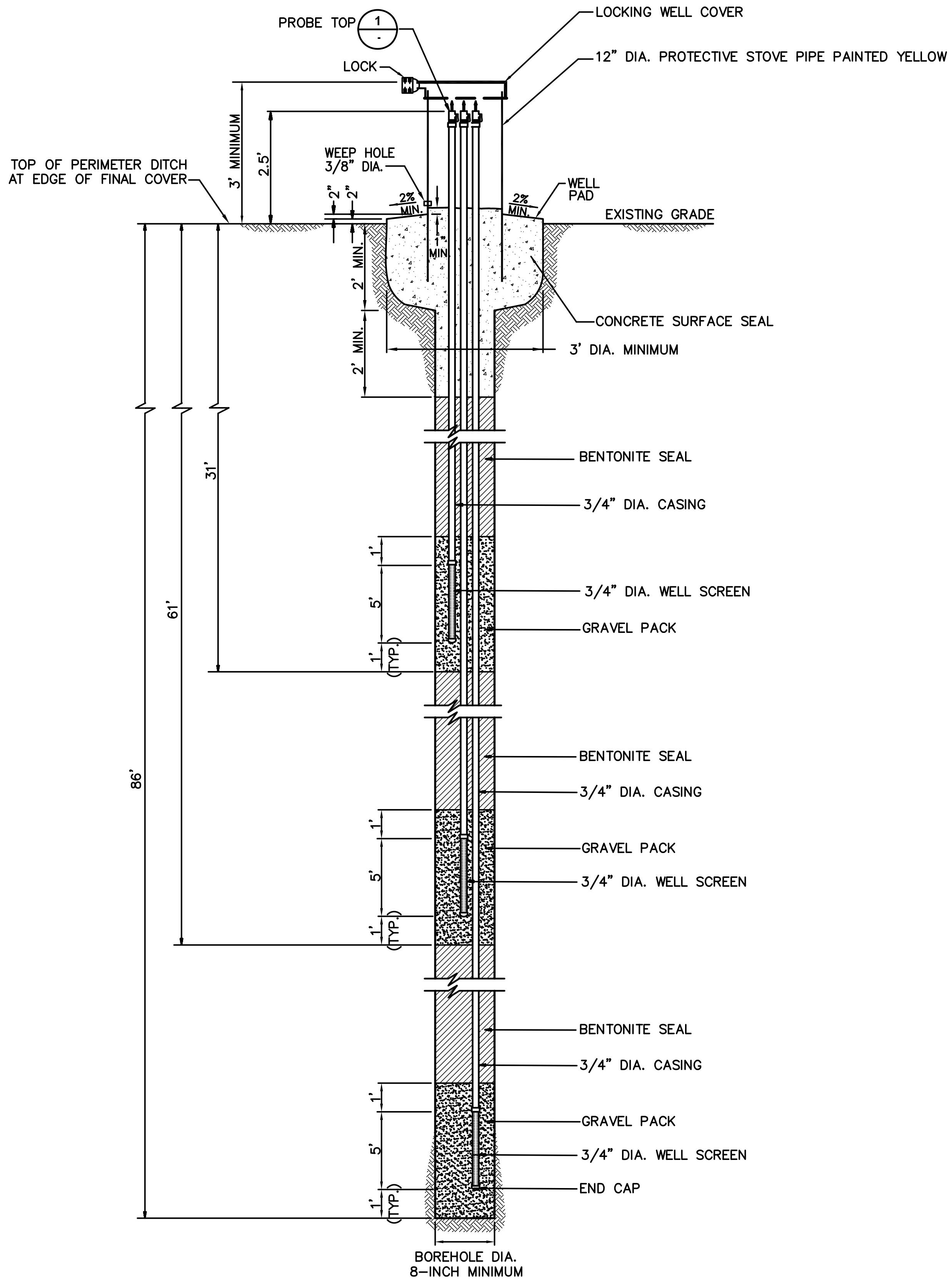
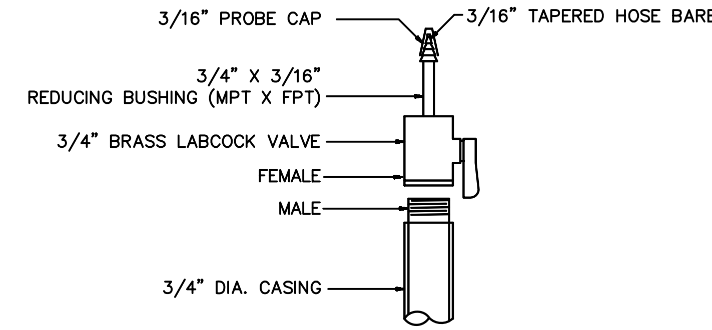
FIGURE 2-2

EXTRACTION WELL DETAIL
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

FORMER FORT ORD, CALIFORNIA

DATE APPROVED:
SCALE:
SPEC. No.
SHEET -
FILE No. 783751SJ-B73





PROBE TOP DETAIL 1

N.T.S.

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FIGURE 2-3

MONITORING PROBE DETAIL
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

FORMER FORT ORD, CALIFORNIA

DATE APPROVED:
SCALE:
SPEC. No.
SHEET -
FILE No. 783751SJ–B72

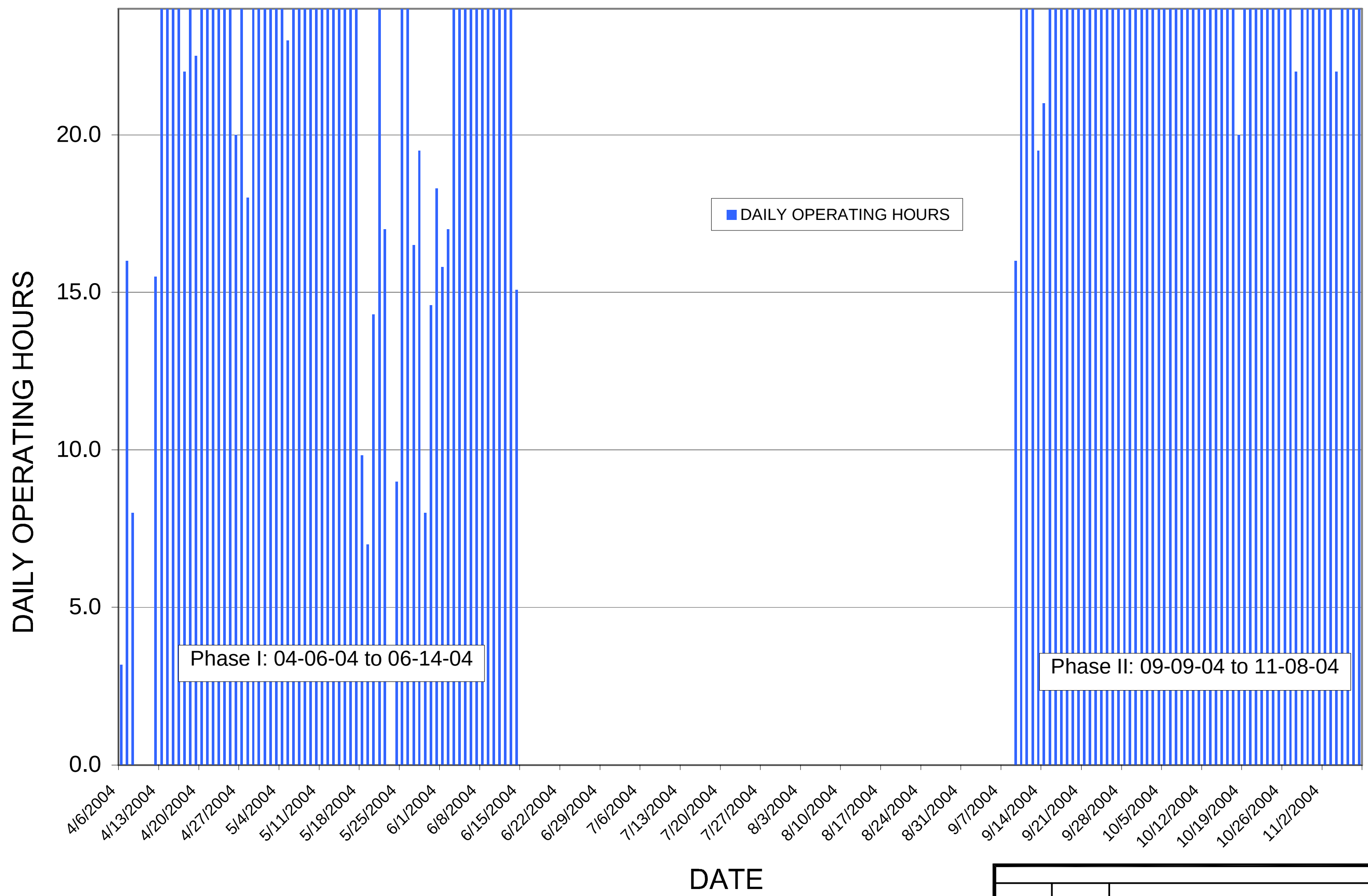

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FIGURE 3-1

DAILY OPERATING HOURS
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

FORMER FORT ORD, CALIFORNIA

SUBMITTED: DATE APPROVED:

SCALE: SPEC. No.

SHEET – FILE No. 783751SJ–A169

LEGEND

- SVE WELL
- MONITORING PROBE
- 8.2 VACUUM (INCHES H_2O); MEASURED 9/14/04
- VACUUM CONTOUR (INCHES H_2O)
- EFFECTIVE SVE REMEDIATION AREA
- 20 PPBV CARBON TETRACHLORIDE CONCENTRATION CONTOUR AT 66 FT. DEPTH PRIOR TO SVE OPERATION; DASHED WHERE INFERRED
- BUILDING

NOTES:

1. Carbon Tetrachloride concentration contours provided by Mactec and based on data collected March to July 2003.

N

0 100 200 FEET

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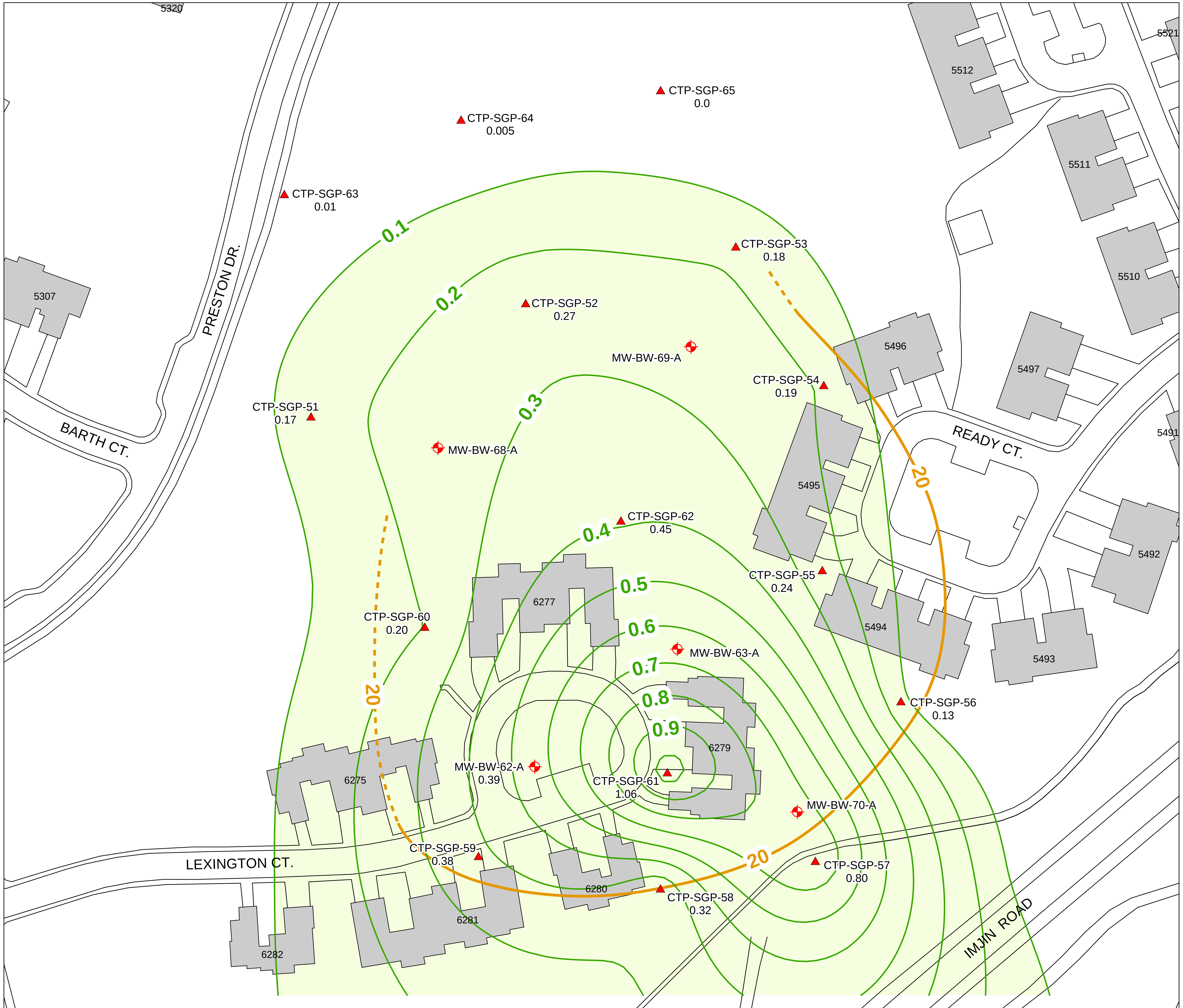
FIGURE 4-1
DEEP VACUUM CONTOURS (80-85 FT.)
SVE PILOT TEST, PHASE II OPERATION
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SUBMITTED: DATE
SCALE: SPEC. No.
SHEET FILE No. Vacuum Deep_9-04.mxd



LEGEND

(symbol)	SVE WELL
(symbol)	MONITORING PROBE
1.06	VACUUM (INCHES H_2O); MEASURED 9/14/04
(line)	VACUUM CONTOUR (INCHES H_2O)
(area)	EFFECTIVE SVE REMEDIATION AREA
(line)	CARBON TETRACHLORIDE CONCENTRATION CONTOURS BETWEEN 55-66 FT. DEPTH (ppbv) PRIOR TO SVE OPERATION; DASHED WHERE INFERRED
(area)	BUILDING

NOTES:

1. Carbon Tetrachloride concentration contours provided by Mactec and based on data collected March to July 2003.

N

0 100 200 FEET

REVISION	DATE	DESCRIPTION	CHKD	APPR
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FIGURE 4-2
INTERMEDIATE VACUUM CONTOURS (55-60 FT.)
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SUBMITTED: DATE
SCALE: SPEC. No.
SHEET FILE No. Vacuum Inter_9-04.mxd

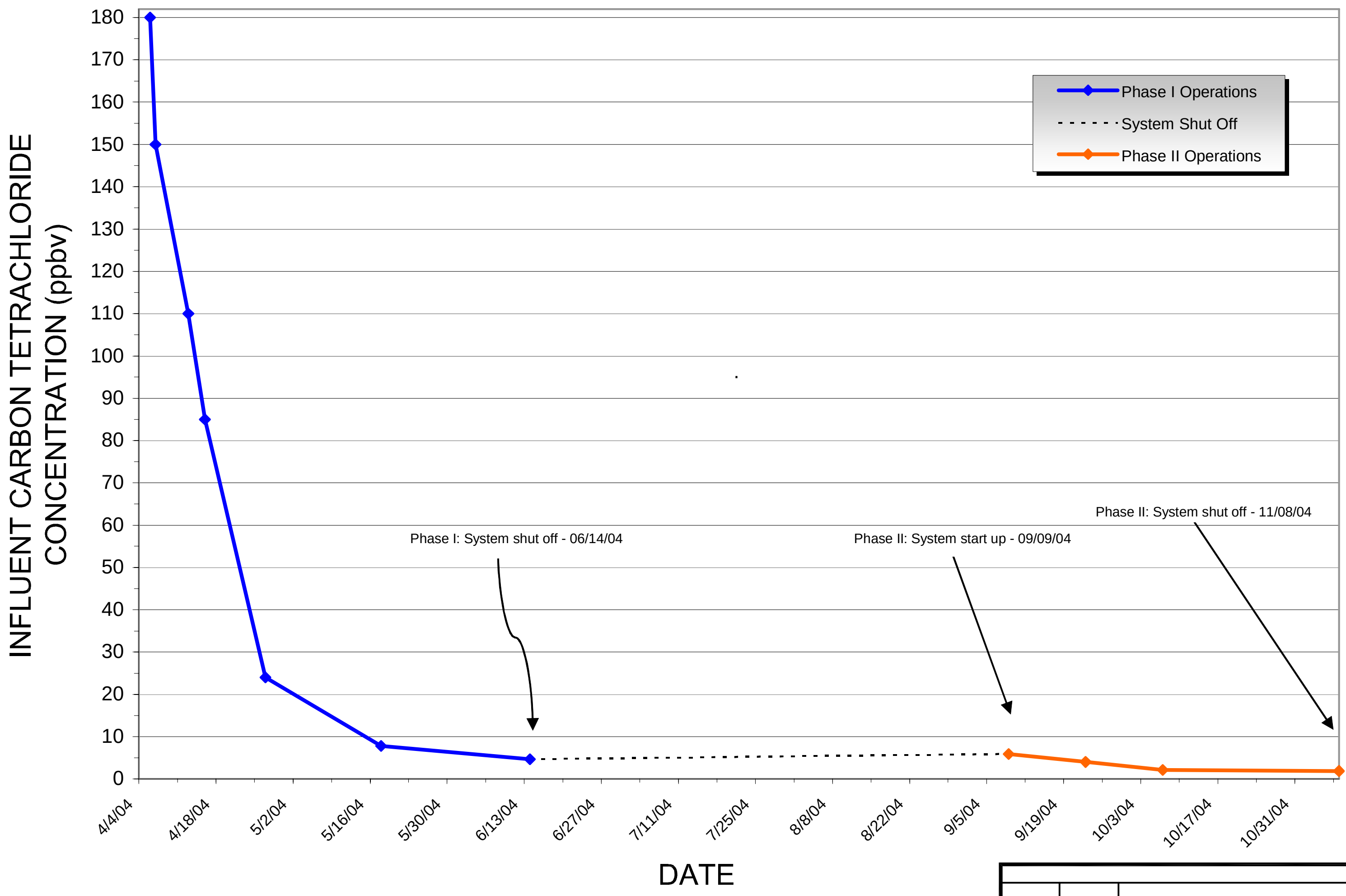

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FIGURE 5-1

INFLUENT CARBON TETRACHLORIDE
CONCENTRATION vs. TIME
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

FORMER FORT ORD, CALIFORNIA

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FILE No. 783751SJ–A170

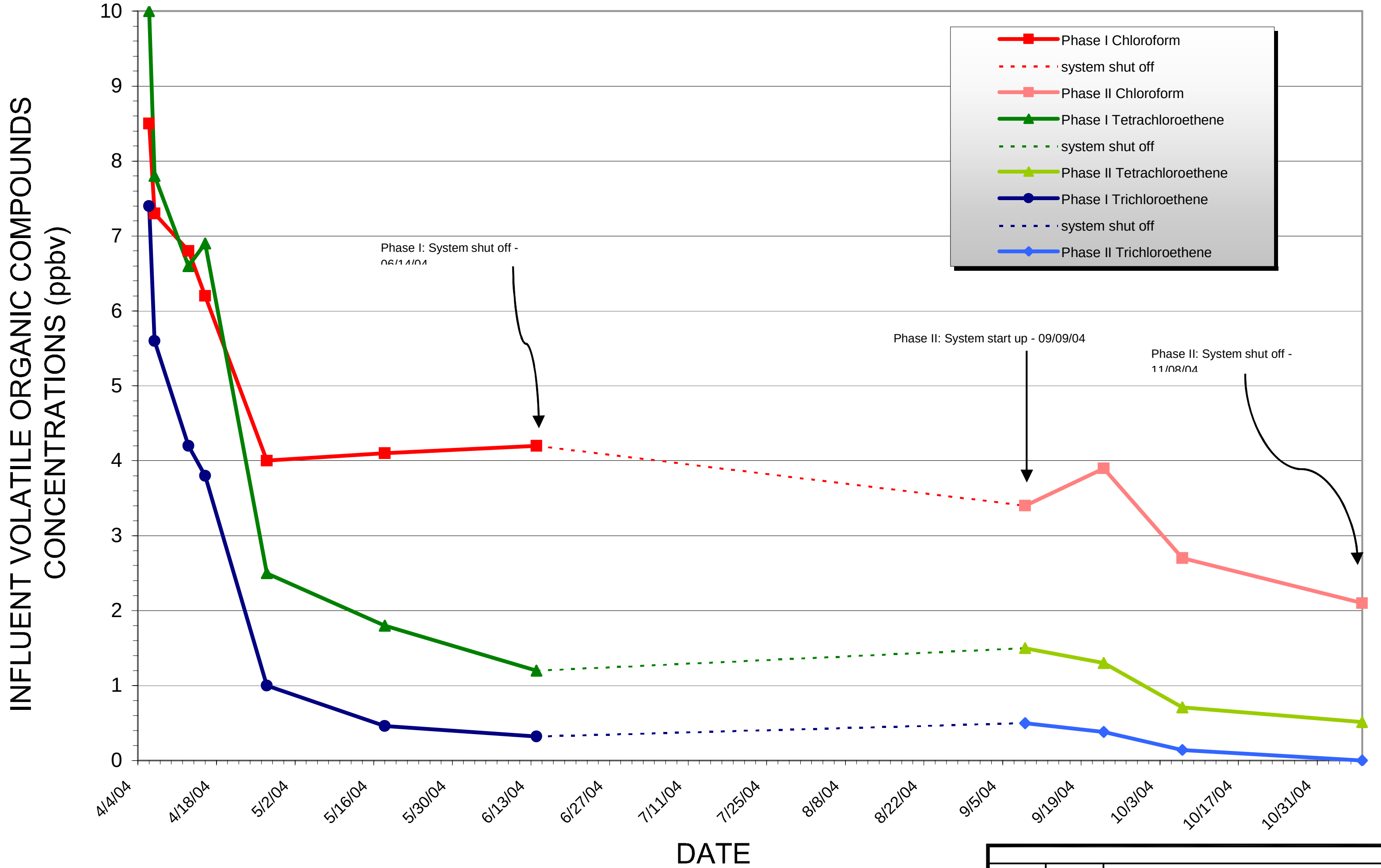

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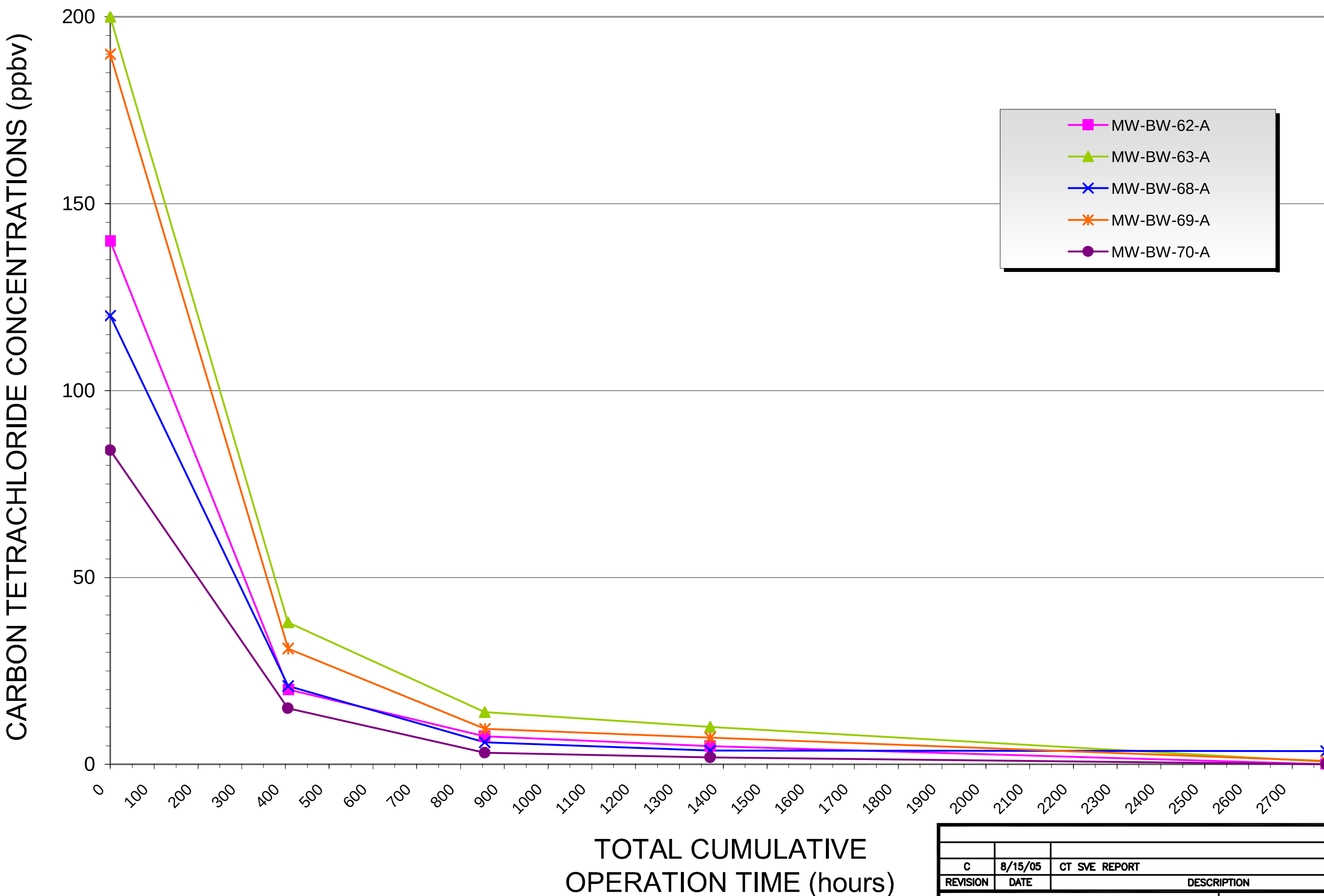
FIGURE 5-2
INFLUENT VOLATILE ORGANIC COMPOUND CONCENTRATION vs. TIME
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SUBMITTED:
DATE APPROVED:
SCALE:
SPEC. No.
SHEET –
FILE No. 783751SJ–A171



REVISION	DATE	DESCRIPTION	CHKD	APPR
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SACRAMENTO, CALIFORNIA

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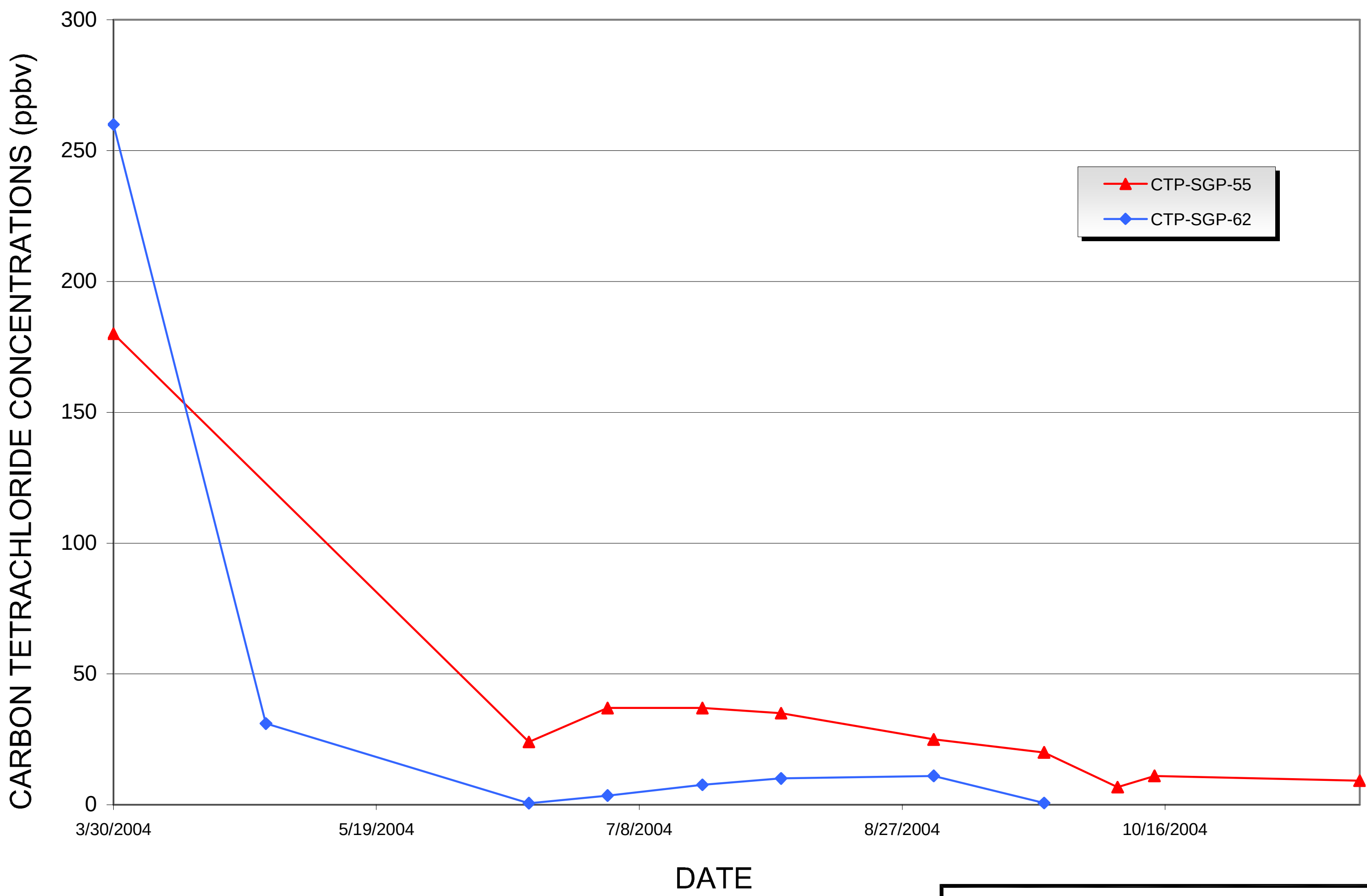
FIGURE 5-3
EXTRACTION WELL CARBON TETRACHLORIDE
CONCENTRATION vs. TIME
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SUBMITTED:
DATE APPROVED:
SCALE:
SPEC. No.
SHEET –
FILE No. 783751SJ–A172



REVISION	DATE	DESCRIPTION	CHKD	APPR
C	8/15/05	CT SVE REPORT	ES	PK

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SACRAMENTO, CALIFORNIA

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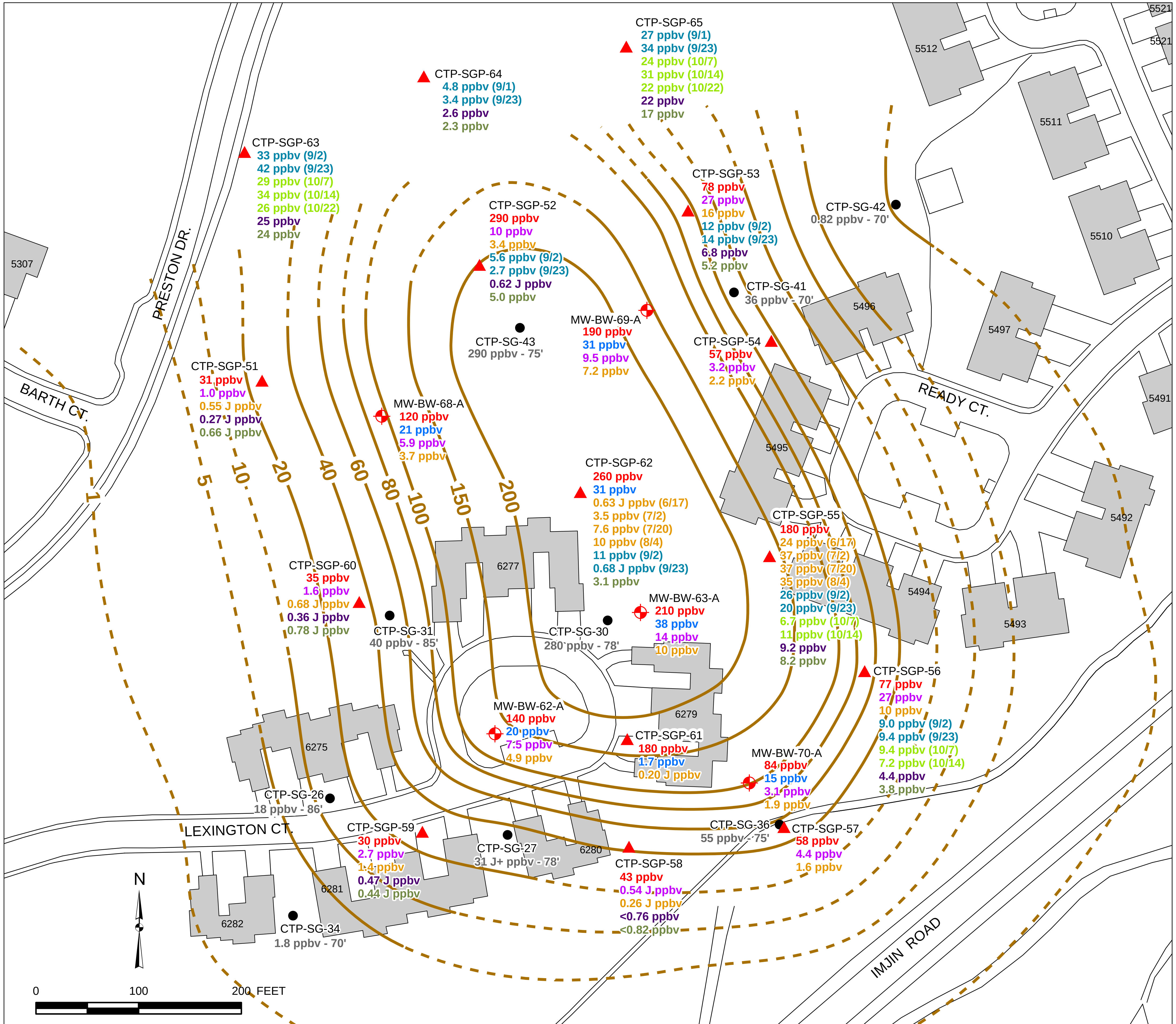
DRAWN: K. BLACK
CHECKED: P. KELSALL

FIGURE 5-4

CARBON TETRACHLORIDE CONCENTRATIONS
IN SELECTED MONITORING PROBES vs. TIME
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

FORMER FORT ORD, CALIFORNIA

SUBMITTED:
DATE APPROVED:
SCALE:
SPEC. No.
SHEET –
FILE No. 783751SJ–A173



LEGEND

- SOIL VAPOR EXTRACTION WELL
- DEEP (80-85 FT.) MONITORING PROBE
- TEMPORARY SOIL GAS MONITORING PROBE SAMPLED MARCH TO JUNE 2003
- 280 ppbv - 78' CARBON TETRACHLORIDE CONCENTRATION MARCH-JUNE 2003; DEPTH OF PROBE SHOWN
- 210 ppbv CARBON TETRACHLORIDE CONCENTRATION - MARCH 2004
- 38 ppbv CARBON TETRACHLORIDE CONCENTRATION - APRIL 2004
- 14 ppbv CARBON TETRACHLORIDE CONCENTRATION - MAY 2004
- 14 ppbv CARBON TETRACHLORIDE CONCENTRATION - JUNE-AUGUST 2004
- 5.6 ppbv CARBON TETRACHLORIDE CONCENTRATION - SEPTEMBER 2004
- 6.7 ppbv CARBON TETRACHLORIDE CONCENTRATION - OCTOBER 2004
- 2.6 ppbv CARBON TETRACHLORIDE CONCENTRATION - NOVEMBER 2004
- 2.3 ppbv CARBON TETRACHLORIDE CONCENTRATION - MAY 2005
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 85 FT. DEPTH (ppbv) PRIOR TO SVE OPERATION; DASHED WHERE INFERRED
- BUILDING

NOTES:

1. March Carbon Tetrachloride concentrations measured between 3/29/04 and 4/1/04, before SVE operation.
2. April Carbon Tetrachloride concentrations measured 4/28/04.
3. May 2004 Carbon Tetrachloride concentrations measured 5/18/04.
4. June-August Carbon Tetrachloride concentrations measured 6/14, 6/17, 7/2, 7/20, and 8/4/04.
5. September Carbon Tetrachloride concentrations measured 9/2/04 and 9/23/04.
6. October Carbon Tetrachloride concentrations measured 10/7/04, 10/14/04, and 10/22/04.
7. November Carbon Tetrachloride concentrations measured 11/17/04, 11/18/04, and 11/22/04.
8. May 2005 Carbon Tetrachloride concentrations measured 5/24/05 and 5/25/05.
9. J is a laboratory qualifier (estimated value).
10. Phase I SVE operation April 6 to June 14, 2004; Phase II Sept. 9 to Nov 8, 2004.

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Shaw Environmental, Inc.

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

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CHECKED: P. KELSALL
SUBMITTED:
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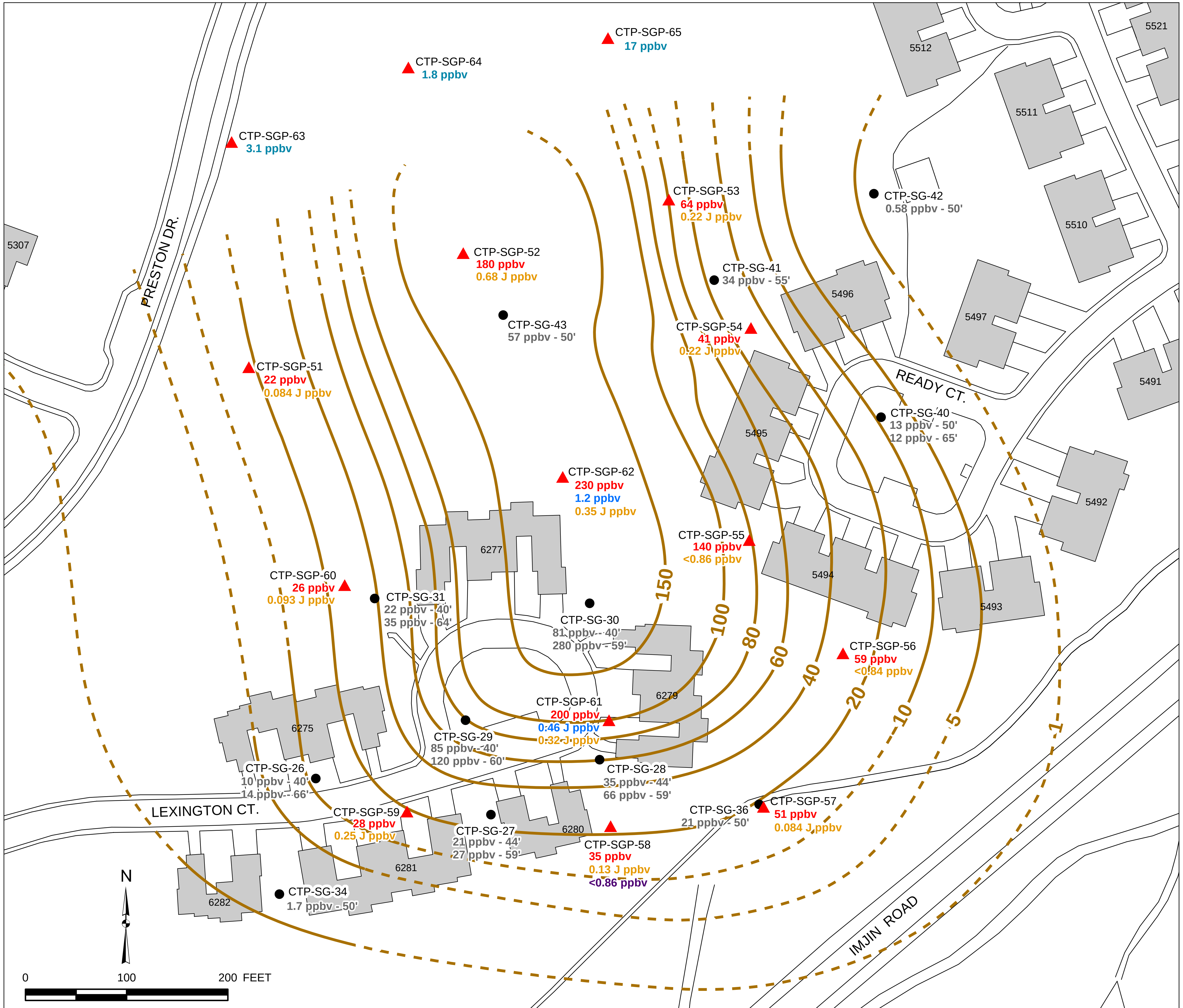
FIGURE 5-5
CARBON TETRACHLORIDE CONCENTRATIONS
DEEP MONITORING PROBES
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SCALE:
SPEC. No.
SHEET
FILE No. CTdeep_May2005.mxd



LEGEND

- ▲ INTERMEDIATE (55-60 FT.) MONITORING PROBE
- ● TEMPORARY SOIL GAS MONITORING PROBE SAMPLED MARCH TO JUNE 2003
- 230 ppbv — CARBON TETRACHLORIDE CONCENTRATION MARCH-JUNE 2003; PROBE DEPTH SHOWN
- 1.2 ppbv — CARBON TETRACHLORIDE CONCENTRATION - MARCH 2004
- 1.2 ppbv — CARBON TETRACHLORIDE CONCENTRATION - APRIL 2004
- 1.2 ppbv — CARBON TETRACHLORIDE CONCENTRATION - JUNE 2004
- 3.1 ppbv — CARBON TETRACHLORIDE CONCENTRATION - SEPTEMBER 2004
- <0.86 ppbv — CARBON TETRACHLORIDE CONCENTRATION - NOVEMBER 2004
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 60 FT. DEPTH (ppbv) PRIOR TO SVE OPERATION; DASHED WHERE INFERRED
- BUILDING

NOTES:

1. March Carbon Tetrachloride concentrations measured between 3/29/04 and 3/31/04, before SVE operation.
2. April Carbon Tetrachloride concentrations measured 4/28/04.
3. June Carbon Tetrachloride concentrations measured between 6/15/04 and 6/17/04.
4. September Carbon Tetrachloride concentrations measured 9/1/04 and 9/2/04.
5. November Carbon Tetrachloride concentrations measured 11/18/04.
6. J is a laboratory qualifier (estimated value).
7. SVE operation started April,6, 2004.
8. Phase I SVE operation April 6 to June 14, 2004; Phase II Sept. 9 to Nov. 8, 2004.

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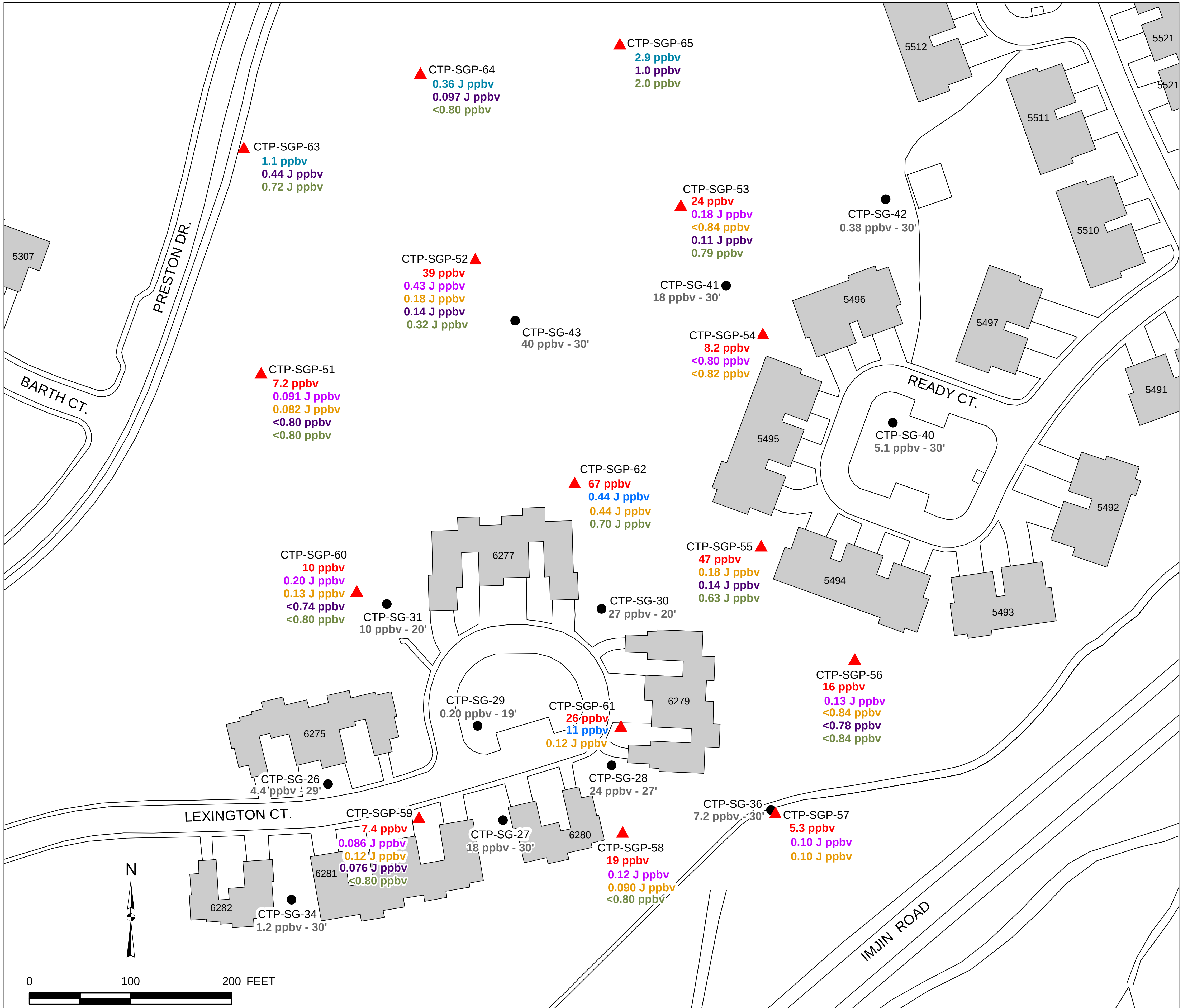
FIGURE 5-6
CARBON TETRACHLORIDE CONCENTRATIONS
INTERMEDIATE MONITORING PROBES
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SCALE:
SPEC. No.
SHEET
FILE No. CTinter_Nov2004.mxd



LEGEND

▲	SHALLOW (25-30 FT.) MONITORING PROBE
●	TEMPORARY SOIL GAS MONITORING PROBE SAMPLED MARCH TO JUNE 2003
18 ppbv - 30'	CARBON TETRACHLORIDE CONCENTRATION MARCH-JUNE 2003; PROBE DEPTH SHOWN
26 ppbv	CARBON TETRACHLORIDE CONCENTRATION - MARCH 2004
11 ppbv	CARBON TETRACHLORIDE CONCENTRATION - APRIL 2004
<0.80 ppbv	CARBON TETRACHLORIDE CONCENTRATION - MAY 2004
0.12 J ppbv	CARBON TETRACHLORIDE CONCENTRATION - JUNE 2004
2.9 ppbv	CARBON TETRACHLORIDE CONCENTRATION - SEPTEMBER 2004
1.0 ppbv	CARBON TETRACHLORIDE CONCENTRATION - NOVEMBER 2004
1.0 ppbv	CARBON TETRACHLORIDE CONCENTRATION - MAY 2005
■	BUILDING

NOTES:

1. March Carbon Tetrachloride concentrations measured between 3/25/04 and 3/31/04, before SVE operation.
2. April Carbon Tetrachloride concentrations measured 4/28/04.
3. May Carbon Tetrachloride concentrations measured 5/18/04 and 5/19/04.
4. June Carbon Tetrachloride concentrations measured between 6/15/04 and 6/17/04.
5. September Carbon Tetrachloride concentrations measured 9/1/04 and 9/2/04.
6. November Carbon Tetrachloride concentrations measured 11/17/04, 11/18/04 and 11/22/04.
7. May 2005 Carbon Tetrachloride concentrations measured 5/24/05 and 5/25/05.
8. J is a laboratory qualifier (estimated value).
9. Phase I SVE operation April 6 to June 14, 2004; Phase II Sept. 9 to Nov 8, 2004.

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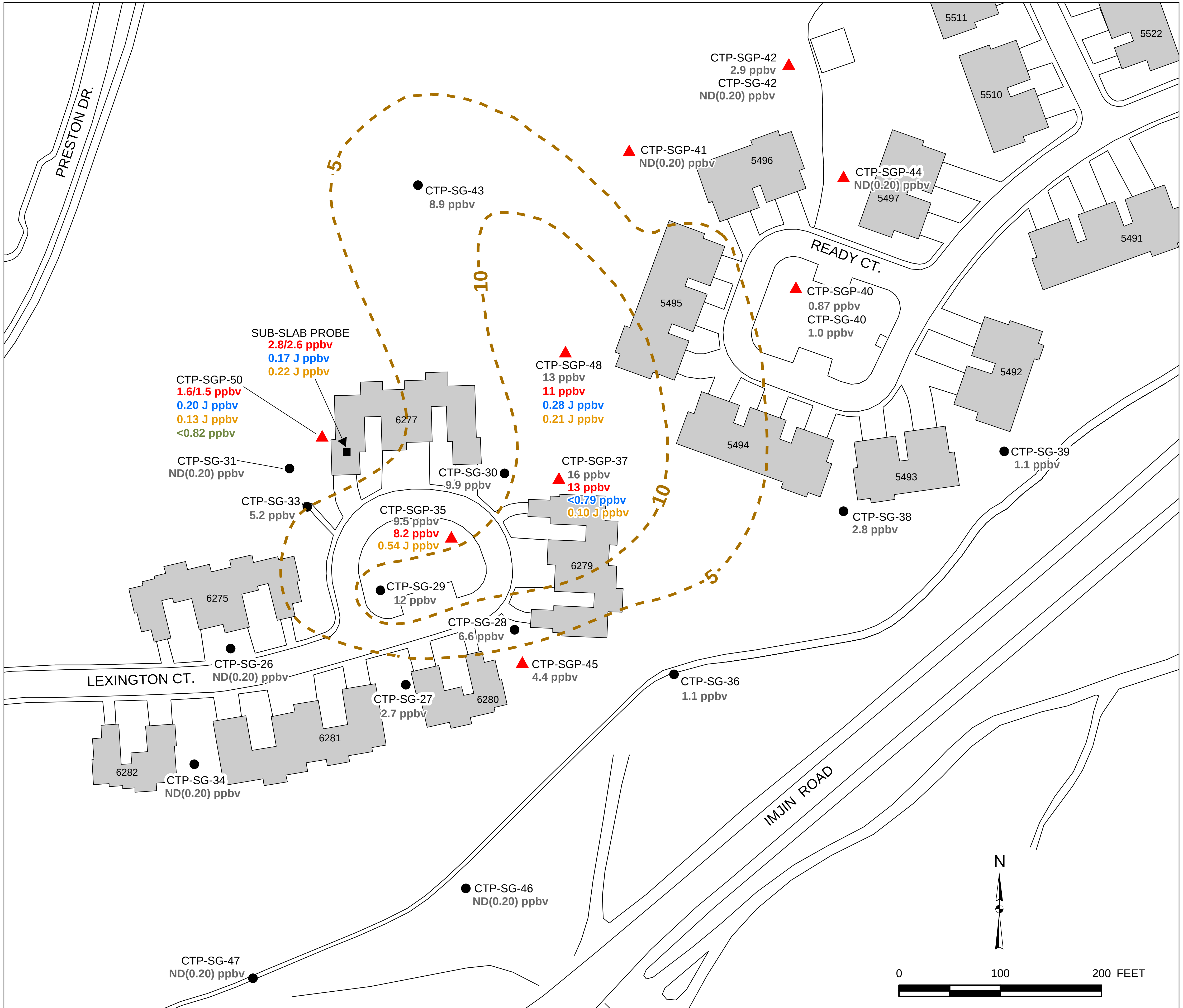
FIGURE 5-7
CARBON TETRACHLORIDE CONCENTRATIONS
SHALLOW MONITORING PROBES
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SCALE: | SPEC. No.
SHEET | FILE No. CTshallow_May2005.mxd



LEGEND

- ▲ NEAR SURFACE (6 FT.) MONITORING PROBE
- ● TEMPORARY SOIL GAS MONITORING PROBE SAMPLED MARCH TO JUNE 2003
- 13 ppbv — CARBON TETRACHLORIDE CONCENTRATION - MARCH-JUNE 2003
- 11 ppbv — CARBON TETRACHLORIDE CONCENTRATION - MARCH 2004
- 0.28 J ppbv — CARBON TETRACHLORIDE CONCENTRATION - APRIL 2004
- 0.21 J ppbv — CARBON TETRACHLORIDE CONCENTRATION - JUNE 2004
- <0.82 ppbv — CARBON TETRACHLORIDE CONCENTRATION - MAY 2005
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 6 FT. DEPTH (ppbv); PRIOR TO SVE OPERATION
- BUILDING

NOTES:

1. March Carbon Tetrachloride concentrations measured between 3/25/04 and 3/31/04, except CTP-SGP-50 and Sub-Slab Probe measured 3/9/04 and 3/15/04, before SVE operation.
2. April Carbon Tetrachloride concentrations measured 4/28/04.
3. June Carbon Tetrachloride concentrations measured 6/18/04.
4. May 2005 Carbon Tetrachloride concentrations measured 5/25/05.
5. Carbon Tetrachloride concentration contours provided by Mactec and based on data collected March to July 2003; adjusted for March 2004 data.
6. J is a laboratory qualifier (estimated value).
7. Phase I SVE operation April 6 to June 14, 2004; Phase II Sept. 9 to Nov. 8, 2004.

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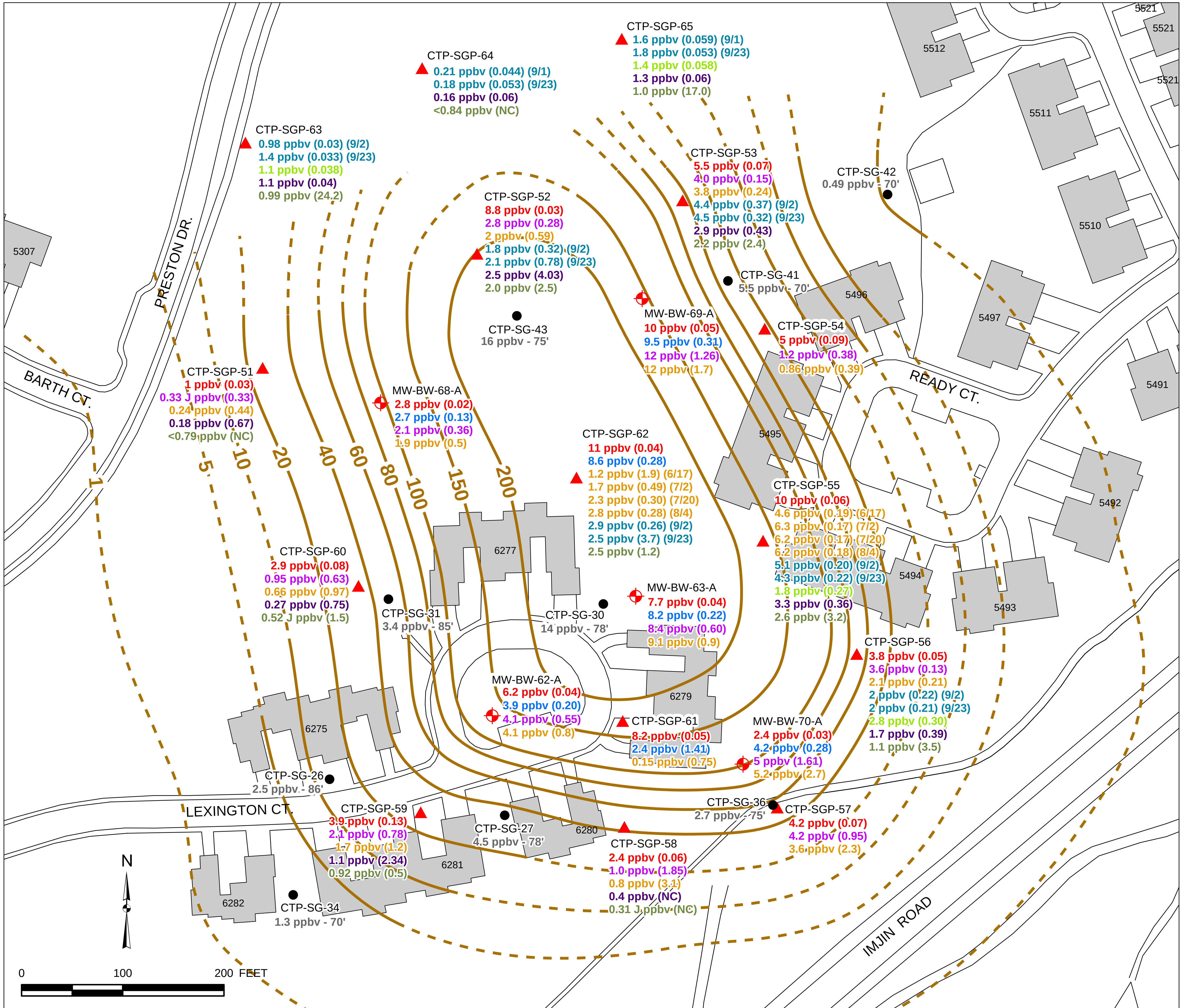
FIGURE 5-8
CARBON TETRACHLORIDE CONCENTRATIONS
NEAR-SURFACE MONITORING PROBES
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SUBMITTED: DATE: SCALE: SPEC. No. SHEET FILE No. CTsurface_May2005.mxd



LEGEND

- SOIL VAPOR EXTRACTION WELL
- DEEP (80-85 FT.) MONITORING PROBE
- TEMPORARY SOIL GAS MONITORING PROBE SAMPLED MARCH TO JUNE 2003
- 14 ppbv — CHLOROFORM CONCENTRATION MARCH-JUNE 2003; DEPTH OF PROBE SHOWN
- 3.8 ppbv (0.05) — CHLOROFORM CONCENTRATION MARCH 2004 (CHLOROFORM / CARBON TETRACHLORIDE RATIO)
- 4.2 ppbv (0.28) — CHLOROFORM CONCENTRATION APRIL 2004 (CHLOROFORM / CARBON TETRACHLORIDE RATIO)
- 3.6 ppbv (0.13) — CHLOROFORM CONCENTRATION MAY 2004 (CHLOROFORM / CARBON TETRACHLORIDE RATIO)
- 2.1 ppbv (0.21) — CHLOROFORM CONCENTRATION JUNE-AUGUST 2004 (CHLOROFORM / CARBON TETRACHLORIDE RATIO)
- 2 ppbv (0.22) — CHLOROFORM CONCENTRATION SEPTEMBER 2004 (CHLOROFORM / CARBON TETRACHLORIDE RATIO)
- 2.8 ppbv (0.30) — CHLOROFORM CONCENTRATION OCTOBER 2004 (CHLOROFORM / CARBON TETRACHLORIDE RATIO)
- 1.3 ppbv (0.06) — CHLOROFORM CONCENTRATION NOVEMBER 2004 (CHLOROFORM / CARBON TETRACHLORIDE RATIO)
- 1.1 ppbv (3.5) — CHLOROFORM CONCENTRATION MAY 2005 (CHLOROFORM / CARBON TETRACHLORIDE RATIO)
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 85 FT. DEPTH (ppbv) PRIOR TO SVE OPERATION; DASHED WHERE INFERRED
- BUILDING

NOTES:

1. March Chloroform concentrations measured between 3/29/04 and 4/1/04, before SVE operation.
2. April Chloroform concentrations measured 4/28/04.
3. May 2004 Chloroform concentrations measured 5/18/04.
4. June-August Chloroform concentrations measured 6/14, 6/17, 7/2, 7/20, and 8/4/04.
5. September Chloroform concentrations measured 9/2/04 and 9/23/04.
6. October Chloroform concentrations measured 10/6/04 and 10/7/04.
7. November Chloroform concentrations measured 11/17/04, 11/18/04, and 11/22/04.
8. May 2005 Chloroform concentrations measured 5/24/05 and 5/25/05.
9. J is a laboratory qualifier (estimated value).
10. Phase I SVE operation April 6 to June 14, 2004; Phase II Sept. 9 to Nov. 8, 2004.

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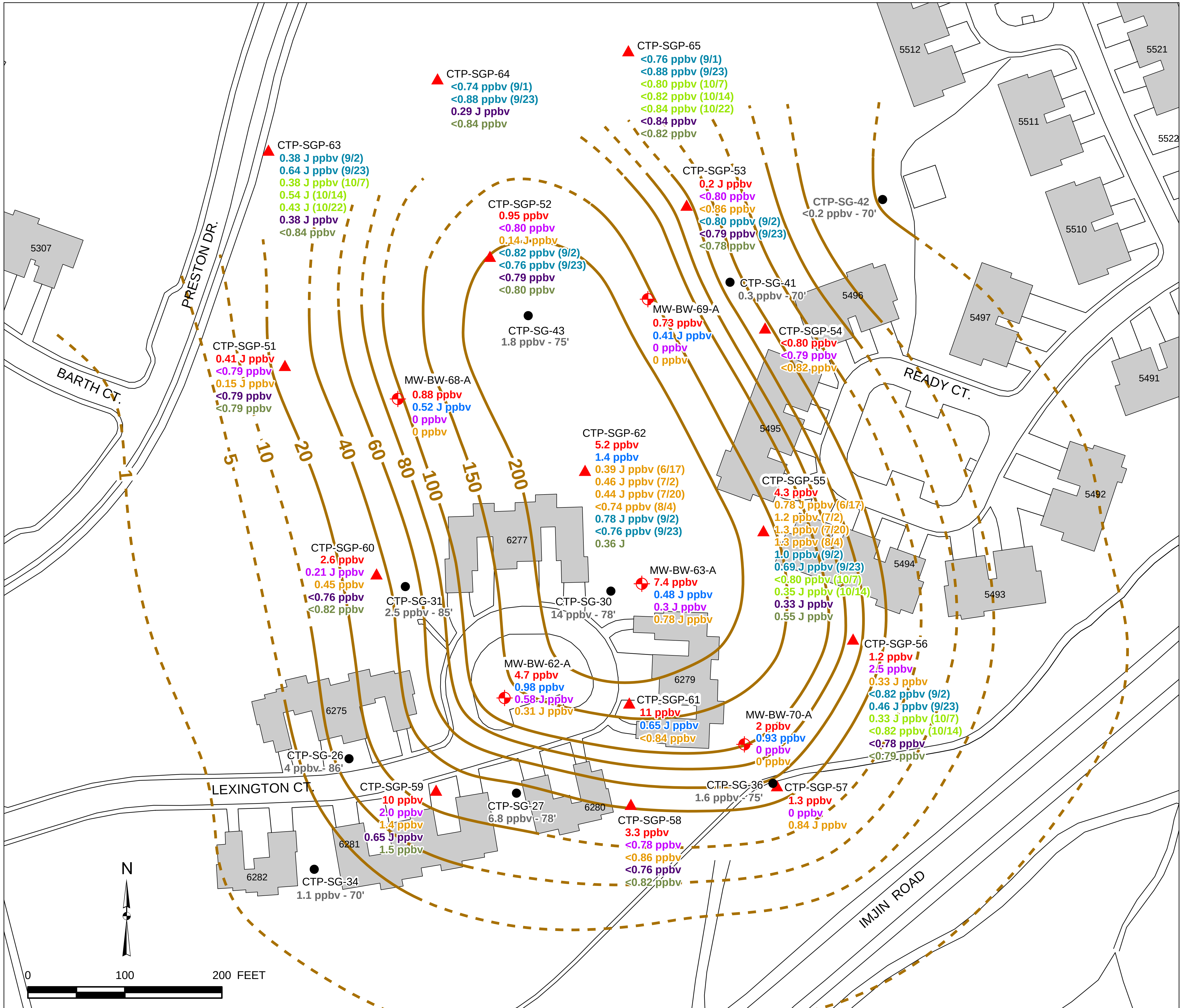
FIGURE 5-9
CHLOROFORM CONCENTRATIONS
DEEP MONITORING PROBES
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SCALE:
SPEC. No.
SHEET
FILE No. CTdeep_CF.mxd



LEGEND

- SOIL VAPOR EXTRACTION WELL
- DEEP (80-85 FT.) MONITORING PROBE
- TEMPORARY SOIL GAS MONITORING PROBE SAMPLED MARCH TO JUNE 2003
- 14 ppbv — TRICHLOROETHENE CONCENTRATION MARCH-JUNE 2003; DEPTH OF PROBE SHOWN
- 1.2 ppbv — TRICHLOROETHENE CONCENTRATION - MARCH 2004
- 0.48 ppbv — TRICHLOROETHENE CONCENTRATION - APRIL 2004
- 2.5 ppbv — TRICHLOROETHENE CONCENTRATION - MAY 2004
- 0.33 ppbv — TRICHLOROETHENE CONCENTRATION - JUNE-AUGUST 2004
- 0.46 ppbv — TRICHLOROETHENE CONCENTRATION - SEPTEMBER 2004
- 0.33 ppbv — TRICHLOROETHENE CONCENTRATION - OCTOBER 2004
- 0.33 ppbv — TRICHLOROETHENE CONCENTRATION - NOVEMBER 2004
- 1.5 ppbv — TRICHLOROETHENE CONCENTRATION - MAY 2005
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 85 FT. DEPTH (ppbv) PRIOR TO SVE OPERATION; DASHED WHERE INFERRED
- BUILDING

NOTES:

1. March Trichloroethene concentrations measured between 3/29/04 and 4/1/04, before SVE operation.
2. April Trichloroethene concentrations measured 4/28/04.
3. May 2004 Trichloroethene concentrations measured 5/18/04.
4. June-August Trichloroethene concentrations measured 6/14, 6/17, 7/2, 7/20, and 8/4/04.
5. September Trichloroethene concentrations measured 9/2/04 and 9/23/04.
6. October Trichloroethene concentrations measured 10/7/04, 10/14/04, and 10/22/04.
7. November Trichloroethene concentrations measured 11/17/04, 11/18/04, and 11/22/04.
8. May 2005 Trichloroethene concentrations measured 5/24/05 and 5/25/05.
9. J is a laboratory qualifier (estimated value).
10. Phase I SVE operation April 6 to June 14, 2004; Phase II Sept. 9 to Nov. 8, 2004.

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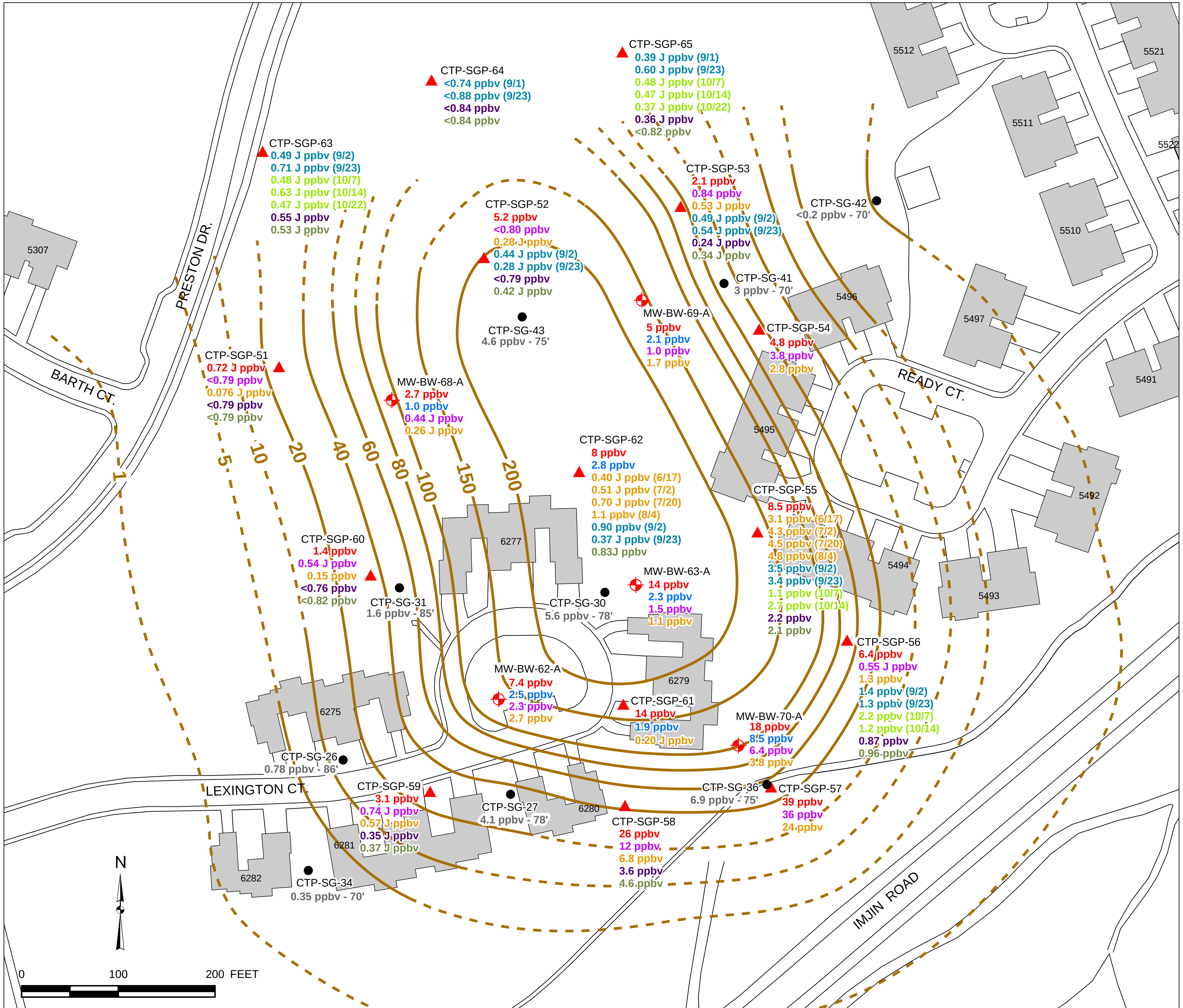
FIGURE 5-10
TRICHLOROETHENE CONCENTRATIONS
DEEP MONITORING PROBES
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SCALE:
SPEC. No.
SHEET
FILE No. CTdeep_TCE.mxd



LEGEND

- SOIL VAPOR EXTRACTION WELL
- DEEP (80-85 FT.) MONITORING PROBE
- TEMPORARY SOIL GAS MONITORING PROBE SAMPLED MARCH TO JUNE 2003
- 14 ppbv — TETRACHLOROETHENE CONCENTRATION MARCH-JUNE 2003; DEPTH OF PROBE SHOWN
- 6.4 ppbv — TETRACHLOROETHENE CONCENTRATION - MARCH 2004
- 0.48 ppbv — TETRACHLOROETHENE CONCENTRATION - APRIL 2004
- 0.55 ppbv — TETRACHLOROETHENE CONCENTRATION - MAY 2004
- 1.3 ppbv — TETRACHLOROETHENE CONCENTRATION - JUNE-AUGUST 2004
- 1.3 ppbv — TETRACHLOROETHENE CONCENTRATION - SEPTEMBER 2004
- 2.2 ppbv — TETRACHLOROETHENE CONCENTRATION - OCTOBER 2004
- 2.2 ppbv — TETRACHLOROETHENE CONCENTRATION - NOVEMBER 2004
- 2.2 ppbv — TETRACHLOROETHENE CONCENTRATION - MAY 2005
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 85 FT. DEPTH (ppbv) PRIOR TO SVE OPERATION; DASHED WHERE INFERRED
- BUILDING

NOTES:

1. March Tetrachloroethene concentrations measured between 3/29/04 and 4/1/04, before SVE operation.
2. April Tetrachloroethene concentrations measured 4/28/04.
3. May 2004 Tetrachloroethene concentrations measured 5/18/04.
4. June-August Tetrachloroethene concentrations measured 6/14, 6/17, 7/2, 7/20, and 8/4/04.
5. September Tetrachloroethene concentrations measured 9/2/04 and 9/23/04.
6. October Tetrachloroethene concentrations measured 10/7/04, 10/14/04, and 10/22/04.
7. November Tetrachloroethene concentrations measured 11/17/04, 11/18/04, and 11/22/04.
8. May 2005 Tetrachloroethene concentrations measured 5/24/05 and 5/25/05.
9. J is a laboratory qualifier (estimated value).
10. Phase I SVE operation April 6 to June 14, 2004; Phase II Sept. 9 to Nov. 8, 2004.

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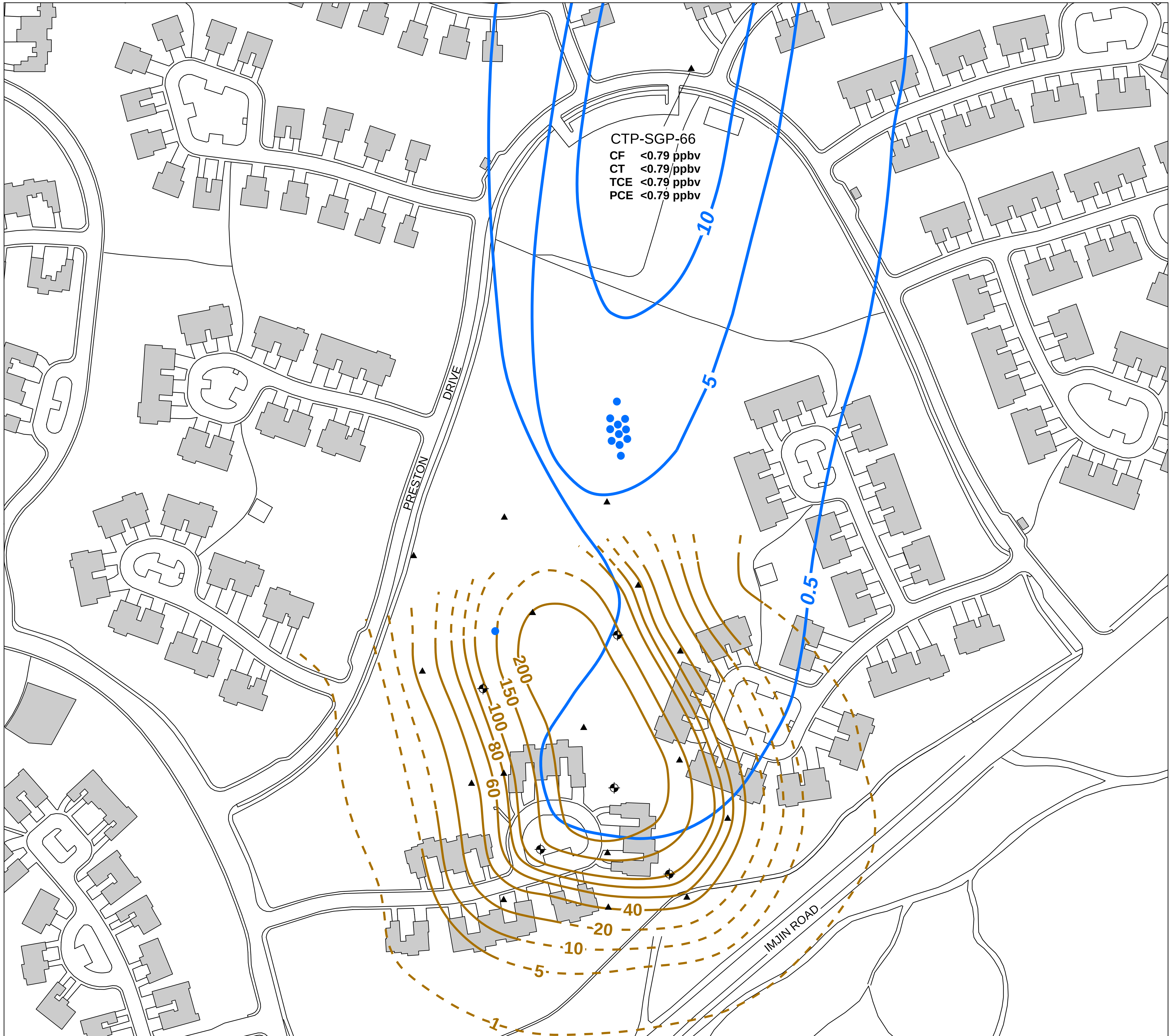
FIGURE 5-11
TETRACHLOROETHENE CONCENTRATIONS
DEEP MONITORING PROBES
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

SUBMITTED: DATE: SCALE: SPEC. No. SHEET FILE No. CTdeep_PCE.mxd



LEGEND

- SOIL VAPOR EXTRACTION WELL
- DEEP (80-85 FT.) SOIL VAPOR MONITORING PROBE
- **<0.79 ppbv** SOIL GAS CONCENTRATION (ppbv); MEASURED 9/1/04
  - CF Chloroform
  - CT Carbon tetrachloride
  - TCE Trichloroethene
  - PCE Tetrachloroethene
- SOIL GAS CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 85 FT. DEPTH (ppbv); DASHED WHERE INFERRED
- GROUNDWATER MONITORING WELL
- A-AQUIFER CARBON TETRACHLORIDE CONCENTRATION CONTOURS (ppbv)
- BUILDING

NOTES:

1. Soil gas concentration contours based on data collected prior to soil vapor extraction.
2. Groundwater concentration contours provided by Mactec and based on data collected December 2003.

N

0 200 400 FEET

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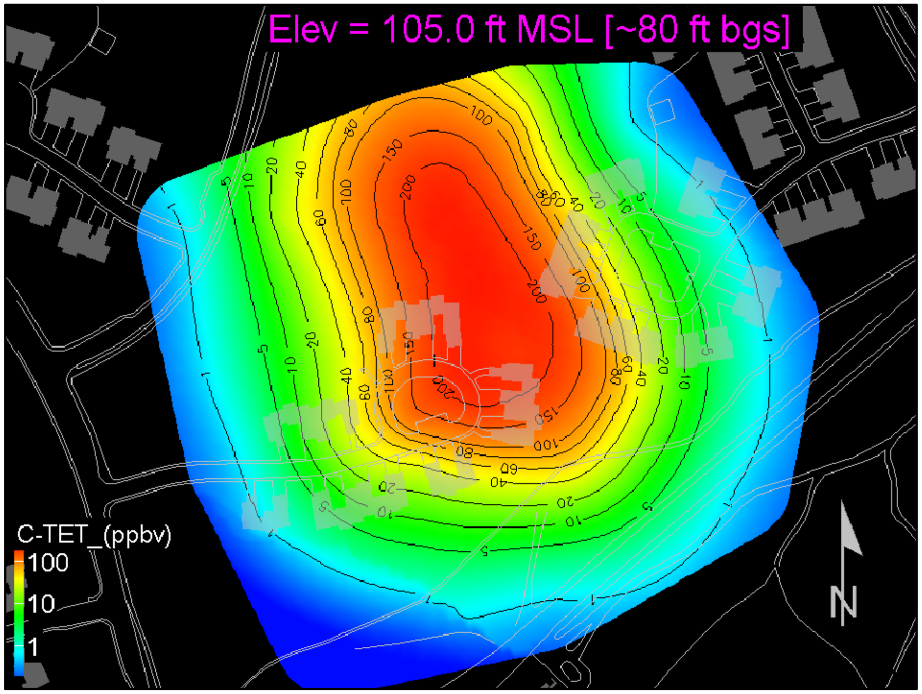
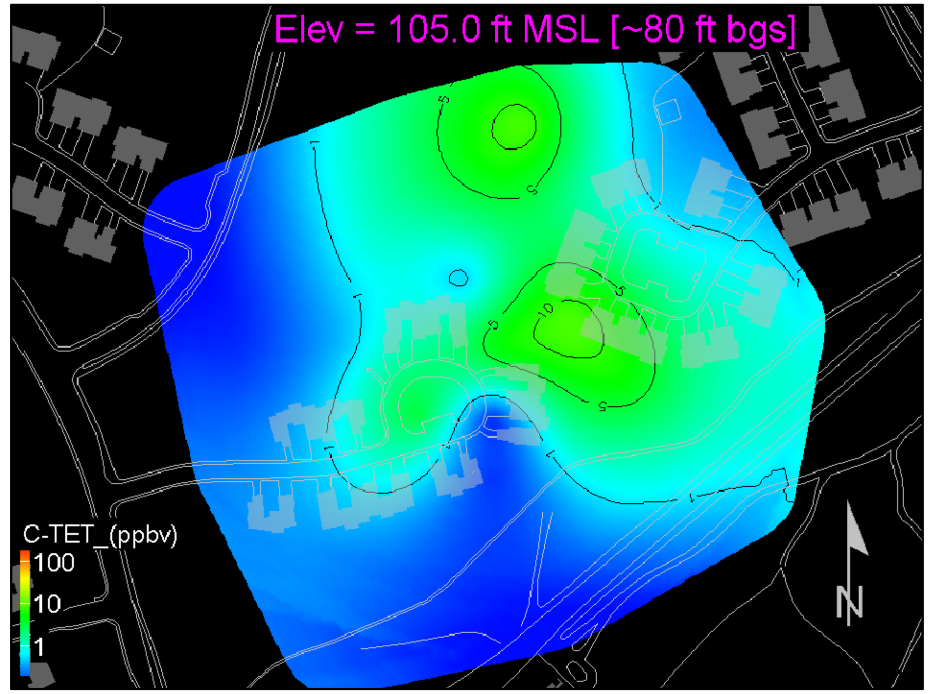
FIGURE 5-12
DATA FROM PRESTON DRIVE MONITORING PROBE
OPERABLE UNIT
CARBON TETRACHLORIDE PLUME
FORMER FORT ORD, CALIFORNIA

SUBMITTED: DATE: SCALE: SPEC. No. SHEET FILE No. CTsoil+gw.mxd



PRE-SVE OPERATION



POST PHASE 1

NOTE:
Model truncated on northern boundary
due to incomplete pre-SVE concentration data.

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FIGURE 6-1

CARBON TETRACHLORIDE CONCENTRATIONS
(80 FT. DEPTH) PRE- AND POST SVE OPERATION
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

FORMER FORT ORD, CALIFORNIA

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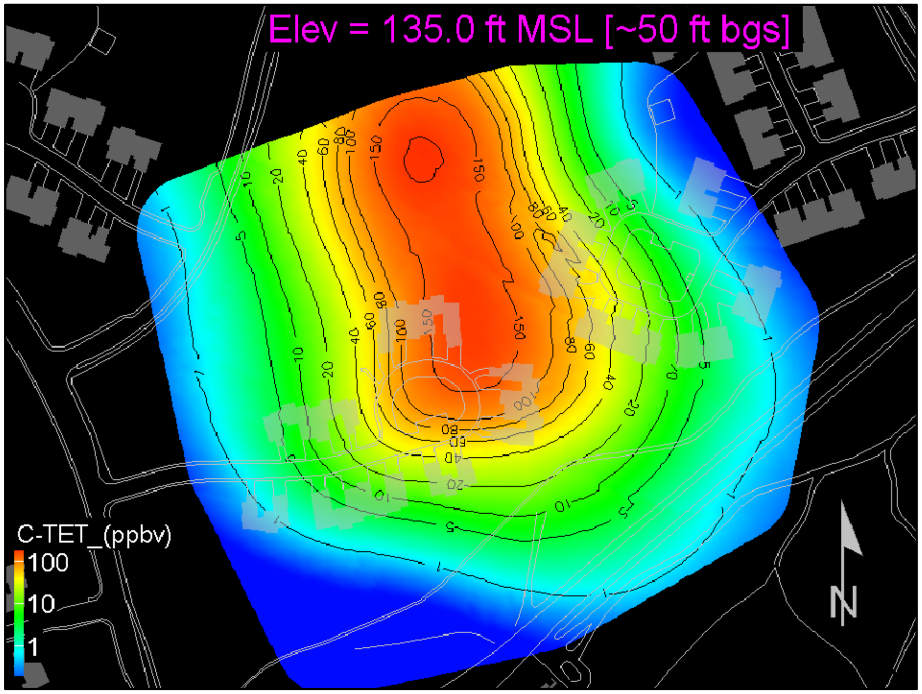
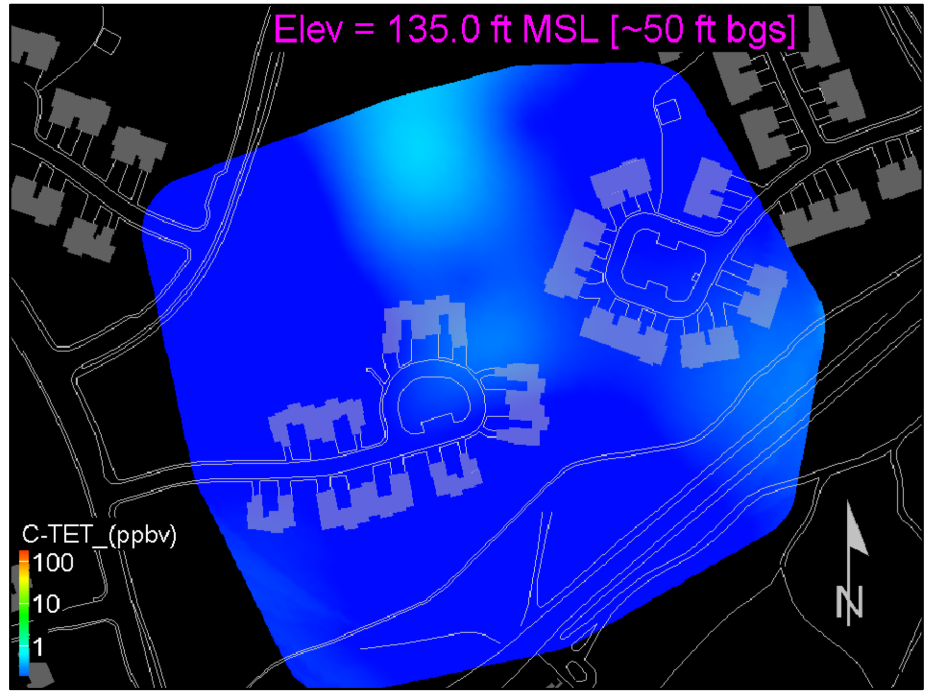
SCALE:
SPEC. No.
SHEET –
FILE No. 783751SJ–A174



PRE-SVE OPERATION



POST PHASE 1

NOTE:
Model truncated on northern boundary
due to incomplete pre-SVE concentration data.

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FIGURE 6-2

CARBON TETRACHLORIDE CONCENTRATIONS
(50 FT. DEPTH) PRE- AND POST SVE OPERATION
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

FORMER FORT ORD, CALIFORNIA

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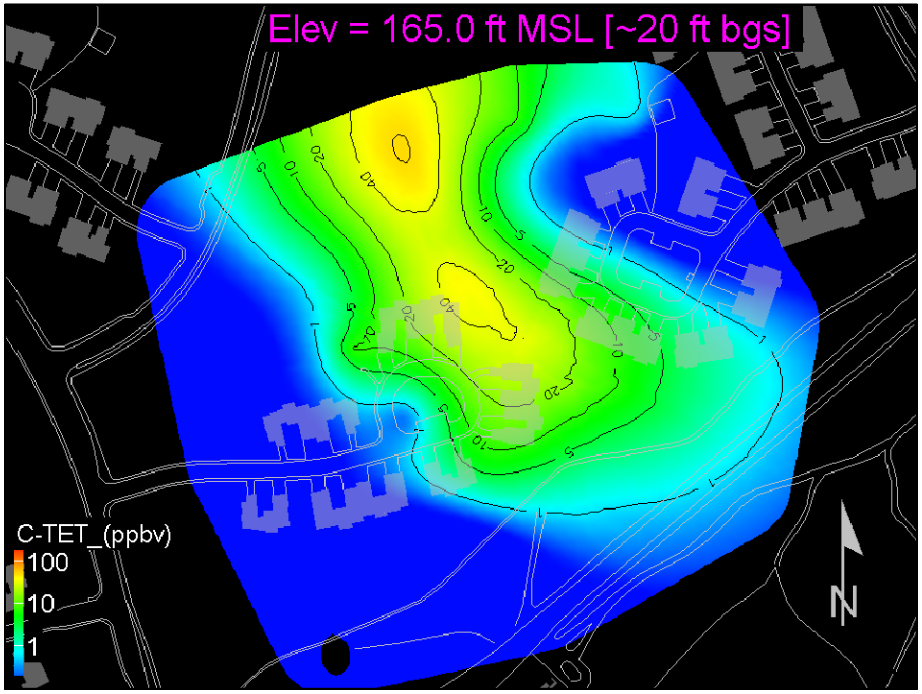
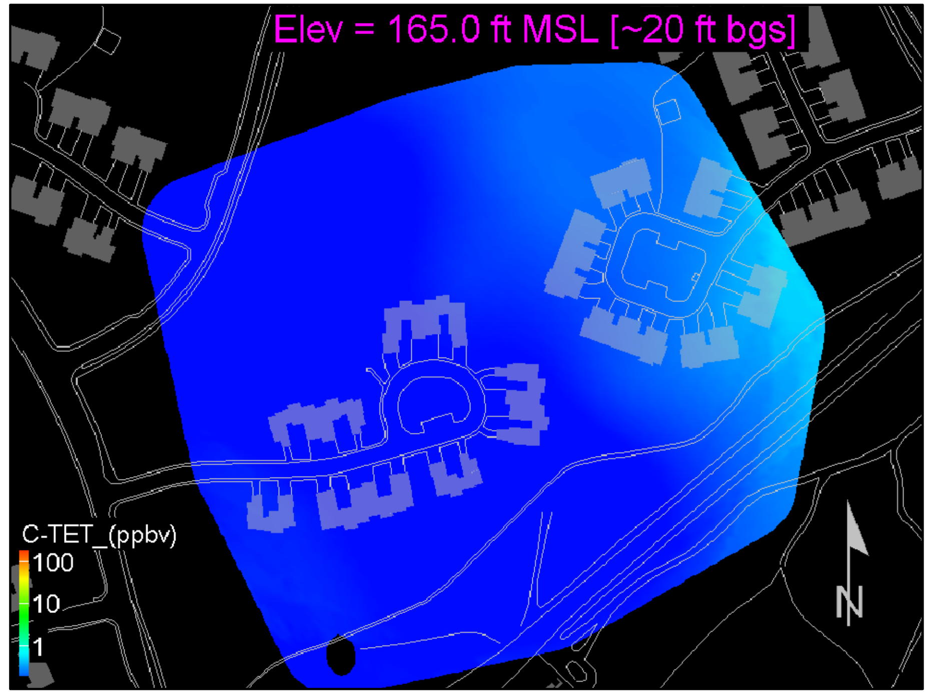
DATE APPROVED:
SCALE:
SPEC. No.
SHEET –
FILE No. 783751SJ–A175



PRE-SVE OPERATION



POST PHASE 1

NOTE:
Model truncated on northern boundary
due to incomplete pre-SVE concentration data.

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SACRAMENTO, CALIFORNIA

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FIGURE 6-3
CARBON TETRACHLORIDE CONCENTRATIONS
(20 FT. DEPTH) PRE- AND POST SVE OPERATION
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

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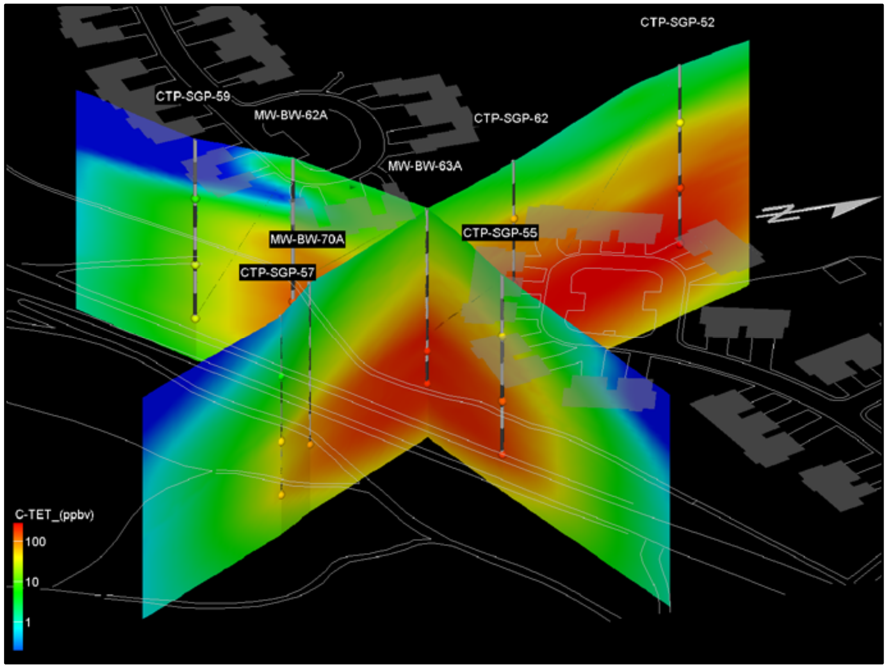
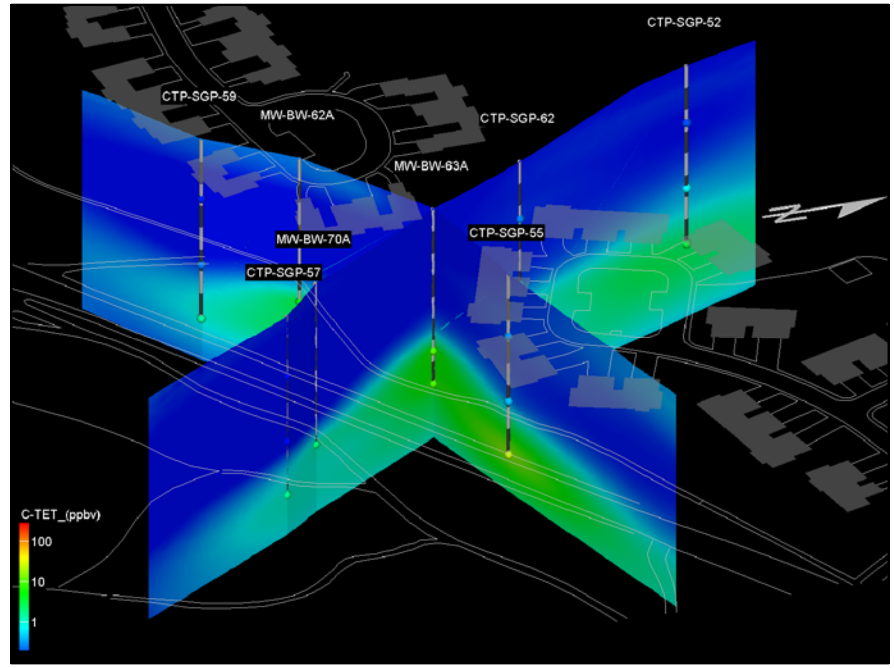
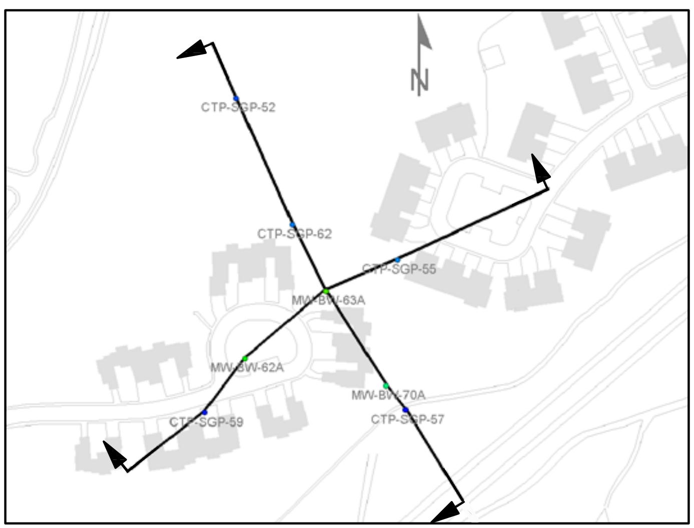
DATE APPROVED:
SCALE:
SPEC. No.
SHEET –
FILE No. 783751SJ–A176



PRE-SVE OPERATION



POST PHASE 1



Cross Section Location

NOTES:

1. Model truncated on northern boundary due to incomplete pre-SVE concentration data.

REVISION	DATE	DESCRIPTION	CHKD	APPR
C	8/15/05	CT SVE REPORT	ES	PK

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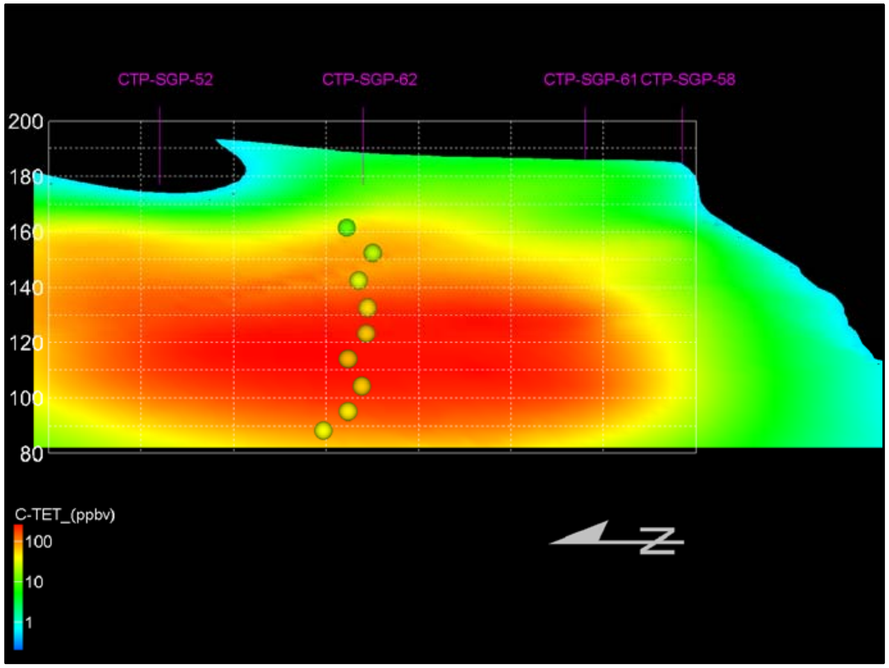
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

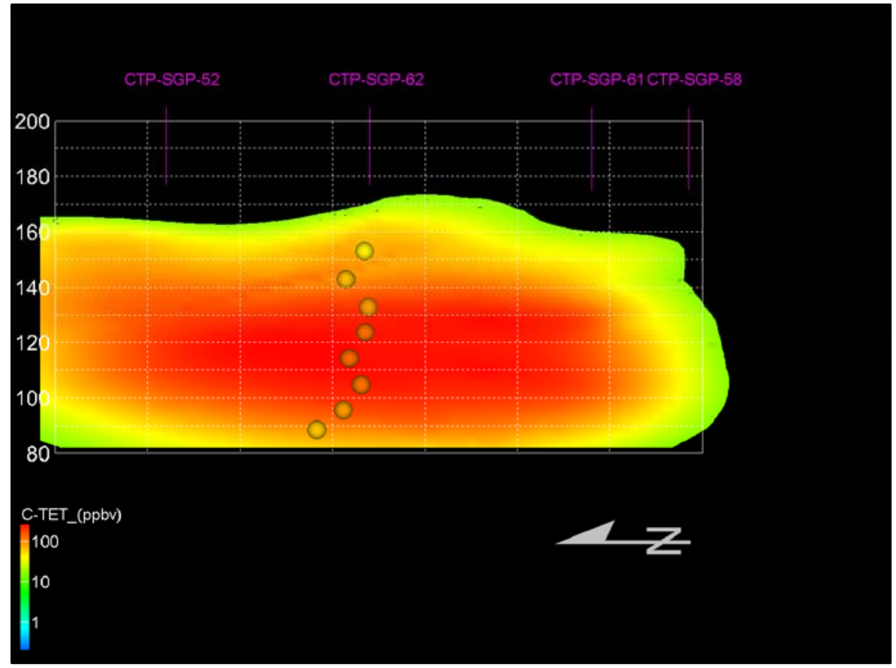
DESIGNED: J. MATOS
DRAWN: K. BLACK
CHECKED: P. KELSALL

FIGURE 6-4
3-DIMENSIONAL REPRESENTATION OF PRE- AND POST SVE CARBON TETRACHLORIDE CONCENTRATIONS
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

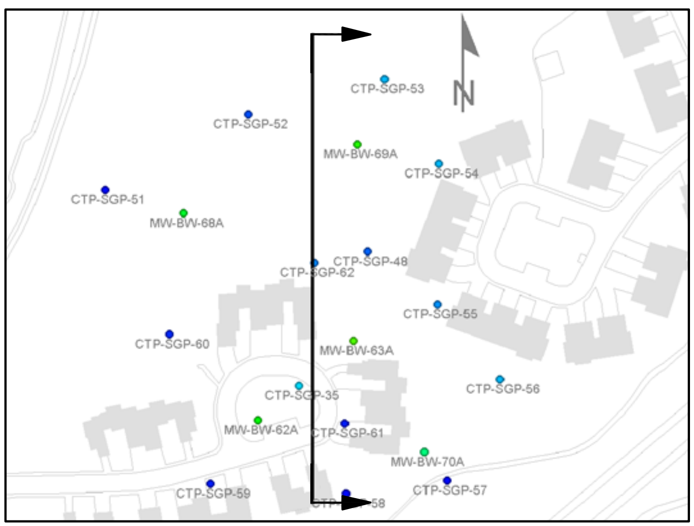
SUBMITTED:
DATE APPROVED:
SCALE:
SPEC. No.
SHEET –
FILE No. 783751SJ–A183



1 ppbv



20 ppbv



Cross Section Location

NOTES:

1. Model truncated on northern boundary due to incomplete pre-SVE concentration data.
2. Spheres colored by average concentration of impacted soil volume for a particular depth interval.
2. Spheres represent vertical location of the center of mass for a particular depth interval.

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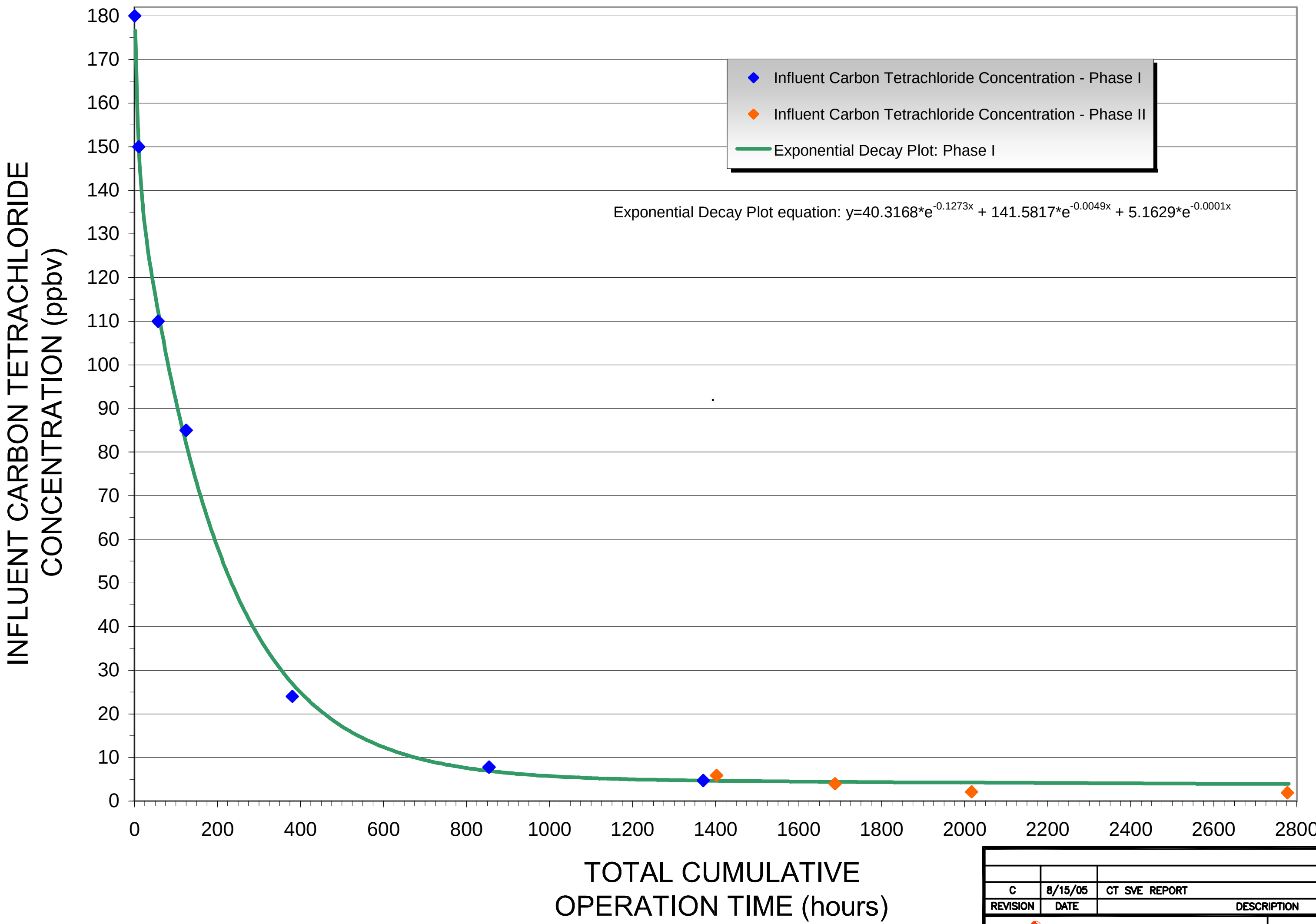
DESIGNED: J. MATOS DRAWN: K. BLACK CHECKED: P. KELSALL	FIGURE 6-5 LOCATION OF CENTER OF MASS FOR CARBON TETRACHLORIDE IMPACTED SOIL VOLUME SVE PILOT TEST OPERABLE UNIT CARBON TETRACHLORIDE FORMER FORT ORD, CALIFORNIA

SUBMITTED:	DATE APPROVED:	SCALE:	SPEC. No.
		SHEET –	FILE No. 783751SJ–A181



REVISION	DATE	DESCRIPTION	CHKD	APPR
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SACRAMENTO, CALIFORNIA

DESIGNED: E. SCHMIDT
DRAWN: K. BLACK
CHECKED: P. KELSALL

FIGURE 7-1
EXPONENTIAL PLOT OF INFLUENT CARBON TETRACHLORIDE CONCENTRATION vs. TIME
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

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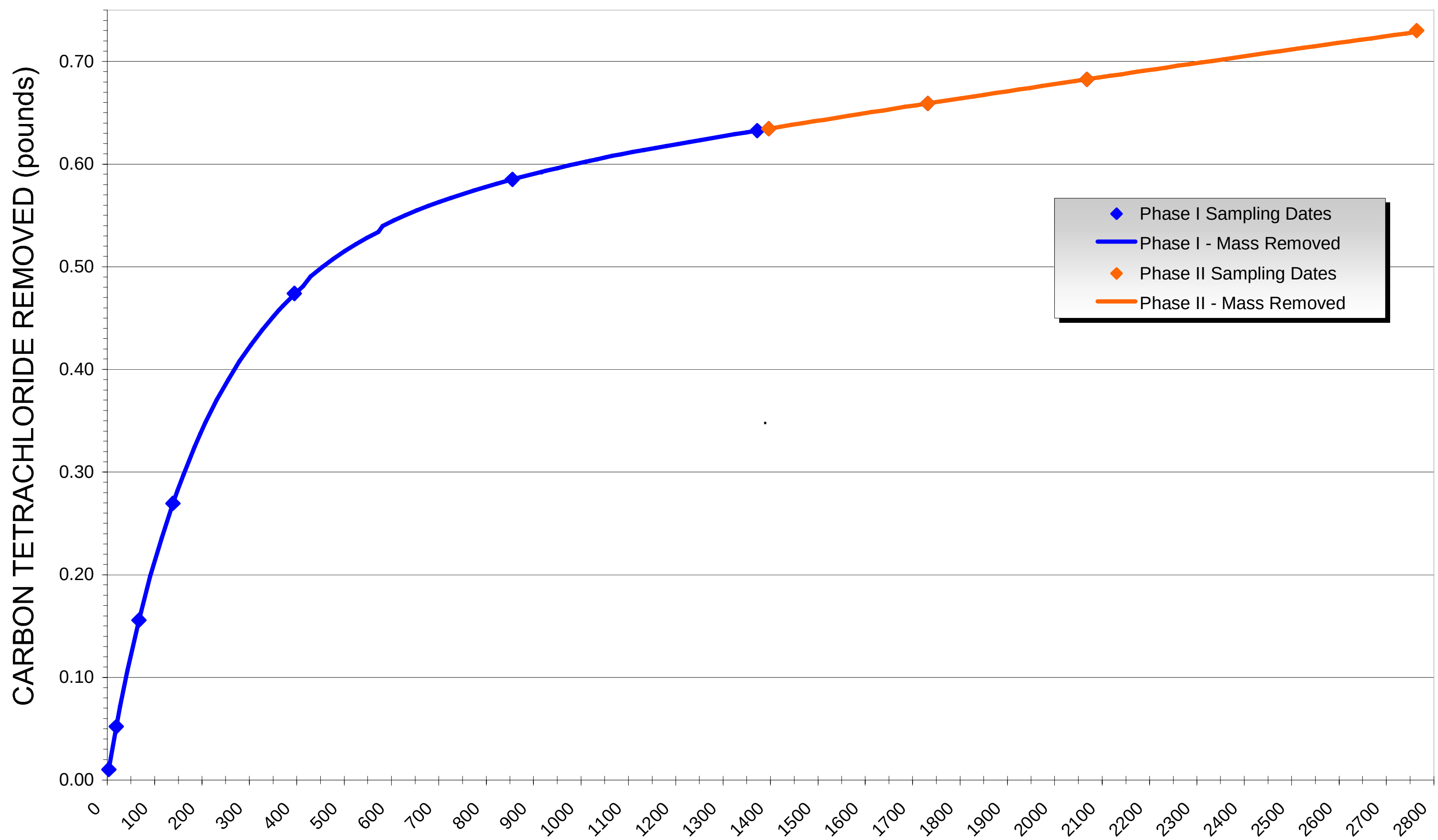
FILE No. 783751SJ–A177



CUMULATIVE OPERATING TIME (hours)

REVISION	DATE	DESCRIPTION	CHKD	APPR
C	8/15/05	CT SVE REPORT	ES	PK

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SACRAMENTO, CALIFORNIA

DESIGNED: E. SCHMIDT
DRAWN: K. BLACK
CHECKED: P. KELSALL

FIGURE 7-2
CUMULATIVE MASS OF CARBON TETRACHLORIDE
REMOVED vs. CUMULATIVE OPERATING TIME
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

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SPEC. No.
SHEET –
FILE No. 783751SJ–A178

Photographs

Photograph 1-1

Lexington Court Building

Photograph 2-1

Installing Monitoring Probe SGP- 55, Ready Court

Photograph 2-2

Pipeline Installation

Photograph 2-3

Well Vault Construction

Photograph 2-4

Treatment System Blower Unit

Photograph 2-5

Soundproofing

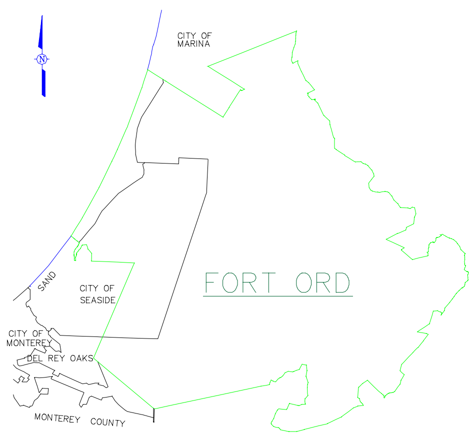
Photograph 2-6

Granulated Activated Carbon Units

Appendix A
Final Work Plan and Sampling and Analysis Plan
Pilot Soil Vapor Extraction and Treatment
Operable Unit Carbon Tetrachloride Plume
Former Fort Ord, California

Associated Field Work Variances

FINAL WORK PLAN AND SAMPLING AND ANALYSIS PLAN PILOT SOIL VAPOR EXTRACTION AND TREATMENT OPERABLE UNIT CARBON TETRACHLORIDE PLUME FORMER FORT ORD, CALIFORNIA MARCH 2004 REVISION 0



TOTAL ENVIRONMENTAL RESTORATION CONTRACT DACW05-96-D-0011

Submitted to:

Department of the Army
Corps of Engineers, Sacramento
1325 "J" Street
Sacramento, California 95814-2922

Submitted by:

Shaw Environmental, Inc.
#4 All Pro Lane
P.O. Box 1698
Marina (Fort Ord), CA 93933

Presidio of Monterey

U.S. ARMY CORPS OF ENGINEERS

Shaw Environmental, Inc.

FINAL WORK PLAN
and
SAMPLING AND ANALYSIS PLAN

PILOT SOIL VAPOR EXTRACTION AND TREATMENT OPERABLE UNIT CARBON TETRACHLORIDE PLUME

FORMER FORT ORD, MARINA, CALIFORNIA

TOTAL ENVIRONMENTAL RESTORATION CONTRACT DACW05-96-D-0011

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Submitted by:

Shaw Environmental, Inc.
#4 All Pro Lane
Marina, California

Revision 0

March 2004

Issued to:______________________________ Date:________________

Copy #:_______ ☐ Controlled ☐ Uncontrolled

FINAL WORK PLAN
and
SAMPLING AND ANALYSIS PLAN

PILOT SOIL VAPOR EXTRACTION AND TREATMENT OPERABLE UNIT CARBON TETRACHLORIDE PLUME

FORMER FORT ORD, MARINA, CALIFORNIA

TOTAL ENVIRONMENTAL RESTORATION CONTRACT DACW05-96-D-0011

Revision 0

March 2004

Approved by: _____Signature on File__________ Date: ______________
John Pietz, PE
Project Engineer

Approved by: _____Signature on File__________ Date: ______________
Tom Ghigliotto
Contractor Quality Control Systems Manager

Approved by: _____Signature on File__________ Date: ______________
Peter Kelsall
Project Manager

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List of Appendices (included on CD)

List of Tables

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List of Acronyms and Abbreviations

%	percent
AHA	activity hazard analysis
AR/COC	Analysis Request/Chain of Custody
ARAR	Applicable, Relevant and Appropriate Requirements
Army	U.S. Department of the Army
BACT	Best Available Control Technology
BCT	Base Realignment and Closure (BRAC) Cleanup Team
BRAC	Base Realignment and Closure
bgs	below ground surface
CDQMP	Chemical Data Quality Management Plan
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CQCP	Contractor Quality Control Plan
CQCSM	Contractor Quality Control System Manager
CT	Carbon tetrachloride
CTAC	carcinogenic air contaminants
CTP	Carbon tetrachloride plume
DQO	data quality objective (s)
EPA	Environmental Protection Agency
ft	feet
GAC	granular activated carbon
HDPE	high-density polyethylene
hp	horsepower
HS	Health and Safety
in	inch
ins.Hg	inches.mercury
IT	IT Corporation
KW	kilowatt
lb	pound
lbs/day	pounds per day
LFG	landfill gas
MBUAPCD	Monterey Bay Unified Air Pollution Control District
NOx	nitric oxide
NPL	National Priority List
O&M	operation and maintenance
OU	Operable Unit
OU2	Operable Unit 2
PCE	Perchloroethylene
PCQCP	Program Contractor Quality Control Plan
PEL	permissible exposure limit
PG&E	Pacific Gas and Electric
ppbv	parts per billion by volume
PQL	practical quantitation limits

List of Acronyms and Abbreviations (continued)

PVC	Polyvinyl Chloride
QC	quality control
RI/FS	Remedial Investigation/Feasibility Study
ROI	radius-of-influence
SAP	Sampling and Analysis Plan
scfm	standard cubic feet per minute
SQP/SOP	Standard Quality Procedures/Standard Operating Procedures
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SVE	Soil Vapor Extraction
TAC	toxic air contaminant
TAT	turn-around-time
TCE	trichloroethene
TERC	Total Environmental Restoration Contract
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound
w.c.	water column

1.0 Introduction

This work plan describes the design and installation of a pilot soil vapor extraction and treatment system (pilot SVE system) to remediate vadose zone soils in a suspected source area for the Operable Unit Carbon Tetrachloride Plume (OU CTP) at former Fort Ord, Marina, California. This work plan was prepared for the U.S. Department of the Army (Army) by Shaw Environmental, Inc. (Shaw, formerly IT Corporation) under the Total Environmental Restoration Contract (TERC) II No. DACW05-96-D-0011.

Analytical results from soil gas and groundwater samples collected in what is now the Preston Park housing area, in the vicinity of Lexington Court and Ready Court, suggest that a source of carbon tetrachloride (CT) may be present in the vadose zone soils in this area. The CT in the soils is suspected to be a continuing source of groundwater contamination and has the potential for vapor intrusion into nearby residential housing. As described in this work plan, the Army will install three new soil vapor extraction wells and convert two existing monitoring wells in this area to extraction wells. The extraction wells will be tied in via pipeline to a vapor treatment system installed in an unused garage at Lexington Court. The treatment system will use granulated activated carbon (GAC) to remove CT and other volatile organic compounds (VOCs) from the extracted soil vapor. Twelve new nested monitoring probes, plus three existing shallow probes, will be used to monitor system performance.

This work plan only addresses implementation of the proposed pilot SVE system. The results of the pilot SVE system will provide data for the OU CTP Remedial Investigation/ Feasibility Study (RI/FS) on the effectiveness of this remedial technology for source control of the CT groundwater plume and mitigation of potential vapor intrusion into the nearby housing area.

1.1 Site Location and History

Ford Ord is a former military installation that comprises approximately 46 square miles in northwestern Monterey County, California (Figure 1-1). Monterey Bay and the Santa Lucia Range form the western and southern boundaries of Fort Ord, respectively. The cities of Marina and Seaside are northwest and southwest of Fort Ord, respectively.

Fort Ord served as a training and staging facility for infantry troops from its opening in 1917 until its closure in 1993. In 1990, Fort Ord was placed on the U.S. Environmental Protection Agency (EPA) National Priority List (NPL), primarily due to VOCs found in groundwater beneath the Fort Ord Operable Unit 2 (OU2) Landfill.

The suspected source area for the OU CTP is located in the northern portion of former Fort Ord, generally south of the city of Marina and north of Imjin Parkway (Figure 1-1). The pilot SVE system will be conducted within the area in which the CT concentration in the soil gas exceeds 20 parts per billion by volume (ppbv) (Figure 1-2).

1.2 Summary of Previous Investigations

Appendix A provides a summary of investigations conducted to date. These investigations have defined an area of soil gas contaminated with CT. Concentrations have been found to be higher in proximity to the water table than at shallow depths. Based on these investigations it appears that soil gas may be a source for continuing groundwater contamination, and possibly a source for indoor air contamination.

1.3 Pilot Soil Vapor Extraction and Treatment System Work Plan Organization

This work plan is organized into the following sections and appendixes:

- Section 1.0 provides an introduction, location and history of OU CTP
- Section 2.0 presents the objectives and benefits of the pilot soil vapor extraction and treatment system
- Section 3.0 describes the regulatory requirements
- Section 4.0 presents the construction work plan for the extraction system
- Section 5.0 presents the construction work plan for the treatment system
- Section 6.0 describes the start-up operations
- Section 7.0 provides a Sampling and Analysis Plan (SAP)
- Section 8.0 describes safety and health requirements
- Section 9.0 discusses contractor quality control and presents the project organization
- Section 10.0 presents the list of references
- Appendix A provides a summary of previous investigations
- Appendix B presents an analysis of soil gas permeability based on tests conducted the landfill gas system at the OU2 Landfill
- Appendix C presents results of air flow modeling used to design extraction well spacing
- Appendix D provides Construction Specifications
- Appendix E provides Activity Hazard Analyses (AHA)
- Appendix F provides Vendor Submittals

All Appendices are included on a compact disk.

2.0 Pilot Soil Vapor Extraction Objectives and System Overview

This section provides the objectives for the pilot SVE system and a general description of the proposed components.

2.1 Objectives

The objectives for the pilot SVE system were developed jointly by the Army, Mactec and Shaw, following the Technical Project Planning (TPP) process developed by USACE (1998).

2.1.1 Evaluate Site Information and Data

A CT soil vapor plume has been identified and delineated using subsurface probes (see Figure 1-2 and Appendix A). The soil vapor plume is located in a residential area in the vicinity of Lexington Court and Ready Court. The soil vapor plume presents a continuing source of groundwater contamination and a potential vapor intrusion problem into the nearby housing .

The primary chemical of concern is CT. Three other VOCs have been detected in the OU CTP groundwater plume and in the soil gas in the study area: chloroform, perchloroethylene (PCE), and trichloroethylene (TCE).

2.1.2 Identify and Document Project Objectives

The Army directed U.S. Army Corps of Engineers (USACE), Mactec and Shaw to design a mitigation that will:

- Provide source control for the CT groundwater plume, and
- Alleviate the potential for vapor intrusion into the nearby housing area

It was agreed that there is currently no specific cleanup level. However, it is anticipated that a cleanup level will be determined after an evaluation of the pilot test data. Shaw will implement a pilot test that will provide data for the RI/FS. The RI/FS schedule requires approximately 3 months of test data by June 2004.

Design guidance includes:

- Existing data from the landfill gas pilot test will be used for design of the extraction well spacing
- The presumptive treatment method is GAC
- A well field will be designed to vent the soils capture area within the existing 20 ppb CT soil vapor contour, with focus on the 80 ppb contour. It was acknowledged that the existing 20 ppb contour does not “close” to the north. For present purposes it will be

assumed that the 20 ppb contour can be extrapolated to close following the trend of the 80 ppb contour. This issue will be resolved by monitoring during pilot testing.

- Piping should be buried for security
- Depth to groundwater in the general vicinity is approximately 100 feet (ft). The vadose zone thickness matches the depth to water.
- Mactec will determine if a target cleanup level for the deep soil vapor can be back-calculated based on a soil gas concentration equivalent to the groundwater cleanup level
- Mactec will determine if a target cleanup level for the shallow soil vapor can be back-calculated from the acceptable risk in the housing.

2.1.3 Identify Stakeholder Perspectives

Various stakeholders include regulators, primarily the Base Realignment and Closure (BRAC) Cleanup Team (BCT), the Army, and the public:

- Impacts to adjacent residents and property should be minimized during construction and operations, e.g. by installing the treatment system in one of the empty houses on Lexington Court. This will provide security and reduce noise.
- The Army will prepare a fact sheet and public notifications. Community relations will not be addressed further in this work plan.
- There is no proven risk to residents in the housing. Concentrations within the houses or beneath the slab have not been determined. With conservative assumptions, the risk may fall in the 10^{-5} to 10^{-6} range, requiring further evaluation. The TPP agreed that an accelerated mitigation is preferable to extended air monitoring and evaluation. (Subsequently the Army has proposed to conduct indoor monitoring at 6277 Lexington Court. This is addressed in a separate sampling and analysis SAP (Shaw 2004).
- The plan will be presented to the BCT for comment prior to preparation of the work plan. This was done at the December 2003 BCT meeting.

2.1.4 Define Probable Remedies

The mitigation will include two main remedy components, the extraction system and the treatment system.

The current proposed extraction system will consist of extraction wells distributed to vent soils within the 20 ppb CT contour. The system will be designed with existing data. Soil venting will be verified using a combination of existing and new monitoring probes at various depths.

The proposed system will use GAC. This method is efficient for removal of CT and the 3 other compounds detected in the soil vapor. The system will be installed in Lexington Court.

Effectiveness of removal will be verified with pre- and post-treatment sampling of the treatment system, and by monitoring soil vapor concentrations. Normal analytical methods will be adequate, and will be defined in the work plan.

2.1.5 Identify Executable Stages to Site Closeout

The following stages in the development of the pilot test were identified:

- Design and work plan using existing data
- Procure and install wells, probes, pipeline and equipment
- 3 month pilot test and evaluation for the RI/FS

At the end of 3 months the effectiveness of the mitigation will be evaluated. If the system is efficiently removing CT, operation will continue at the discretion of the Army until either: a) cleanup levels have been attained, or b) removal of CT is low and continued operation is not cost effective.

2.1.6 Recognize Site Constraints and Dependencies

Design of the pilot test must take into account the existing housing and potential impacts to residents.

Permits are not required for the pilot test. Discharge will be designed to be in compliance with Monterey Bay Unified Air Pollution Control District (MBUAPCD) Regulation II (New Sources) and Regulation X (Toxic Air Contaminants) - Rule 207 and Rule 1000.

2.1.7 Data gaps

It was agreed that the test can be designed with existing data. Existing soil vapor concentrations have been defined (Appendix A). Soil permeability can be extrapolated from previous design work for the OU2 landfill gas (LFG) system. Data gaps that will be addressed by the pilot test include:

- **Flow rate vs time.** At the present time the concentration of the CT and other VOCs in vadose zone probes is known but there is no data regarding the flow rate. In the extraction system it is expected that the flow rate will be a function of induced vacuum, and it may vary with time and location.
- **Soil gas vapor composition vs time.** At the present time the composition and concentration of the soil gas vapor are known but there is no data on how these concentrations will behave over time while the system is in operation. A rapid

decrease in soil vapor concentrations to near zero in all extraction wells and monitoring probes may indicate that a vadose zone source for CT is not present.

- **Radius of influence (ROI) of extraction wells.** The ROI of extraction wells may be estimated but various assumptions are involved in the calculation including the permeability and homogeneity of the soil. Flow to the wells may be influenced by the presence of silty strata.

2.1.8 Define Courses of Action for Achieving Site Closeout

The TPP Team directed Shaw to develop this work plan and implement the pilot SVE system after review and approval.

2.2 General Description

The pilot SVE system will consist of vertical extraction wells, monitoring probes, and a vapor treatment system installed in the vicinity of Lexington Court and Ready Court, the suspected source area for the CT groundwater plume. The pilot SVE system will reduce the migration of VOCs from the vadose zone into the groundwater and reduce the potential for soil vapor intrusion into nearby housing areas. The pilot SVE system will be operated for three months to provide data on the effectiveness of this remedial technology for the OU CTP RI/FS. At the end of three months of system operation, the performance of the pilot SVE system will be evaluated. If this evaluation shows that the system is effectively removing VOCs from the vadose zone soils, operation will continue at the direction of the Army until either: a) cleanup levels have been attained, or b) removal of VOCs from the soils is low and continued operation of the system is not cost effective.

2.2.1 Extraction Wells

Shaw will convert two existing monitoring wells, MW-BW-62-A and MW-BW-63-A, to soil vapor extraction wells and will install three additional extraction wells in the vicinity of Lexington Court and Ready Court. The new extraction wells will be constructed similar to the existing monitoring wells and will be screened approximately over the lower 30 feet (ft) of the vadose zone. Based on estimates of the air permeability of soils from pilot tests of the OU2 LFG System (Appendix B) and three-dimensional airflow modeling of the pilot SVE system (Appendix C), the spacing between extraction wells in the pilot SVE system is set at approximately 300 ft. Figure 2-1 shows that the combined expected ROI of the five extraction wells will vent the soils within the 20 ppbv contour.

2.2.2 Monitoring Probes

Twelve nested soil vapor probes will be installed to monitor the performance of the pilot SVE system (Figure 2-2). The nested monitoring probes will consist of three probes installed at approximate depths of 85, 60, and 30 ft below ground surface (bgs). The probes will be equipped to allow for the collection of induced vacuum measurements and soil vapor samples during operation of the pilot SVE system. Three existing shallow (6-ft) probes will also be monitored during system operation.

In addition, two shallow probes are to be installed in connection with indoor ambient air sampling (Shaw, 2004). One probe will be installed through the slab of the building at 6277 Lexington Court and the other outside the building to a depth of 6 ft. These probes will be monitored as part of the pilot test.

2.2.3 Treatment System

The wells will be tied in via pipeline to a soil vapor treatment system installed in a garage in Lexington Court (Figure 2-3) .The treatment system will consist of a 20-horsepower (hp) vacuum blower, and two 2,000-pound (lb) vessels of GAC connected in series. The blower will provide the suction for removal of the soil vapor and the pressure for treatment of the recovered soil vapors by the downstream GAC adsorption vessels.

Treatment using GAC is a standard industry treatment for VOC vapor control. The GAC chemically traps VOCs, removing them from the vapor stream. The GAC has a finite capacity for VOCs. However, based on the expected low CT concentrations in the influent it is likely that GAC replacement will not be required during the period of the pilot test (Section 6.3). If GAC replacement is required, the spent GAC will be sent offsite for disposal or thermal regeneration. Two GAC vessels in series will be used to provide a measure of redundancy for vapor treatment.

The blower and control panels will be housed in a garage located on Lexington Court. The GAC vessels will be placed outside the garage. Adequate soundproofing and weatherproofing will be installed in the garage to minimize noise and allow for safe operation of the process equipment. Power for treatment system operation will be provided initially by a diesel generator. A service connection to Pacific Gas and Electric (PG&E) power will be added later if feasible. A fence will be installed to provide security.

2.3 Benefits of the Pilot SVE System

Installation and operation of the pilot SVE system will have the following benefits:

1. The pilot extraction and treatment system will provide data on the effectiveness of soil vapor extraction technology for removing CT and other VOCs from vadose zone soils that can be used in the evaluation of alternative remedial technologies during preparation of the OU CTP RI/FS.

2. Soil vapor extraction removes CT and other VOCs that otherwise may be transported to the groundwater. Soil vapor extraction may shorten future groundwater treatment and reduce groundwater treatment costs.

3. Soil vapor extraction removes CT and other VOCs that otherwise may escape to the atmosphere and impact ambient air quality or result in vapor intrusion into nearby residential housing.

4. If soil vapor extraction is effective in removing CT and other VOCs from the vadose zone soils, the pilot system may be adequate to remediate the entire suspected source area for the OU CTP.

3.0 Regulatory Requirements

This section presents the applicable regulatory requirements for the discharge of organic compounds to the atmosphere by the treatment system, and the installation of the extraction wells and monitoring probes.

Based on our review of the applicable or relevant and appropriate requirements (ARARs) for the soil vapor treatment system, no permitting will be required because this system is a component of a pilot test system. However, discharge of organic compounds by the treatment system will be designed to be in compliance with the following air quality standards of the Monterey Bay Unified Air Pollution Control District (MBUAPCD):

- MBUAPCD Regulation II (New Sources) – Rule 207
- MBUAPCD Regulation X (Toxic Air Contaminants) – Rule 1000.

Installation of the soil vapor extraction wells and monitoring probes will be subject to the well permitting requirements of the Monterey County Health Department, Division of Environmental Health, Hazardous Materials.

3.1 Monterey Bay Unified Air Pollution Control District Regulations

MBUAPCD Regulation II (New Sources) and Regulation X (Toxic Air Contaminants) - Rule 207 and Rule 1000

3.1.1 Regulation II, Rule 207

The MBUAPCD regulates New Sources under the permitting requirements described in Regulation II, Rule 207. Under Rule 207, Best Available Control Technology (BACT) shall be required for any new or modified permit unit with a potential to emit 25 pounds per day (lbs/day) or more of VOCs or nitric oxide (Nox). In no event shall the application of BACT result in the emissions of any pollutant which exceed the emissions allowed by any applicable standard in 40 Code of Federal Regulations (CFR) Part 60 (New Source Performance Standards), or in 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants), or in 40 CFR Part 63 (National Emission Standards for Hazardous Air Pollutants for Source Categories).

Based on the contours shown in Figure 1-2, the CT concentrations at the 5 proposed extraction well locations range from approximately 65 to 300 ppbv, with an average of approximately 160 ppbv. With this average concentration the daily emissions of CT without treatment would be approximately 0.09 lbs. This is a conservative estimate of actual emissions for a number of reasons: 1) the 140 ppbv average is based on concentrations at greater than 66 ft depth which are higher than concentrations at shallower depths; 2) concentrations of CT in the influent are expected to decline significantly as the system is operated; 3) GAC treatment will be installed.

The concentrations of the other compounds found in the soil gas are lower than those of CT. For the expected influent CT concentration of 160 ppbv, the equivalent expected concentrations are chloroform 10 ppbv, PCE 5 ppbv, and TCE 8 ppbv.

The controlled emissions for the pilot SVE system are expected to be far below the allowable maximum.

3.1.2 Regulation X, Rule 1000

The soil vapor treatment system has the potential to emit very low levels of carcinogenic air contaminants (CTAC), or toxic air contaminants (TAC) so it will be designed to meet MBUAPCD Rule 1000, Permit Guidelines and Requirements for Sources Emitting Toxic Air Contaminants. Under MBUAPCD Rule 1000, the emission limits are health-based and are expressed in terms of allowable increased risks of no more than 1 in 100,000 (or 1 x 10^{-5}).. To demonstrate that the treatment system emissions are in substantial compliance with this rule the following items must be completed:

- Reasonable Control Technology must be installed to control emissions of TAC's.
- BCT must be installed to control emissions of CTAC's.
- Emissions of any TAC or CTAC may not exceed 1/420th of the permissible exposure limit (PEL) at the property line.
- A risk assessment must be completed to demonstrate that the emissions from the system will not cause a net increased cancer risk in excess of one incidence per 100,000 population.

The PEL for CT is 2,000 ppbv and 1/420th of the PEL is 4.76 ppbv. As described above, it is expected that the concentration in the influent to the treatment system will be less than 140 ppbv at the beginning of the test, and will decline thereafter. Also, the expected removal efficiency for one vessel of GAC is at least 95 percent (%). This means that the concentration after one vessel should be approximately 7 ppbv, and after two vessels in series approximately 0.35 ppbv. Based on this analysis, the CT concentration after one vessel will only slightly exceed 1/420th of the PEL, and the concentration after two vessels will be approximately 7% of 1/420th of the PEL. Because of dispersion, concentrations at the property line or any potential receptor would be much less.

The other VOCs present in the influent to the treatment system are expected to be present at lower concentrations then the CT at the beginning of the test, and as with CT, the concentrations will decline thereafter. The following table shows the expected initial influent concentration and the corresponding 1/420th of the PEL:

	Expected influent concentration (ppbv)	PEL (ppbv)	1/420th PEL (ppbv)
Chloroform	10	2000	4.8
PCE	5	25,000	59.5
TCE	8	25,000	59.5

This indicates that the concentrations of PCE and TCE will be below 1/420th PEL even without treatment, while the concentrations of chloroform without treatment will be only two times the 1/420th PEL value. It is concluded that the concentrations after treatment will be significantly less than the 1/420th PEL values. This will be confirmed by monitoring during system operations.

3.2 Monterey County Health Department, Division of Environmental Health, Hazardous Materials-Well Drilling Permits

The new soil vapor extraction wells and monitoring probes are designed to intercept CT and other VOC migration to the groundwater table. Permits will be obtained from the Monterey County Health Department, Division of Environmental Health, Hazardous Materials Branch prior to the start of construction activities. One application will be submitted for each extraction and monitoring probe location.

4.0 Construction Work Plan, Soil Vapor Extraction System

Construction of the pilot soil vapor extraction system will include the conversion of two existing monitoring wells in the vicinity of Lexington Court and Ready Court to soil vapor extraction wells, the installation of three new extraction wells and 12 nested monitoring probes, and the installation of a buried collection header system for the extracted soil vapor. The construction requirements for the extraction system are summarized below.

4.1 Soil Vapor Extraction Wells and Monitoring Probes

4.1.1 Extraction Wells

Two existing monitoring wells will be converted to soil vapor extraction wells and three new extraction wells will be installed for the pilot soil vapor extraction system. These wells will be located so that the extraction well system will effectively vent the portion of the suspected source area where CT concentrations in soil gas are greater than 20 ppbv.

Figure 2-3 shows the site layout, the location of the extraction wells, and the collection header system layout. The construction details for the extraction wells, wellheads, and vaults are shown in Figure 4-1.

4.1.1.1 Conversion of Existing Monitoring Wells

Two existing monitoring wells, MW-BW-62-A and MW-BW-63-A, will be converted to soil vapor extraction wells. These wells were installed with two screens, the first from approximate depths of 58 to 88 ft bgs for soil vapor monitoring, and the second from 98 to 128 ft bgs for groundwater monitoring. The water table occurs between the lower and upper screens at a depth of approximately 100 ft, and will effectively seal off the lower screen. As a result, no subsurface modifications are required to convert the monitoring well to a soil vapor extraction well. After the SVE is completed the well will remain in place for groundwater monitoring.

A CES-Landtec Accu-flo™ wellhead will be installed at each well in a protective concrete vault. To minimize air infiltration through the ground surface, a plastic sheet will be placed on the surface around the well, below each protective vault.

4.1.1.2 Installation of New Extraction Wells

Three new soil vapor extraction wells will be installed at the locations shown in Figure 2-3. Locations were chosen to provide capture within the 20-ppbv CT contour, with minor adjustments for field conditions such as trees and utilities. The extraction wells will be constructed with 4-in. diameter Schedule 40 Polyvinyl Chloride (PVC) casing and screen. Each extraction well will be constructed to approximately 90 ft bgs, with the bottom 30 ft constructed with a 0.125 (1/8 inch [in.])-slotted Schedule 40 PVC well screen. The annulus surrounding the well screen will be backfilled with 3/8-in. crushed or natural washed pea gravel per Specification Section 02521 (Appendix D). A CES-Landtec Accu-flo™ wellhead will be installed at each well in a protective concrete vault. To minimize air infiltration through the ground surface, a plastic sheet will be placed on the surface around each well, below the protective vault.

The construction and installation details for the extraction wells, wellheads, and vaults are shown in Figure 4-1.

4.1.1.3 Extraction Well Vaults

Extraction wells will be completed below grade, enclosed in 2-ft by 2-ft by 2-ft concrete vaults with locking aluminum covers. Construction details for the vaults are presented in Figure 4-1. The extraction wells will be connected to the collection header laterals with a CES-Landtec Accu-flo™ wellhead.

4.1.2 Monitoring Probes

Twelve nested soil vapor probes will be installed to monitor the performance of the pilot soil vapor extraction and treatment system. The nested monitoring probes will consist of three probes installed at approximate depths of 85, 60, and 30 ft bgs. The monitoring probes will be constructed with ¾-in. diameter Schedule 40 PVC casing and screen. The bottom 5 ft of each probe will be constructed with a 0.125 (1/8 in.)-slotted Schedule 40 PVC well screen. The annulus surrounding the well screens will be backfilled with 3/8-in. crushed or natural washed pea gravel per Specification Section 02521 (Appendix D). The probes will be equipped with sampling port assemblies to allow for the collection of induced vacuum measurements and soil vapor samples during system operation. A 12-in diameter stovepipe or flush-mount protective cover will be installed on each nested monitoring probe.

Figure 2-2 shows the location of the monitoring probes. The construction and installation details for the monitoring probes are shown in Figure 4-2.

4.1.3 Extraction Well and Monitoring Probe Permits

Permits for the extraction wells and monitoring probes will be obtained from the Monterey County Health Department, Division of Environmental Health, Hazardous Materials Branch prior to the start of construction. One application will be submitted for each extraction well and monitoring probe location.

4.1.4 Drilling Equipment Decontamination

Tools and equipment used during drilling operations will be pressure washed using hot water prior to initial use, between boreholes, and before departing the project site.

Well materials, exclusive of sand pack, bentonite, and grout shall be decontaminated before placement in the borehole as described above. Following decontamination, all materials shall be placed on clean metal racks or clean plastic sheeting. If materials are not used immediately, they shall be wrapped or covered with clean plastic sheeting.

4.2 Collection Header System

4.2.1 Collection Pipes and Valves

The soil vapor extraction wells will be connected to a common 6-in. diameter high-density polyethylene (HDPE) SDR 17 header pipe. Lateral connections will be constructed of 4-in. diameter HDPE SDR 17 pipe (Figure 2-3). The header and laterals will be installed below grade. The piping runs and invert elevations will be engineered in the field to ensure proper drainage of condensate into the extraction wells.

Control valves will be installed at each extraction well connection. A butterfly valve will be installed in the main header before the blower.

The header pipe and laterals will be pressure tested to 5 pounds per square inch for 20 minutes. If there is a pressure drop, the leak will be isolated and repaired. Then the line(s) will be re-tested until all of the lines pass the pressure testing. The pressure testing will be conducted in accordance with the manufacturer's recommendations and procedures.

Piping will be single wall and not double-contained. Double-contained pipe is not considered necessary because the piping will contain only small amounts of condensed soil vapor moisture (water) under vacuum, rather than pressure. Also, the SVE will be installed above the footprint of the existing impacted groundwater plume. Also, the specified HDPE pipe is strong and durable and will be pressure tested for leakage before long-term operation.

4.2.2 Condensate Management

The piping layout will be designed so that most condensate in the piping system will drain back to the wells. In addition, a condensate sump consisting of a cleanout riser will be installed near the location where the header pipe enters the treatment building. This location is expected to be a local low in the pipe run elevation that will be prone to condensate accumulation. This sump will be pumped out manually as necessary. The volume of condensate is expected to be small because of the high vapor flow rate and installation of the piping below grade, where it will be insulated from potentially colder surface temperatures. If higher than expected volumes of condensate are realized and removal of the higher volume of condensate becomes labor-intensive, the system can be modified with a larger subgrade condensate sump equipped with automatic pump-out controls.

4.3 Environmental Protection

Environmental impacts associated with drilling and construction activities will be mitigated as described in the following sections.

4.3.1 Habitat Protection

Site preparation will include brush clearance and tree trimming in the work areas.

Vegetation clearance will be conducted in a manner to protect the existing oak trees. Tree branches may be trimmed as necessary to provide access, but no trees will be removed. Brush will be cut to a height approximately 6 ins. above the ground, where necessary for access. Where feasible, a mechanical device mounted on a backhoe will be used. Manual tools such as brush hogs and trimmers will be used in tight areas, such as between the trees. Brush will be excavated only where necessary for pipeline installation. Vegetation removed from work areas will be taken to Marina Landfill.

4.3.2 Dust Control

It is not anticipated that significant dust will be generated. Water trucks will be used to spray water in active construction areas, if noticeable dust is generated. If required, due to high winds, additional engineering measures will be implemented to control dust during drilling and construction activities.

4.3.3 Erosion Control

Mitigation measures to minimize disturbance of the vegetative cover and sensitive habitat were described in Section 4.3.1. Erosion damage is not expected because of the low relief and small amount of ground disturbance. If required, erosion control measures such as berms and silt fencing will be used to prevent erosion damage if inclement weather is forecast.

4.3.4 Security

The treatment facility will be protected with a security fence as described in Section 5.3. Temporary excavations and drill sites will be protected as necessary with temporary fencing and security patrols.

4.4 Construction Derived Waste

Wastes will be kept separate by type (i.e. soil cuttings will not be mixed with wastewater). Soil cuttings will be collected and tested to determine disposal requirements. Water generated during pressure washing will be contained and transported to the OU2 groundwater treatment plant. Other wastes (e.g. cement bags) will be disposed of as regular waste.

4.5 Demobilization

After completion of the pilot test all pipelines, valves, condensate tanks, and well vaults will be removed. These locations will be restored as near as possible to original surface conditions. The extraction wells and monitoring probes will be left in place for inclusion in a future well abandonment program.

5.0 Construction Work Plan, Soil Vapor Treatment System

This section presents the construction and electrical requirements for installation of the soil vapor treatment system. The treatment system will consist of a vacuum blower, and two GAC adsorption vessels. The blower will be installed in the garage at 6277 Lexington Court and the GAC vessels will be placed outdoors adjacent to the garage. The piping and instrumentation are shown in Figure 5-1.

A security fence and an outdoor light will be installed around the driveway to limit access to the treatment system.

5.1 Installation of the Blower and GAC Vessels

The garage will require minor modifications for the installation of the electrical service (including use of the temporary generator), installation of the blower, connection to the GAC vessels, and sound proofing.

The intake piping will be installed subgrade to the side of the garage, where a 6-in. riser and elbow will be installed to allow penetration of the building. Prior to the riser, a 6-inch tee will be installed in the line that will serve as a condensate sump and cleanout for any condensed moisture. The 6-in. header will be installed through a penetration in the side of the garage. Prior to connection to the blower, an adequate straight section of pipe will be installed to enable measurement of the airflow velocity using a pitot tube. Permanent penetrations will be installed in this straight section of pipe for pitot tube insertion.

The 20-hp regenerative-type 480-volt three phase vacuum blower will be installed in the garage, where it will be lagged to the floor. The blower will be equipped with thermal protection. A blower control panel consisting of a disconnect with adequate fusing for three-phase power, blower start and shutdown button, and a blower starter will be installed on an adjacent wall. As shown in Figure 5-1, a pressure switch and a temperature switch will be installed immediately downstream of the blower. In the event of a high temperature or pressure conditions, these switches will cause blower shutdown by interrupting power at the blower starter within the control panel.

Connection from the blower to the GAC vessels will consist of a flexible metal hose that penetrates the garage wall. This type of hose will also be used for the interconnection of the two GAC vessels. The use of flexible metal hose will allow the order of the GAC vessels to be changed without physically moving the vessels.

The GAC vessels will be placed alongside the garage driveway. A vapor sampling port will be installed between the vessels. The last vessel will be equipped with a five-foot long PVC stack fitted to the top flange. This stack will have a rain guard. Access gates will be installed to facilitate GAC change out.

Other modifications to the garage include installation of sheetrock to meet fire code requirements. As necessary, the existing vents will be modified to improve ventilation. Insulation and/or baffles will be added to reduce noise outside the building.

5.2 Electrical Installation

The total electrical load of the treatment system will be approximately 20 hp. Initially, a 35-kilowatt (KW) portable diesel generator will provide electrical power. A grounding rod will be installed adjacent to the generator.

Electrical cables will be used to convey power from the diesel generator to the treatment system components in the building interior. These cables will be placed in an above-grade metal conduit to protect the cables against damage. The cables will penetrate into the building either through a penetration in the wall or the garage door. In either case, a metal conduit will be placed within the penetration to guard against cable abrasion.

Inside the garage, the power will be connected to appropriate fusing and the disconnect switch. Grounding lugs on the disconnect and on the motor will be connected back to the generator ground, which in turn will be grounded through a grounding rod.

Shaw has requested a permanent power connection from PG&E. This will require running conduit to a transformer located approximately 550 ft west of the treatment location (Figure 2-3). It is not expected that this power source will be available at the beginning of pilot SVE system operations.

5.3 Fencing

The GAC vessels and generator and diesel tank will be enclosed by a security fence. The fence will be 8-ft tall chain link topped with 3 strands of barbed wire. Green slats will be added for privacy screening. Two 12-ft swing gates will be included.

5.4 Demobilization

After completion of the pilot test, equipment and fencing will be removed. These locations will be restored as near as possible to original conditions. Holes to garage walls will be repaired. All other modifications to the garage will be left in place.

6.0 Treatment System Operations and Maintenance

This section presents the procedures and requirements for the initial shakedown, start-up and monitoring of the treatment system, as well as normal operations and maintenance.

The primary objectives for the shakedown and start-up operations are to:

- Balance airflow and applied vacuum between the extraction wells
- Measure the influent and effluent VOC concentrations
- Measure the induced vacuum in the network of subsurface monitoring probes
- Prove the blower and other systems for unattended operation
- Prove the effectiveness of the treatment system.

The primary goal of normal operation is to ensure that operation and maintenance is optimized so that the design basis objectives of the pilot test are met.

The above tasks are described in further detail in the following sections.

6.1 Shakedown and Start-up Operations and Maintenance

Initial shakedown of the treatment system includes inspection by the design engineer and site-operator training. Specific tasks include:

- Test generator and power to blower, including blower rotation direction
- Test blower disconnect
- Confirm the applied vacuum and flow are present at extraction wells
- Test and assure correct operation of other controls and systems
- Train site operator in basic operations and troubleshooting.

6.1.1 Equipment Inspection

During the start-up phase, after initial shakedown, the site operator will visually inspect the treatment facility equipment and piping daily. The following items will be inspected each day, for the first five days of operation:

- Generator operation and diesel fuel tank level
- In-line sumps at pipe run low-points
- Blower inlet and discharge piping instrumentation
    - Inlet vacuum

– Inlet gas temperature
– Discharge pressure
– Discharge gas temperature

The site operator will note and immediately schedule repair and maintenance items.

6.1.2 Monitoring

Start-up monitoring activities consist of monitoring and sampling of the soil vapor extraction wells and monitoring probes, and treatment system influent and effluent streams. To achieve the start-up objectives, the following will be performed daily during the first five days of operation of the treatment system:

- Measure flow rate and applied vacuum at each extraction well per the monitoring schedule (Table 6-1).
- Measure induced vacuum at all of the monitoring probes per the monitoring schedule (Table 6-1).
- Measure flow rate to the GAC vessels twice per day for the first two days and daily for the next three days per the monitoring schedule (Table 6-1).
- Measure VOC concentrations in the influent and effluent streams on a 24-hour laboratory turn-around-time (TAT) on days 1 and 3 and standard TAT on days 2, 4 and 5per the sampling schedule (Table 6-2).
- Baseline monitoring of VOCs concentrations in the extraction wells and monitoring probes prior to system operation, as described in the SAP (Section 7.0).

6.2 Normal Operation Operations and Maintenance

Normal operations are defined as operations of the treatment system after the initial five-day shakedown and start-up period. At a minimum the system will be inspected weekly. Prior to connection to the local PG&E, more frequent system inspection may be required to top off the generator.

6.2.1 Equipment Maintenance

Equipment maintenance activities consist of:

- Maintain generator operation according to the manufacturer requirements and maintaining appropriate fuel tank level;
- Monitor in-line sumps and empty, if necessary;
- Monitor blower inlet and discharge piping instrumentation
  - Inlet vacuum

- Inlet gas temperature
- Discharge pressure
- Discharge gas temperature

- Monitor influent and effluent stream VOC concentrations to determine the effectiveness of emissions control in meeting regulatory requirements;
- Monitor applied vacuum and vapor flow rates in the extraction wells and adjustment of flow rate, if necessary;
- Monitor the induced vacuum and VOC concentrations at the subsurface monitoring points.

6.3 Monitoring

The performance of the system will be monitored using a combination of field instruments and laboratory analysis. Field instruments will be used to measure flow rate, applied and induced vacuum. As described in the SAP (Section 7.0), samples will be sent to an analytical laboratory to measure the concentration of CT and other VOCs.

Monitoring for flow rate and vacuum will be performed per the schedule outlined in Table 6-1. Monitoring for the concentration of CT and other VOCs will be performed per the schedule outlined in Table 6-2. These schedules may be modified by field work variance depending on observed data.

System performance will be gauged by the results of sampling and monitoring of extraction wells, monitoring probes, and treatment system influent, mid and effluent streams.

6.3.1 Instrumentation

A GEM-500™ will be used measure applied vacuum from 0.1 to 100 ins. water column (w.c.), and flow rate (scfm). The GEM-500™ can measure vacuum at a resolution of 0.1 ins. wc. This instrument has integrated microprocessors that will calculate the flow rate after the required parameters are programmed in; they store about 200 readings, which can be downloaded into a computer. A second port in the GEM-500™ will measure a velocity head (differential pressure) across a flow-measuring device (orifice).

A Dwyer series 475 Mark III (model 475-1-FM) digital manometer will be used to measure induced vacuum from 0.01 to 19.99 ins. w.c. This manometer has a resolution of 0.01 ins. w.c. The operator shall read the manufacturer supplied operation manual prior to use, and perform all required instrument calibrations according to the manufacturer's specifications.

A digital barometer will be used to measure atmospheric pressure concurrently with the induced vacuum measurements. The operator shall read the manufacturer supplied operation manual prior to use, and perform all required instrument calibrations according to the manufacturer's specifications.

The principles of operation, operating procedures, calibration procedures, and preventative maintenance of these instruments must be thoroughly understood in order to perform accurate monitoring. The operator must also understand the operating limitations of the instruments.

6.4 GAC Changeouts

As described in Section 3.1, it is expected that the concentration in the influent to the treatment system will be less than 140 ppbv at the beginning of the test, and will decline thereafter. Also, the expected removal efficiency for one vessel of GAC is at least 95%. This means that the concentration should not exceed 7 ppbv after one vessel, and should not exceed 0.35 ppbv after two vessels in series.

For purposes of monitoring and developing decision rules relating to GAC changeout (Section 7.2.5), breakthrough will be defined as the detection of CT exceeding 7 ppbv in a sample collected midstream between the two GAC vessels, or a CT concentration exceeding 4.76 ppbv (1/420th of the PEL as explained in Section 3.1.2) in the effluent sample collected downstream of the second vessel. In the event of breakthrough of the first vessel, the system will be shut down, the first vessel changed and the order of operation of the vessels rotated so that the second vessel becomes the lead vessel. The use of flexible hoses between the vessels will enable this operation. In the event of breakthrough of the second vessel, the system will be shut down, and both GAC vessels will be replaced. A qualified GAC vendor equipped with a vacuum truck will change the GAC vessels. Vapor-phase, virgin GAC will be used for the vessels.

The expected life of one 2,000-pound GAC vessel before significant breakthrough occurs is approximately 600 days for an influent CT concentration of 160 ppbv. Therefore, breakthrough is not expected during the course of the pilot test. Two sets of samples will be obtained on a rapid turnaround during the first week of the test (6.1.3) to provide data to verify assumptions. Thereafter, sampling of the GAC system will be performed on normal turnaround.

The other VOCs present in the influent to the treatment system are expected to be present at lower concentrations then the CT at the beginning of the test, and as with CT concentrations will decline thereafter. Based on expected influent concentrations it is not expected that any of these compounds will breakthrough before CT.

6.5 Notifications

The Army shall notify the MBUAPCD at least 24 hours prior to start-up of the pilot SVE system.

7.0 Sampling and Analysis Plan

This SAP describes the sampling and analytical methods that will be performed associated with the pilot test. Sampling will be conducted to measure the concentration of selected VOCs in the following locations:

- Extraction wells
- Monitoring probes
- Soil vapor treatment system.

All sampling will be performed following the guidance of the *Standard Quality Procedures/Standard Operating Procedures Manual, Former Fort Ord, California* (SQP/SOP) (IT, 2002), and the *Chemical Data Quality Management Plan, Former Fort Ord, California, Revision 0* (CDQMP) (IT, 2001).

This SAP establishes the data quality objectives (DQOs), sampling design, analytical methods, and sampling procedures that will be used in collecting data. Consideration is given to both laboratory analytical and field monitoring requirements and methods.

7.1 Background

Background information and general objectives for the pilot SVE system were provided in Sections 1.0 and 2.0 of this work plan. Additional background soil gas data are provided in Appendix A.

This SAP is intended to outline the sampling and analysis that will occur to measure VOC concentrations in the extraction wells, monitoring probes, and soil vapor extraction system. The chemicals of concern are four VOCs that have been detected in the soil gas and the underlying groundwater plume:

- Carbon Tetrachloride
- Chloroform
- Trichloroethene
- Tetrachloroethene.

7.2 Data Quality Objectives

Data generated from the sampling and analysis activities for this project will be verified against established DQOs to determine if the data are of sufficient quality to be used in meeting the primary end-use requirements. The DQO process is designed to provide a means to determine what type of data need to be collected, as well as to ensure that the data collected are scientifically sound, defensible, and of known, acceptable documented quality. The DQO process is established in accordance with the procedures outlined in the Guidance for Planning for Data Collection in Support of Environmental Decision Making using Data Quality Objectives Process (EPA, 1994).

The DQO process consists of the seven steps outlined below:

- State the problem
- Identify the decisions
- Identify inputs to decisions
- Define the study boundaries
- Develop decision rules
- Specify tolerable limits on decision errors
- Optimize investigation design for obtaining data.

7.2.1 State the problem

Define the problem so the focus of the study will be unambiguous

Volatile organic compounds (primarily CT) exist in a shallow soil gas plume. These are suspected to be a continuing source of groundwater contamination and present a potential vapor intrusion problem into the nearby housing. A pilot SVE system will be installed to extract the VOCs that are present and thus reduce and remove the source of contamination. Sampling and analysis for VOCs and other field measurements are required in order to optimize the performance and monitor the effectiveness of the pilot SVE system.

Identify members of the planning team and the primary decision-maker

The planning team will consist of project and technical staff from Shaw, Mactec and USACE. Initial technical decisions will be made by the project engineer/manager, and will be submitted to the USACE technical team leader for approval.

Specify available resources and relevant deadlines for the study.

Shaw will conduct the work with technical oversight from USACE. The Army has directed that the mitigation should be implemented as soon as possible. An objective is to provide approximately 3 months of test data by June 2004 for inclusion in the OU CTP RI/FS.

7.2.2 Identify the Decisions

Identify the principal study question

The principal study question is:

1) Is the pilot SVE system effectively removing VOCs from the soil gas?

Additional study questions are:

2) Can the pilot SVE system be optimized to more effectively remove the VOCs from the soil gas?

3) Is VOC breakthrough occurring in the GAC system?

These questions will be addressed on a continuing basis, to determine how system performance is changing versus time.

Define the alternative actions that could result from resolution of the principal study question

The current sampling design for the pilot SVE system includes 5 extraction wells and 17 monitoring probes. Also included are 3 locations at the treatment system: 1) influent stream, 2) midstream between the two GAC vessels, and 3) effluent stream. The alternative actions that could result from the study questions outlined above are that:

1) The flow rate of each of the extraction wells may be modified based on the induced vacuum measurements or concentrations of VOCs observed in the monitoring probes. (e.g., the rate of extraction could be increased in wells with higher concentration of VOCs and reduced in wells with lower concentrations)

2) The concentration of VOCs measured in the influent stream to the pilot SVE system will quantify the amount that is removed from the plume. Based on this information, the frequency of system operation or the flow rate may be modified or the operation of the system may be shutdown if its operation is no longer cost effective

3) The concentration of VOCs measured in the after the lead GAC vessel will determine when breakthrough is occurring and determine that a GAC change out is necessary

4) The concentration of VOCs measured in the effluent stream will determine the ability to achieve the requirements set forth in MBUAPCD Rule 1000.

7.2.3 Identify Inputs to Decisions

Identify the information that will be required to resolve the decision statement

The following information will be required in order to resolve the decision statements:

- Flow rates from extraction wells as a function of applied vacuum;
- Applied vacuum in the extraction wells;
- Induced vacuum in the monitoring probes;

- VOC concentrations of the gas taken from the monitoring and extraction wells, influent, mid, and effluent streams of the treatment system;

Determine the sources for each item of information identified

A field portable landfill gas (LFG) analyzer (CES-Landtec GEM-500™) will be used to measure flow rate and applied vacuum in the extraction wells. Lower induced vacuums (e.g., at the monitoring probes) will be measured with a digital manometer with a resolution of 0.01 ins. wc.

Volatile organic compounds will be measured in the soil gas samples by a fixed-based analytical laboratory using *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected In Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)* (EPA, 1999).

7.2.4 Define Study Boundaries

Define the spatial and temporal boundaries that are covered by the decision statement

The Technical Planning process (Section 2.1) determined that the boundary of the pilot test would be the 20 ppbv CT contour in soil gas (Figure 1-2).

The Army has directed that the mitigation should be implemented as soon as possible. An objective is to provide approximately 3 months of test data by June 2004 for inclusion in the OU CTP RI/FS.

Determine the timeframe to which the decision applies.

A majority of the decisions will be made in the early phases of operation of the pilot SVE system; monitoring frequency will be reduced as the system is optimized for performance efficiency. The initial phase of operation is for 3 months. At the end of the three months of system operation, the performance of the pilot SVE system will be evaluated. If this evaluation shows that the system is effectively removing VOCs, an optional 6-month operation period may continue at the direction of the Army until either: a) cleanup levels have been attained, or b) removal of VOCs from the soils is low and continued operation of the system is not cost effective.

7.2.5 Develop Decision Rules

The planning team has not identified a complete set of quantitative decision rules for the pilot test. In consultation with USACE and Mactec, Shaw will evaluate the test data as the pilot test is conducted. The following decision rules will be applied:

- During the initial 3-month pilot test, operating parameters may be adjusted to optimize performance at the discretion of the Project Engineer.
- At the completion of 3 months, or at any subsequent evaluation, the test may be concluded if two or more of the following apply:
  - Concentrations of VOCs in the vadose zone are lower than a target cleanup level for the shallow soil vapor back-calculated from the acceptable risk in the housing;
  - Concentrations of VOCs in the vadose zone are lower than a target cleanup level for the deep soil vapor back-calculated based on a soil gas concentration equivalent to the groundwater cleanup level; and
  - Concentrations of VOCs in the influent stream have declined to an asymptotic level such that it is not cost-effective to continue operation
- The two GAC vessels will be reversed based upon an evaluation of the results of the midstream sample
- The two GAC vessels will be replaced based upon a review of the effluent sample results

7.2.6 Specify Tolerable Limits on Decision Errors

Identify sources of errors and biases that could affect the decision

Decisions could be adversely affected by errors in field or laboratory measurements, or if the flow rate, vacuum, and VOC concentrations that are measured during operation are not representative.

Describe ways to minimize biases and errors

Potential biases and errors may result from field instrument measurements, and fixed-based laboratory analyses. The following types of decision errors are possible:

- Accepting field measurements for determining the appropriate conditions for pilot SVE system optimization when the measurements are higher then they truly are; and
- Accepting field measurements for determining the appropriate conditions for pilot SVE system optimization when the measurements are lower then they truly are.
- Accepting fixed-based laboratory results for determining the appropriate conditions for pilot SVE system optimization when the results are higher then they truly are; and

- Accepting fixed-based laboratory results for determining the appropriate conditions for pilot SVE system optimization when the results are lower then they truly are.
- Performing a GAC change out before it is needed because the fixed-based laboratory results are higher then they truly are.
- Not performing a GAC change out when it is needed because the fixed-based laboratory results are lower then they truly.
- Determining that the source of contamination for the CTP has not been removed because the fixed-based results are higher then they truly are.
- Determining that the source of contamination for the CTP has been removed because the fixed-based results are lower then they truly.

Errors associated with field instruments will be minimized by the use of established methods and calibration according to manufacturers' instructions. Errors associated with laboratory chemical analyses may result from analytical and sample collection processes. To limit decision errors during analysis, method requirements have been established. The laboratory will perform analysis in accordance with Compendium Method TO-15 (EPA, 1999) to reduce the occurrence of false positive and negative analytical errors. In order to limit decision errors in the field, samples will be collected following the guidance of the SQP/SOP manual, CDQMP, and this SAP. Additionally, quality control (QC) samples (field duplicates) will be collected at a rate of 5% to measure potential sources of error during the sample collection.

To the extent possible, uncertainty in the test data will be factored into any decisions made with regard to pilot SVE system optimization, GAC change outs, and pilot SVE system shutdown.

7.2.7 Optimize Design for Obtaining Data

The following sections describe the optimization of design and sampling procedures for each type of measurement that will be collected for this project.

7.2.7.1 Sampling for Volatile Organic Compounds

This section presents procedures and sampling method requirements for collecting VOC samples from the extraction wells, monitoring probes, sub-slab probe, and the components associated with the pilot SVE system (influent, mid, and effluent streams). A summary of the samples that will be collected, and the frequency of collection are presented in Table 6-2. It is believed that frequency of sampling provided in Table 6-2 provides sufficient information in order to resolve the decision statements.

As explained in Section 3.1, it will be necessary to measure the concentrations of target VOCs to at or below a value 1/420th of the PEL. The practical quantitation limits (PQLs) for target VOCs are 0.5 ppbv. Table 7-1 shows that the PQLs are sufficient to quantify concentrations significantly below the 1/420th PEL value for each of the target chemicals.

Pre-sampling Activities

Prior to collection of samples that will be sent to the fixed-based analytical laboratory, the field technician should obtain the following:

1) Evacuated 6-liter passivated stainless-steel SUMMA™ canisters provided by the laboratory

2) Teflon connecting tubing and fittings, etc.

3) Vacuum gauge for measuring initial and final pressures in the canister

4) Barometer for measuring atmospheric pressure

5) Map showing the sample locations (extraction wells, monitoring probes, etc.)

6) Sample collection logs (Form 7-1), clipboard, and pen.

7) Analysis Request/Chains-of-Custody (AR/COC) (Form 7-2)

Sampling Procedure

Volatile organic compound samples will be collected using the following sampling requirements and procedures:

1) Purge monitoring probes by attaching a personal sampling pump (Gil-Air™ or equivalent) with a Tygon connecting tube to the sample port. Approximately 3 well/probe volumes of gas shall be removed prior to sampling. The pump should be operated at rate of approximately 200 milliliters/minute. If sampling is during normal operations, shut down the treatment system prior to sampling.

2) Purge extraction wells initially (prior to full system startup) by using the blower from the treatment system to remove a minimum of 3 casing volumes a predetermined period of time. During normal operations, shut down the treatment system prior to sampling.

3) Check the SUMMA™ canister using the vacuum gauge to confirm that it is negatively pressurized (vacuum should be at least 27 inches. mercury [ins. Hg]);

4) Attach the stainless steel canister using a Teflon connecting tube, and collect the sample by opening the vacuum gauge attached to the canister to allow the slow intake of sample. Continue sampling until the gauge shows a negative pressure between 2 to 5 ins. Hg.

5) Affix a label to the stainless steel canister that will be taped with clear tape and a custody seal. The stainless steel canister is stored in a box.

6) Close sampling port and cap when sampling is complete.

7) Complete sample collection logs (Form 7-1) and AR/COC (Form 7-2)

8) Sample collector will change powder-free nitrile gloves between samples.

Data Recording

The following data should be recorded in the sample collection log for each sample collected:

1) Name of person(s) collecting sample;

2) Date and time collected

3) Atmospheric pressure, and whether rising or falling

4) Weather conditions, wind and rain

5) Sample number and source location (e.g., extraction well, influent, etc.)

6) Initial and final SUMMA™ canister pressure

Sampling Method Requirements

Gas samples will be collected in accordance with the SQP/SOP Manual (IT, 2002). Applicable SOPs are as follows:

SOP No.	SOP Title
1.1	Chain of Custody
2.1	Sample Handling, Packaging, and Shipping
17.1	Sample Labeling
19.1	Onsite Sample Storage

Sample Numbering System

A sequential sample numbering system will be employed. All samples to be collected from the CTP will be designated with the prefix "CTP". Following this prefix the sample number will have a designation of its location (EW = extraction well, MP = monitoring probe (also referred to as soil gas probe), INF = Influent, MID = midstream, EFF = effluent). After the location designation, the extraction well or monitoring probe number will be identified. All samples in order of collection will be assigned the next number in the consecutive sequence. For example, CTP-EW62A-001 is the first sample collected from an extraction well 62A, CTP-MP51-005 is the fifth sample collected from a monitoring probe 51.

Sample Labels

A sample label will be attached to each and every sample container. Indelible ink must be used when filling out all sample labels. Persons responsible for sample labeling must ensure that each sample collected has a label and that the information documented on the sample label corresponds with the information documented on the AR/COC.

Sample Handling, Packaging, and Shipping

The stainless steel canisters will be shipped back to the laboratory in the same box they were received via surface transport. The canisters do not require preservation.

Analysis Request/Chain of Custody Procedures

It is critical that AR/COCs are properly maintained and that all AR/COC procedures are properly implemented.

Quality Control Samples

The sampling methodologies described in this sampling and analysis plan have been selected to ensure appropriate data quality. The appropriateness of the field sampling protocol will be verified by inclusion of field duplicate samples.

Field duplicates are replicates submitted blind to the contract laboratory for the purpose of assessing contract laboratory precision and measuring potential sources of error during the sample collection process. Field duplicate samples for this project will be collected at a rate of 5% of the total samples collected, and analyzed for the same parameters as the corresponding primary sample. Field duplicates will be collected using two SUMMA™ canisters attached together using a manifold to avoid bias.

7.2.7.2 Field Measurements for Flow Rate and Pressure

Flow rate and vacuum measurements will be made on the extraction wells, monitoring probes, sub-slab probe, and the pilot SVE system. These measurements are made in order to fully optimize the system for maximum removal of VOCs from the soils. A summary of the measurements that will be made and their frequency is presented in Table 6-1.

Pre-sampling Activities

Prior to collection of data, the field technician should obtain the following:

1) A map showing extraction well and monitoring probe locations and identifications

2) Calibrated GEM-500™ LFG analyzer

3) Calibrated digital manometer (with resolution of 0.01 ins. w.c.)

4) Calibrated digital barometer

5) Teflon connecting tubing and fittings, etc.

6) Sample collection log (Form 7-3)

Vacuum and Flow Rate Measurements

The type of measurement and the instrumentation used will depend upon the location that is being measured. For example, extraction wells will have a higher vacuum then monitoring wells, and will require flow measurements. For this reason, the measurement of pressure and flow rate at extraction wells will be performed using a GEM-500™ LFG analyzer. Lower vacuums at the monitoring wells, and sub-slab probe will be measured using a digital manometer (with a resolution of 0.01 ins. w.c.). The sampling requirements and procedures are as follows:

1) Read pressure (ins. w.c.) using either the GEM-500™ or a digital manometer (depending upon sample location);

2) Read barometric pressure (mm Hg) using digital barometer

3) Attach GEM-500™ to the probe using a Teflon connecting tube. Measure flow rate in standard cubic feet per minute (scfm);

4) Disconnect the GEM-500™ (or digital manometer);

5) Reseal the well/probe/port when monitoring is complete. The sampling point should always remain sealed when not being monitored;

6) Complete the sample collection log (Form 7-3). Additional information and comments will be documented in a field activity daily log (Form 7-4).

Instrumentation

Section 6.3.1 provides detailed information about the field instrumentation that will be used.

7.2.8 Analytical Method Requirements

EPA Method TO-15 (EPA, 1999) is a procedure for sampling and analysis of VOCs in gas. The VOCs are separated by gas chromatography and measured by a mass spectrometer or by multi-detector techniques. The method presents procedures for sampling into canisters to final pressures both above and below atmospheric pressure (respectively referred to as pressurized and sub-atmospheric pressure sampling).

Analysis of samples will be performed per the requirements presented in Tables 7-1 – 7-7. Air Toxics Ltd., Folsom, California, will perform analyses.

8.0 Site Safety and Health Plan

Work activities will be performed utilizing safe work practices as detailed in the *Site Safety and Health Plan, Fort Ord Remedial Action, Former Fort Ord, California* (Basewide SSHP) (Shaw, 2003). Activity Hazard Analyses providing a summary of the hazards anticipated during the construction and operation of the pilot SVE system, and actions to be implemented to avoid and minimize the impact of these hazards, are presented in Appendix E.

9.0 Contractor Quality Control Plan

This Contractor Quality Control Plan (CQCP) has been developed in accordance with the requirements of the *Program Contractor Quality Control Plan for Sacramento TERC II* (PCQCP) (ICF Kaiser, 1998). A table showing the summary of project team QC responsibilities is presented in Table 9-1.

9.1 Project Organization

This section provides a brief description of the roles and responsibilities of personnel who will be involved with installation and testing of the pilot soil vapor extraction and treatment system. A project organization chart is presented in Figure 9-1.

9.1.1 Project Manager

The Project Manager, Peter Kelsall, is responsible for the quality and cost and schedule performance of all project activities, including those performed by subcontractors. The Project Manager is the primary interface with the Army and regulatory agencies.

9.1.2 Project Engineer

The Project Engineer, John Pietz P.E., is responsible for the design of the pilot soil vapor extraction and treatment system and will provide technical direction for installation, testing and operations. Changes to the design or testing procedures will be reviewed and approved by the Project Engineer. The Project Engineer is responsible to the Project Manager and the Task Manager on project issues.

9.1.3 Task Manager

The Task Manager, Jen Moser R. G., is responsible for day-to-day management of engineering, construction, operation, monitoring and testing activities including, but not limited to:

- Detailed planning and scheduling
- Managing Shaw resources and subcontractors
- Coordinating testing and monitoring activities
- Data compilation and reporting
- Tracking the project cost and schedule and implementing corrective measures when necessary.

9.1.4 Contractor Quality Control System Manager

The Contractor Quality Control System Manager (CQCSM), Tom Ghigliotto, supports the Task Manager in day-to-day operations; however, the CQCSM will report functionally to the TERC II QC Supervisor, Michael Reed. The CQCSM has sufficient authority, including stop work authority; to ensure that all project site activities comply with approved work documents. This authority applies equally to all project activities, whether performed by Shaw or its subcontractors and suppliers.

The CQCSM will be responsible for planning and executing QC oversight of project operations and shall ensure compliance with specified QC requirements in project plans, procedures, and contract documents.

9.1.5 Certified Industrial Hygienist

The TERC II Program Certified Industrial Hygienist (CIH), Dr. Rudy Von Burg, is responsible for the development, implementation, and oversight of the Basewide Site Safety and Health Plan (SSHP) (Shaw, 2003). The CIH will provide oversight during construction and sampling activities.

9.1.6 Site Safety and Health Officer

The Site Safety and Health Officer (SSHO), Charles Luckie, is responsible for implementation of the Basewide SSHP (Shaw, 2003) and applicable corporate Health and Safety (HS) procedures. Specific responsibilities include developing AHAs and monitoring construction and sampling activities for compliance with the Basewide SSHP. The SSHO is responsible to the Task Manager in day-to-day operations, but reports functionally to the TERC II Program CIH, Dr. Rudy Von Burg.

9.1.7 Project Superintendent

The Project Superintendent, Dan Nohrden, is responsible for overseeing construction activities performed at the site. Field activities may be conducted by qualified in-house staff or by subcontractors. The Project Superintendent reports to the Task Manager.

9.1.8 Project Subcontractors

A subcontractor to be selected later will perform extraction well drilling and installation. Subcontracted work will be conducted in accordance with the requirements of the contract, subcontractor scopes of work.

9.2 Definable Features of Work

The definable features of work are as follows:

1. Prepare Work Plan

2. Drill and install extraction wells and monitoring probes
3. Install extraction well piping, vaults and condensate collection tank, and convert monitoring wells MW-BW-62A and MW-BW-63 to extraction wells
4. Prepare treatment system site and required utilities, install treatment system, and connect extraction piping to the treatment system.
5. Phase 1 system operation including preparation of a data report.
6. Phase 2 system operation including preparation of a data report.

9.3 Deliverables

Project deliverables for this project include the following:

- Pilot Soil Vapor Extraction and Treatment Work Plan, including SAP and Contractor Quality Control Plan
- Construction record drawings showing all installed systems.
- Phase 1 data report
- Phase 2 data report

10.0 References

EPA, 1994, Guidance for Planning for Data Collection in Support of Environmental Decision Making using Data Quality Objectives Process.

EPA, 1999, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, 2nd Edition, Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS) EPA/625/R-96/010b

Harding Lawson Associates, 1994, Draft Final, Basewide Hydrogeologic Characterization, Fort Ord, California.

Harding Lawson Associates, 1999. Draft Final, Carbon Tetrachloride Investigation Report, Fort Ord, California.

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Harding Lawson Associates, 2002a. Draft Final, Natural Attenuation Summary Report, Carbon Tetrachloride Investigation, Former Fort Ord, California.

Harding Lawson Associates, 2002b. Draft Final, Carbon Tetrachloride Study Area, Drilling Letter Report - Wells MW-BW-30-A through MW-BW-42-A.

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ICF Kaiser, 1998, Program Contractor Quality Control Plan For Sacramento TERC II, USACE Contract No. DACW05-96-D-0011, Oakland, CA.

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IT, 2002, IT Standard Quality Procedures and IT Standard Operating Procedures, Revision 5, Concord, California.

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Shaw, 2003, Site Safety and Health Plan, Fort Ord Remedial Action, Former Fort Ord, California

Shaw, 2004, Draft Sampling and Analysis Plan, Indoor Air Sampling, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California

Tables

Table 6-1
Performance Monitoring Airflow and Vacuum Measurement Schedule

Measurement Location		Pilot System Operation									Optional 6-Month System Operation
		Week 1					Week 2	Month 1	Month 2	Month 3	
		Day 1	Day 2	Day 3	Day 4	Day 5					Monthly
Extraction Wells (Airflow and Vacuum)	MW-BW-62-A	X	X	X	X	X	X	X	X	X	X
	MW-BW-63-A	X	X	X	X	X	X	X	X	X	X
	MW-BW-68-A	X	X	X	X	X	X	X	X	X	X
	MW-BW-69-A	X	X	X	X	X	X	X	X	X	X
	MW-BW-70-A	X	X	X	X	X	X	X	X	X	X
Monitoring Probes (Vacuum)	Interior										
	CTP-SGP-61	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-62	X	X	X	X	X	X	X	X	X	X
	Perimeter										
	CTP-SGP-51	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-52	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-53	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-54	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-55	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-56	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-57	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-58	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-59	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-60	X	X	X	X	X	X	X	X	X	X
	Shallow										
	CTP-SGP-35	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-37	X	X	X	X	X	X	X	X	X	X
	CTP-SGP-48	X	X	X	X	X	X	X	X	X	X
Treatment System	Total Airflow	X	X	X	X	X	X	X	X	X	X

Note: Flow rate and vacuum will be monitored at least twice on Day 1, and may be monitored more than once on days 2 through 5 depending on observed trends

Table 6-2
Performance Monitoring Volatile Organic Compound Sampling Schedule

Sampling Location		Phase 1 Operation										Optional 6 Month System Operation			
		Baseline	Week 1					Week 2	Month 1	Month 2	Month 3	Months 4-5	Month 6	Months 7-8	Month 9
Extraction Wells	MW-BW-62-A	1						1	1	1	1		1		1
	MW-BW-63-A	1						1	1	1	1		1		1
	MW-BW-68-A	1						1	1	1	1		1		1
	MW-BW-69-A	1						1	1	1	1		1		1
	MW-BW-70-A	1						1	1	1	1		1		1
Monitoring Probes	Interior														
	CTP-SGP-61	3						3	3		3		3		3
	CTP-SGP-62	3						3	3		3		3		3
	Perimeter														
	CTP-SGP-51	3									3				3
	CTP-SGP-52	3							3		3		3		3
	CTP-SGP-53	3									3				3
	CTP-SGP-54	3									3				3
	CTP-SGP-55	3							3		3		3		3
	CTP-SGP-56	3									3				3
	CTP-SGP-57	3									3				3
	CTP-SGP-58	3							3		3		3		3
	CTP-SGP-59	3									3				3
	CTP-SGP-60	3							3		3		3		3
	Shallow														
	CTP-SGP-35	1									1				1
	CTP-SGP-37	1						1	1		1		1		1
	CTP-SGP-48	1						1	1		1		1		1
	6277 Lexington Court														
	CTP-SGP-49 (Sub-Slab)							1	1		1		1		1
	CTP-SGP-50 (Exterior)							1	1		1		1		1
	Sub-total	44	0	0	0	0	0	15	27	5	46	0	27	0	46

Sampling		Phase 1 Operation										Optional 6 Month System Operation			
			Week 1					Week 2	Month 1	Month 2	Month 3	Months 4-5	Month 6	Months 7-8	Month 9
Location		Baseline	**Day 1 (24-hour)**	Day 2	**Day 3 (24-hour)**	Day 4	Day 5								
Soil Vapor Treatment System	Influent	na	**1**	1	**1**	1	1	na	1	1	1	2	1	2	1
	Lead Carbon Vessel	na	**1**					na	1	1	1	2	1	2	1
	Effluent	na	**1**	1	**1**	1	1	na	1	1	1	2	1	2	1
	Sub-total	0	3	2	2	2	2	0	3	3	3	6	3	6	3
	Total Samples	44	3	2	2	2	2	15	30	8	49	6	30	6	49

3 MONTH OPERATION

TOTAL GAS SAMPLES = 157
FIELD DUPLICATES = 9
CUMULATIVE TOTAL = 166

OPTIONAL 6 MONTH OPERATION

TOTAL GAS SAMPLES = 91
FIELD DUPLICATES = 5
CUMULATIVE TOTAL = 96

Table 7-1
Practical Quantitation Limits for Volatile Organics by U.S. Environmental Protection Agency Method TO-15[a]

Parameter	Method	Analyte[b]	Reporting Limit (ppbv[c])	PEL[d] (ppbv)	1/420th PEL[e] (ppbv)
Volatile Organic Compounds	TO-15	Carbon Tetrachloride	0.5	2,000	4.76
		Chloroform	0.5	2,000	4.76
		Trichloroethene	0.5	25,000	59.52
		Tetrachloroethene	0.5	25,000	59.52

Notes:

[a] U.S. Environmental Protection Agency, 1999, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, 2nd Edition, EPA/624/R-96/0106

[b] Control will be maintained on all analytes

[c] Parts per billion by volume

[d] Permissible Exposure Limit. The maximum permitted 8-hour time-weighted-average (TWA) concentration of an airborne contaminant, California Code of Regulations (CCR) Title 8, Section 5155, Table AC-1, Permissible Exposure Limits for Chemical Contaminants.

[e] Monterey Bay Unified Air Pollution Control District Rule 1000, Permit Guidelines and Requirements For Sources Emitting Toxic Air Contaminants

Table 7-2
Bromofluorobenzene Key Abundance Criteria for Volatile Organics by U.S. Environmental Protection Agency Method TO-15[a]

Mass	Ion Abundance Criteria
50	15 to 40 percent of mass 95
75	30 to 60 percent of mass 95
95	Base peak, 100 percent relative abundance
96	5 to 9 percent of mass 95
173	<2 percent of mass 174
174	>50 percent of mass 95
175	5 to 9 percent of mass 174
176	>95 percent but <101% of mass 174
177	5 to 9 percent of mass 176

Notes:

[a] U.S. Environmental Protection Agency, 1999, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, 2nd Edition, EPA/624/R-96/0106

Table 7-3
Laboratory Control Limits for Surrogate Spikes for Volatile Organics by U.S. Environmental Protection Agency Method TO-15[a]

Analytical Method	Spiking Compounds	Percent Recovery (%)
TO-15	1,2-dichloroethane-d_4	70-130
	Toluene-d_8	70-130
	4-Bromofluorobenzene	70-130

Notes:

[a] U.S. Environmental Protection Agency, 1999, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, 2nd Edition, EPA/624/R-96/0106

Table 7-4
Laboratory Control Limits for Internal Standards for Volatile Organics by U.S. Environmental Protection Agency Method TO-15[a]

Analytical Method	Internal Standard	Percent Recovery (%)[b]
TO-15	Bromochloromethane	50-200
	1,4-Difluorobenzene	50-200
	Chlorobenzene-d_5	50-200

Notes:

[a] U.S. Environmental Protection Agency, 1999, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, 2nd Edition, EPA/624/R-96/0106

[b] Internal standard area counts must not vary by more than a factor of two (-50 percent to +100 percent) from the associated 12hr calibration standard (per EPA Functional Guidelines), however, if the recovery is high, and samples are non-detectable then no corrective action is required.

Table 7-5
Control Limits for Laboratory Control Samples for Volatile Organics by U.S. Environmental Protection Agency Method TO-15[a]

Analytical Method	Spiking Compounds[b]	Percent Recovery (%)
TO-15	Carbon Tetrachloride	70-130
	Chloroform	70-130
	Trichloroethene	70-130
	Tetrachloroethene	70-130

Notes:

[a] U.S. Environmental Protection Agency, 1999, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air* , 2nd Edition, EPA/624/R-96/0106

Table 7-6
Summary of Calibration Procedures for Volatile Organics
by U.S. Environmental Protection Agency Method TO-15[a]

Method	Parameter	Calibration	Frequency	Acceptance Criteria	Corrective Action
TO-15	Volatile Organics	Check instrument tuning	Every 12 hours criteria using BFB[b]	Refer to Table 7-2	1) Retune instrument 2) Repeat BFB analysis
		Multipoint Calibration	Initially and as required (minimum 5 points) (ICAL)[c]	%RSD[d] $\leq$ 30%	1) Evaluate system 2) Recalibrate
		Continuing calibration	Every 12 hours check standard (CCV)[e]	%Difference $\leq$ 30%	1) Evaluate system 2) Repeat calibration check 3) Recalibrate 4) Reanalyze affected samples

Notes:

[a] U.S. Environmental Protection Agency, 1999, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, 2nd Edition, EPA/624/R-96/0106
[b]Bromofluorobenzene
[c]Initial calibration
[d]Relative Standard Deviation
[e]Continuing calibration verification

Table 7-7
Summary of Internal Quality Control Procedures for Volatile Organics by U.S. Environmental Protection Agency Method TO-15[a]

Method	Parameter	QC Element	Frequency	Acceptance Criteria	Corrective Action
TO-15	Volatile Organics	Method blank	1/batch; batch is not to exceed 20 samples	< PQL[b]	1) Check calculations 2) Inspect system 3) Reanalyze blank
		Laboratory duplicate	5 percent of the project samples	RPD[c] < 25% for detections >5 times the detection limit	1) Reanalyze sample 2) Inspect system for anomalies 3) Flag data
		Field duplicate	5 percent of the project samples	RPD[c] < 50% for detections	1) Evaluate sampling procedure to determine potential cause 2) No flagging, outlier noted.
		Surrogate spike	Every sample and the method blank	Refer to Table 7-3	1) Check calculations 2) Evaluate batch for adverse trends 3) If no interference is evident, digest/reanalyze 4) Narrate any outliers 5) Reanalyze affected samples
		Internal standard (IS)	Every continuing calibration standard and sample	Retention time must be within 30 seconds of the CCV[d]; IS area in the sample must be within factor of 2 of the IS in the CCV (Table 6)	1) Check sensitvity of instrument 2) Evaluate data 3) Reanlayze sample or standard once 4) Narrate any outliers
		Laboratory Control Standard	1/batch; not to exceed 20 samples	Refer to Table 7-4	1) Check calculations 2) Reanalyze LCS; if passes, report 3) Reanalyze samples as needed 4) Narrate any outliers

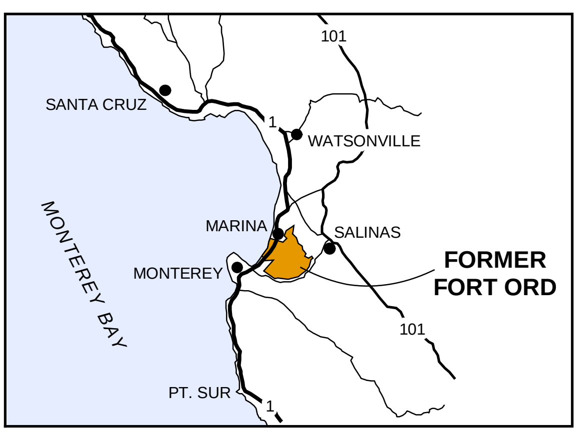
Notes:

[a] U.S. Environmental Protection Agency, 1997, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air* , 2nd Edition, EPA/624/R-96/0106
[b]Practical Quantitation Limit
[c]Relative Percent Difference
[d]Continuing Calibration Verification standard

Table 9-1
Summary of Project Team QC Responsibilities

	TASK MANAGER	CONTRACTOR QUALITY CONTROL SYSTEMS MANAGER (CQCSM)	FIELD TECHNICIAN	SITE SAFETY AND HEALTH OFFICER (SSHO)	USACE REP
Preparatory Meeting	Coordinate prep meeting with CQCSM. Discuss task requirements and personnel responsibility.	Schedule and prepare package for the Prep Meeting. Invite USACE Rep a minimum of two days before the Prep Meeting. Discuss the overall QC process, including CQCSMs function as an extension of the Task Manager.	Must ensure that he/she understands the scope of work, assess task readiness, and prevent surprises.	Discuss Site-Specific Health and Safety Plan (SSHP) requirements and Activity Hazard Analyses (AHA).	He/She wants to understand scope of work, judge potential base impacts, and tell you how they would like to be involved on the task.
Preparatory Inspections	Prepare definable features of work. Coordinate with CQCSM. Ensure that plans are approved; materials and equipment are on-site, inspected and acceptable. Note: Prep Inspection status should be discussed at the Prep Meeting.	Ensure that plans, drawings, etc. are complete and approved with comments incorporated. Inspect submittals, materials, equipment, supplies, work areas, etc. prior to starting the task. Document inspection.	Understand the work plan. Communicate and resolve issues such as proposed exceptions or deviations with the Task Manager. Coordinate work schedule with Task Manager.	Inspect work area and other site health and safety requirements. Verify that workers have read and acknowledged the SSHP and AHA. Verify that workers have provided documentation or requisite training and physical exams.	Ensures approvals of submittals, materials, supplies, equipment, testing subs, etc. based on contract requirements. The CQCSM should coordinate and track status of all Government approvals.
Initial Inspection	Initial Phase often resembles on-the-job training. Never assume your task assumptions will be 100% valid. Expect to make procedure refinements based on the situation. Establish quality standards.	The CQCSM will coordinate independent USACE oversight activities. Notify USACE Rep a minimum of two days before the initial inspection. Observe Task Manager/USACE concerns during work performance, and formulate follow-up inspection strategy. Know the standard of quality expected. <u>Note</u>: Task Managers must be advised of proposed changes to Plan/Procedure.	Review task requirements and readiness before you depart to the job site. Are your properly equipped to do task? Don't arrive with expectation of being told what to do. Demonstrate you can follow the plan, effectively perform the work, and complete documentation. Establish an expected "quality standard" with the Task Manager and CQCSM.	The SSHO monitors the workers to independently verify that workers are effectively implementing SSHP procedures. The SSHO may modify AHAs to reflect any unanticipated hazards.	Government oversight may include any of the following; safety checks, task surveillance, material inspections, independent testing, etc., to verify conformance w/contract requirements.
Follow-Up Inspections	Review and discuss follow-up inspections with CQCSM based on results of initial phase inspection.	Perform daily follow-up inspections. Identify and document task inspected. As with Preparatory and Initial Inspections, attach inspection records to your Daily QC Report. Document, communicate and resolve task nonconformance(s) with Task Manager.	Continue to achieve expected quality and productivity. Offer suggestions to the Task Manager to improve productivity. Do not deviate from task procedures and requirements without receiving Task Manager authorization.	Implement Daily Tailgate Safety Meetings. Make sure workers continue to adhere to SSHP and AHA requirements. Evaluate any monitoring data relative to action levels established in the SSHP and AHA.	Coordinate and schedule independent follow-up inspections or testing of ongoing work with CQCSM. Review and approve daily and task-related submittals as required by contract requirements and the Project Submittal Register.
Completion Inspection	Verify that work performance and results will achieve contractual requirements and project objectives.	Notify USACE Rep a minimum of two working days before the Completion Inspection. Escort USACE Rep during Completion Inspection. Perform final review of submittals and testing required by contract (or subcontract). Take lead on Punch List.	Make sure that task completion inspection is scheduled prior to your departure or demobilization from the job site. Complete punch list (action items) based on completion inspection.	Ensure health and safety requirements and submittals (e.g., air monitoring data), if required, have been completed before workers demobilize from site.	Conduct site walk and completion Inspection with CQCSM. Develop punch list of rework items. Discuss schedule for re-inspection.

Figures



N

0 2,000 4,000 FEET

REVISION	DATE	DESCRIPTION	CHKD	APPR

Shaw® Shaw Environmental, Inc.

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

DESIGNED: P. KELSALL

DRAWN: K. BLACK

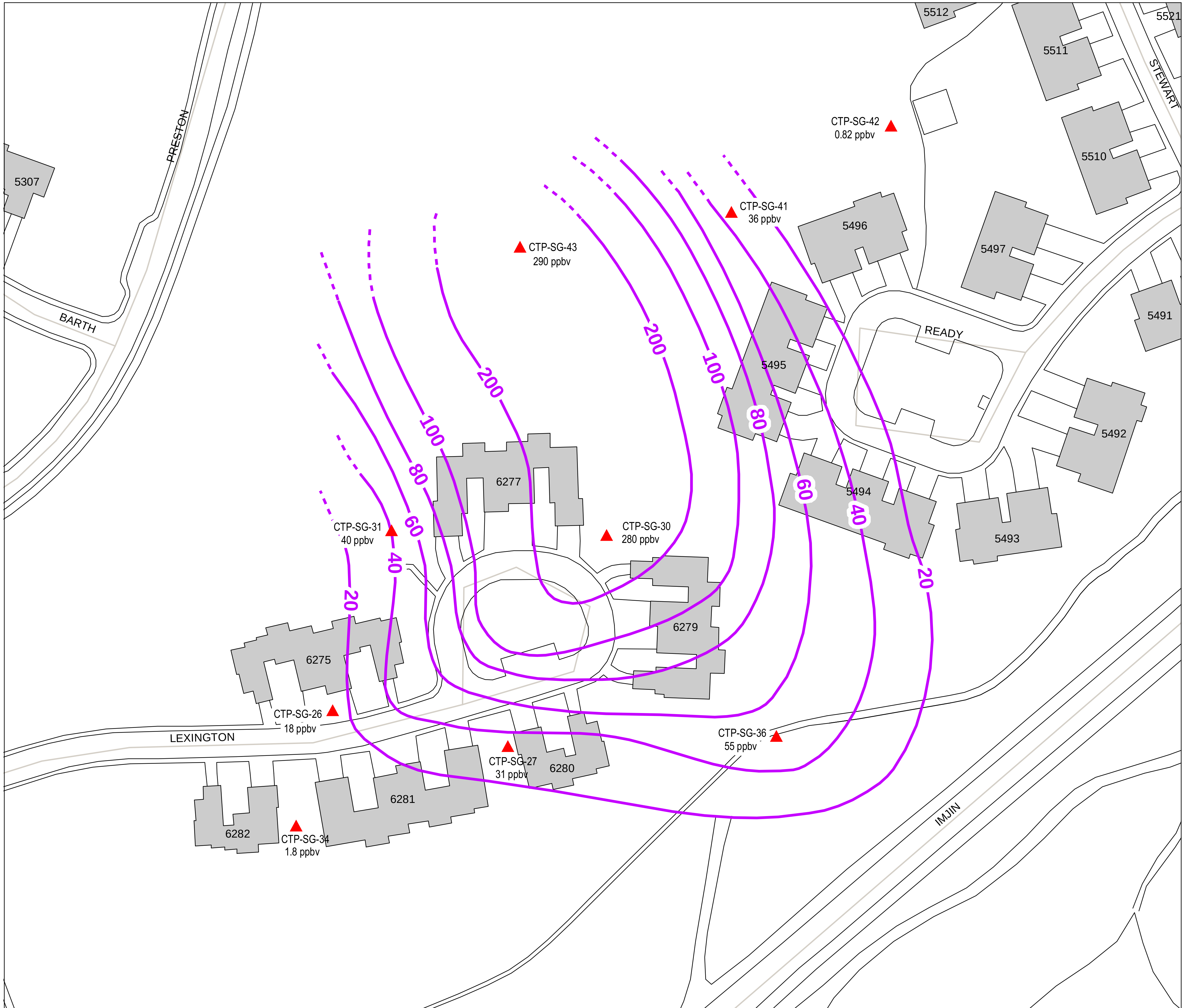
CHECKED: P. KELSALL

Figure 1-1
LOCATION MAP
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
Former Fort Ord, California

SUBMITTED: DATE

SCALE: SPEC. No.

SHEET FILE No. CTP Location.mxd



LEGEND

CTP-SG-36 55 A ppbv — SOIL GAS SAMPLE LOCATION, SAMPLE DESIGNATION, CONCENTRATION

CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 66-FT. DEPTH (ppbv); DASHED WHERE INFERRED

BUILDING

NOTE:
Carbon tetrachloride concentrations at depths below 66 ft., March to May 2003. Contours from Mactec. See Appendix A for concentrations at shallower depths.

N

0 100 200 FEET

REVISION	DATE	DESCRIPTION	CHKD	APPR

Shaw Shaw Environmental, Inc.

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

DESIGNED: E. SCHMIDT
DRAWN: K. BLACK
CHECKED: P. KELSALL

Figure 1-2
CARBON TETRACHLORIDE CONCENTRATIONS IN SOIL GAS AT 66-FT. DEPTH
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
Former Fort Ord, California

SUBMITTED: DATE: SCALE: SPEC. No.
SHEET FILE No. CT_contours_66ft.mxd

LEGEND

- NEW SVE WELL
- CONVERTED EXISTING WELL
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS (ppbv); DASHED WHERE INFERRED
- RADIUS OF INFLUENCE (VACUUM IN INCHES H2O AT 75 FT. DEPTH, PREDICTED USING VADOSE ZONE AIRFLOW MODELING)
- BUILDING

NOTE:
Carbon tetrachloride concentrations at depths below 66 ft., March to May 2003. Contours from Mactec. See Appendix A for concentrations at shallower depths.

N

0 100 200 FEET

REVISION	DATE	DESCRIPTION	CHKD	APPR

Shaw Shaw Environmental, Inc.

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

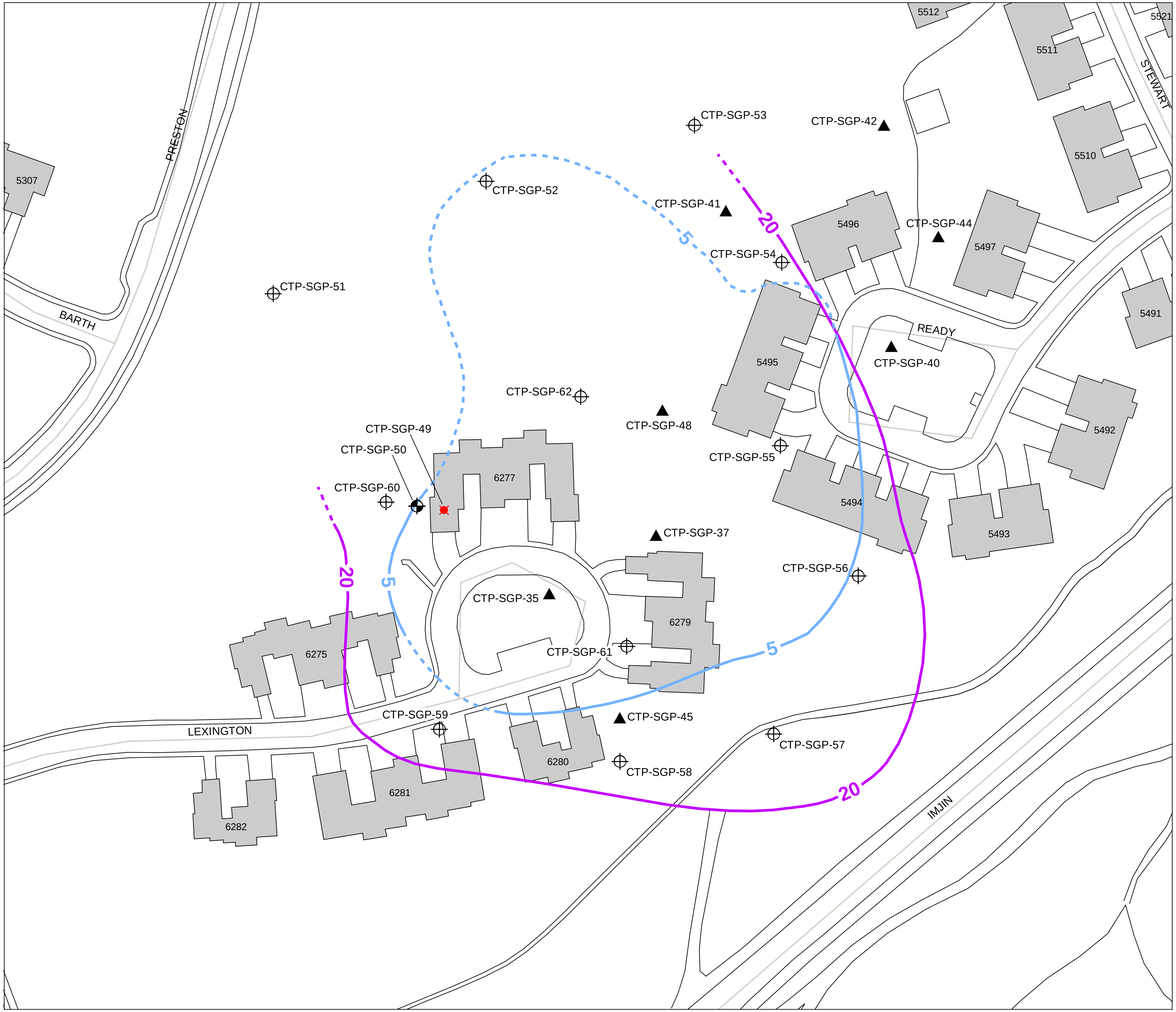
DESIGNED: T. COTA
DRAWN: K. BLACK
CHECKED: P. KELSALL

Figure 2-1
EXTRACTION WELL RADIUS OF INFLUENCE
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

Former Fort Ord, California

SUBMITTED: DATE

SCALE: SPEC. No.
SHEET FILE No. Radius_Influence.mxd



LEGEND

- ▲ EXISTING SHALLOW (6 FT.) MONITORING PROBE
- PROPOSED DEEP (86 FT.) MONITORING PROBE
- PROPOSED SHALLOW (6 FT.) MONITORING PROBE
- PROPOSED SUB-SLAB MONITORING PROBE
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 6 FT. DEPTH (ppbv); DASHED WHERE INFERRED
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 66 FT. DEPTH (ppbv); DASHED WHERE INFERRED
- BUILDING

NOTE:
CARBON TETRACHLORIDE CONCENTRATIONS MEASURED MARCH TO JULY 2003.

N

0 100 200 FEET

REVISION	DATE	DESCRIPTION	CHKD	APPR

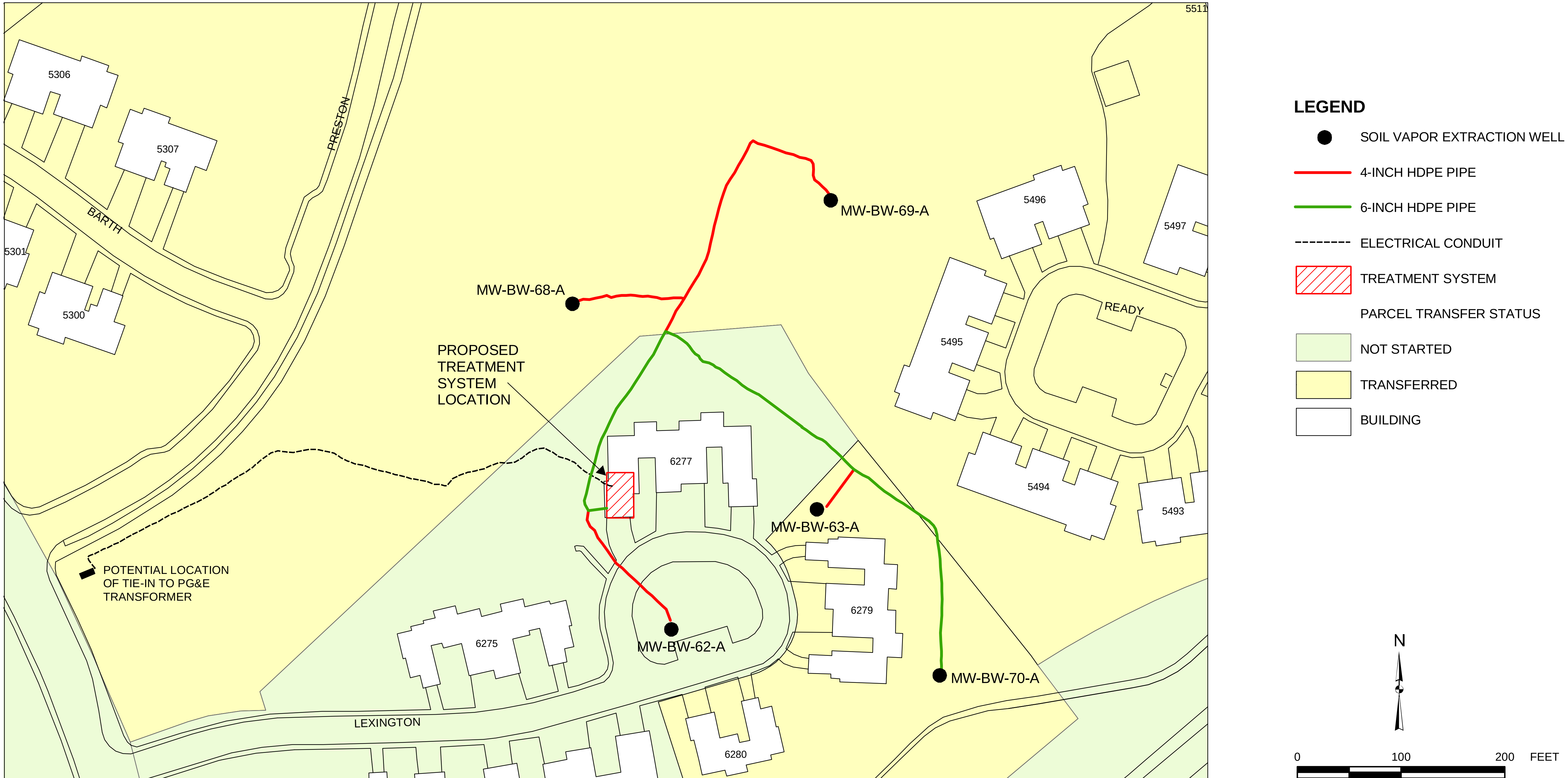
Shaw® Shaw Environmental, Inc.

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

DESIGNED: E. SCHMIDT
DRAWN: K. BLACK
CHECKED: P. KELSALL

Figure 2-2
MONITORING PROBE LOCATIONS
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
Former Fort Ord, California

SUBMITTED: DATE
SCALE: SPEC. No.
SHEET FILE No. Probes.mxd



REVISION	DATE	DESCRIPTION	CHKD	APPR

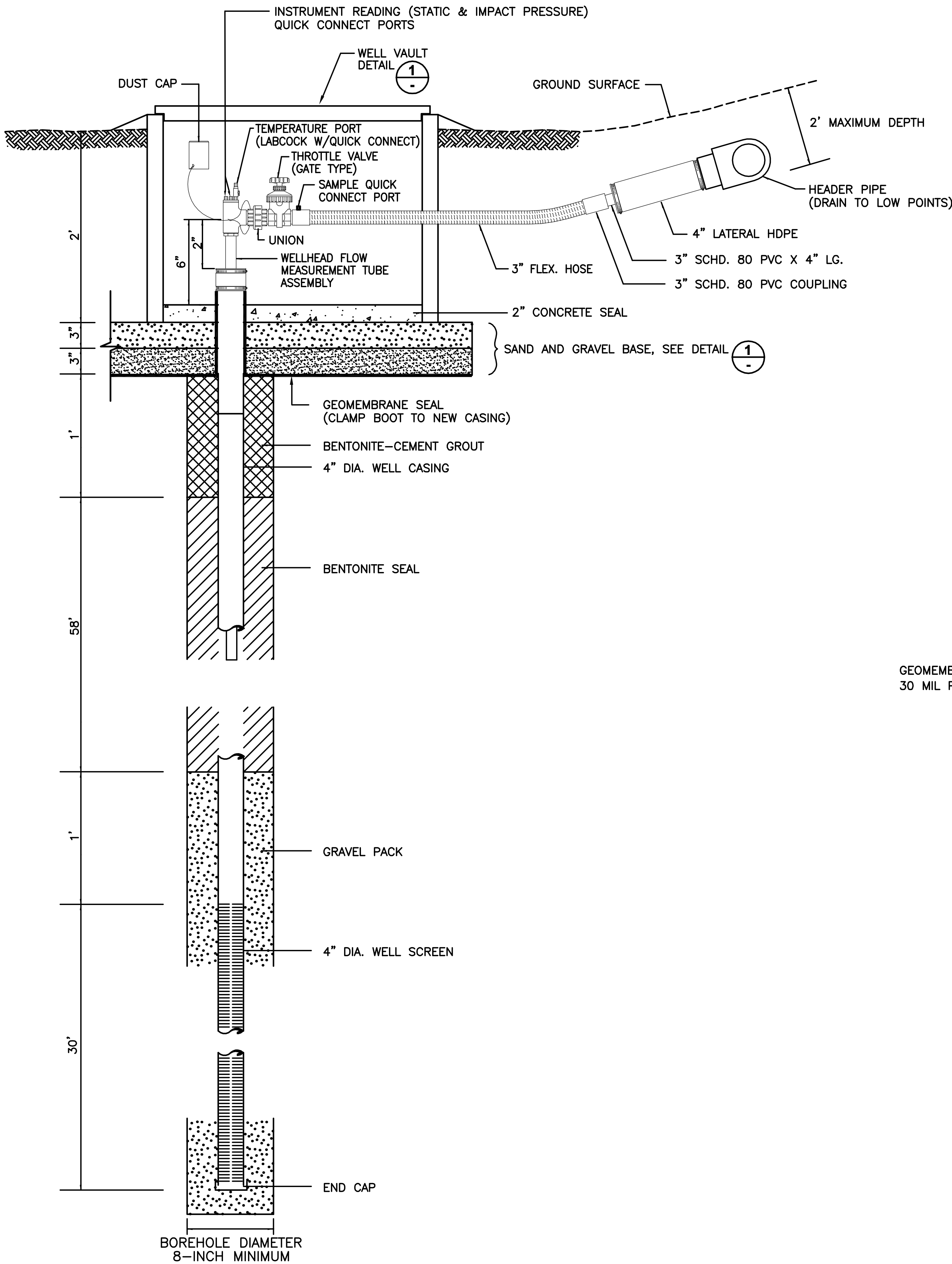
Shaw Environmental, Inc.

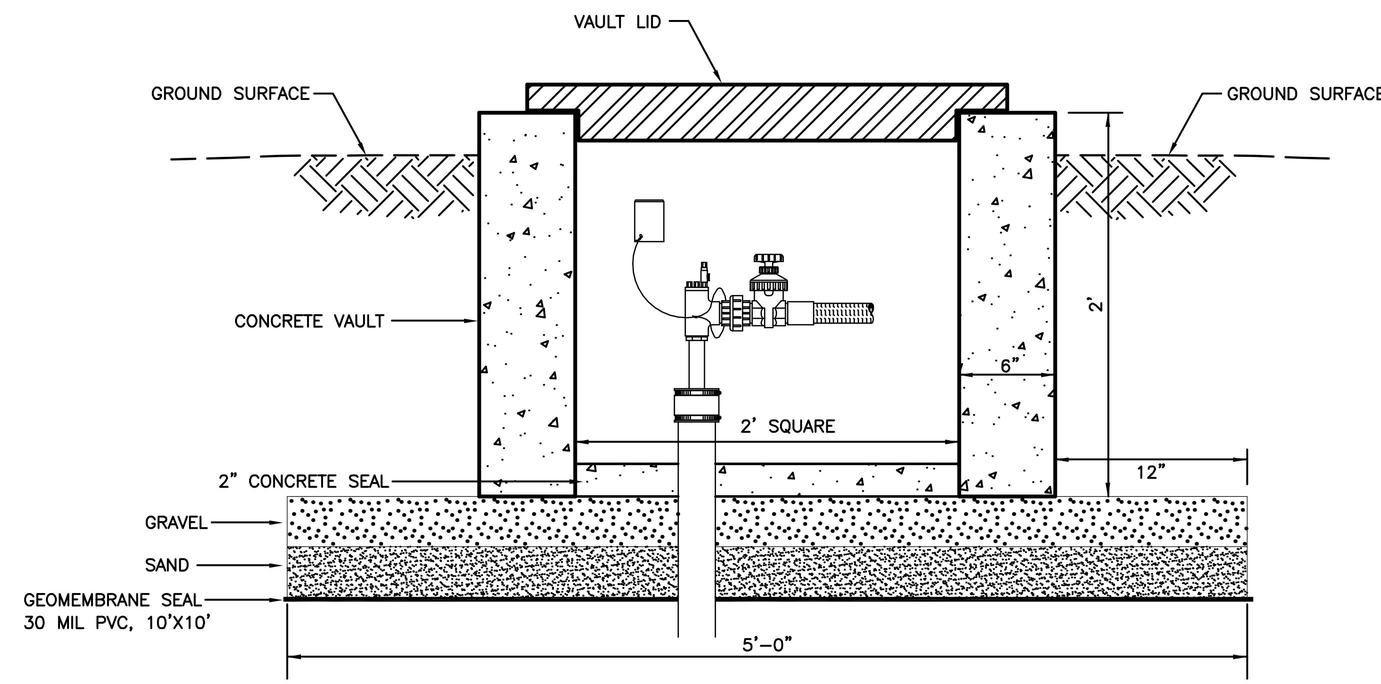
Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

DESIGNED: J. PIETZ
DRAWN: K. BLACK
CHECKED: P. KELSALL
SUBMITTED: DATE

Figure 2-3
PROPOSED PIPELINE AND TREATMENT SYSTEM LOCATIONS
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
Former Fort Ord, California

SCALE: | SPEC. No. | SHEET | FILE No. Treatment_System.mxd





WELL VAULT DETAIL (1 / -)
NOT TO SCALE

REVISION	DATE	DESCRIPTION	CHKD	APPR

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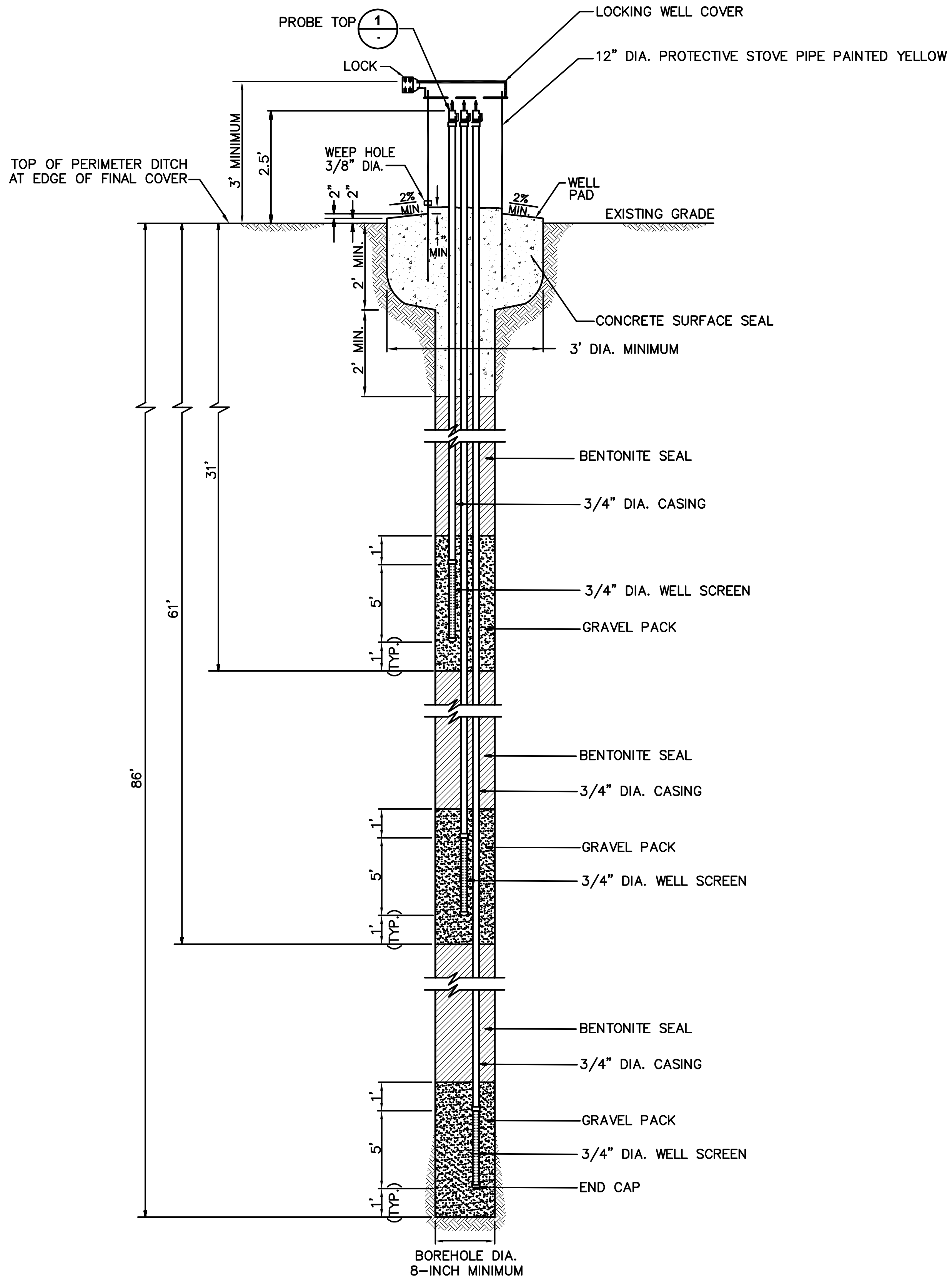
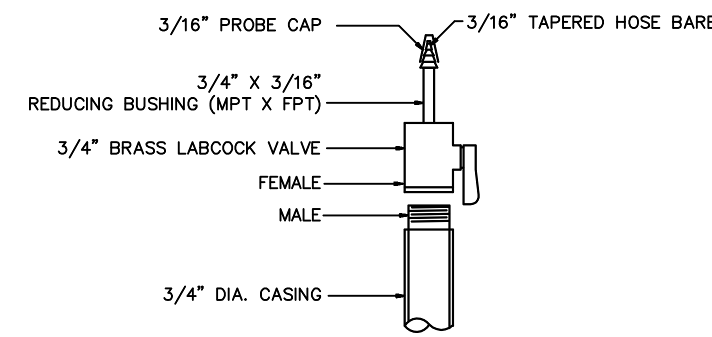
SACRAMENTO, CALIFORNIA

DESIGNED: T. COTA
DRAWN: K. BLACK
CHECKED: P. KELSALL
SUBMITTED:

FIGURE 4-1
EXTRACTION WELL DETAIL
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE
FORMER FORT ORD, CALIFORNIA

DATE APPROVED:
SCALE:
SPEC. No.
SHEET
FILE No. 783751S I-B73





PROBE TOP DETAIL 1
N.T.S.

REVISION	DATE	DESCRIPTION	CHKD	APPR

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DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

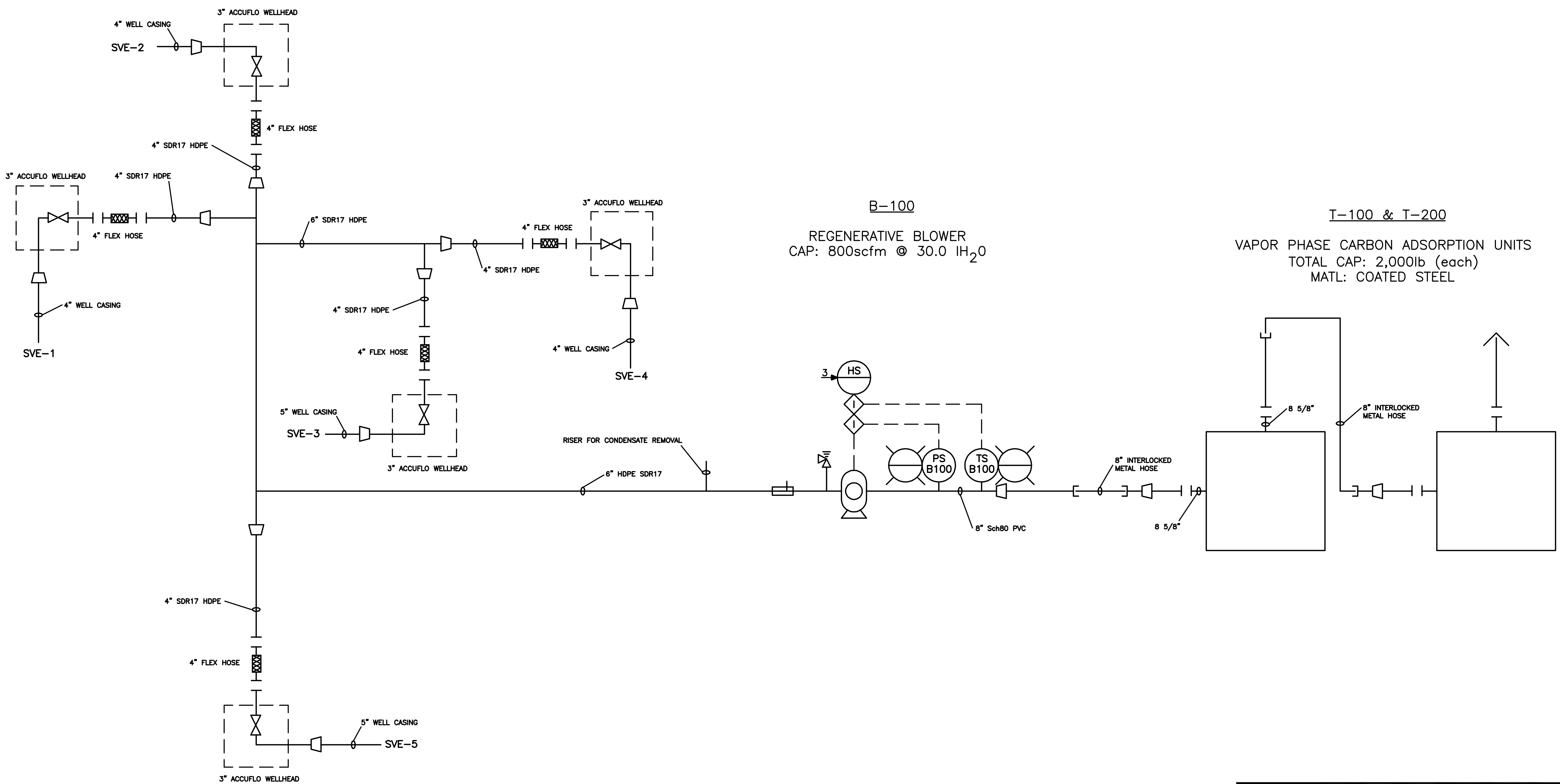
DESIGNED: T. COTA
DRAWN: K. BLACK
CHECKED: P. KELSALL

FIGURE 4-2

MONITORING PROBE DETAIL
SVE PILOT TEST
OPERABLE UNIT CARBON TETRACHLORIDE

FORMER FORT ORD, CALIFORNIA

SUBMITTED:
DATE APPROVED:
SCALE:
SPEC. No.
SHEET
FILE No. 783751S I-B72



REVISION	DATE	DESCRIPTION	CHKD	APPR

Shaw® Shaw Environmental, Inc.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. PIETZ
DRAWN: Z. CARPIO
CHECKED: P. KELSALL

FIGURE 5-1 - SHEET 1

OU CTP PILOT
SOIL VAPOR EXTRACTION SYSTEM
P&ID

FORMER FORT ORD, CALIFORNIA

SUBMITTED:
DATE APPROVED:
SCALE:
SPEC. No.
SHEET
FILE No. 783751S1-B75

INSTRUMENTATION

MEANINGS OF IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ACTUATOR		ALARM		
B	BURNER FLAME/BREAK		USERS CHOICE	USERS CHOICE	USERS CHOICE
C	CONDUCTIVITY/CHECK/ CURRENT (ELECTRICAL)			CONTROL	
D	DENSITY (MASS) OR SPECIFIC GRAVITY/DIGITAL	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)	FILTER		
G	GAUGING (DIMENSIONAL)		GLASS/GAS		
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE/INPUT		
J	POWER	SCAN			
K	TIME OR TIME SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR MODULATING MOTOR			MOTOR	MIDDLE OR INTERMEDIATE
O	EQUIPMENT STATUS		ORIFICE (RESTRICTION)		
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY OR STATUS	INTEGRATE OR TOTALIZE			
R	RADIOACTIVITY		RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VISCOSITY/VIBRATOR			VALVE, DAMPER, OR LOUVER	
W	WEIGHT OR FORCE		WELL		
Y	USERS CHOICE	SAMPLER		RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

TYPICAL INSTRUMENTATION IDENTIFICATION

FLOW

FC	FLOW CONTROLLER
FCV	FLOW CONTROL VALVE
FE	FLOW ELEMENT
FI	FLOW INDICATOR
FIC	FLOW INDICATING CONTROLLER
FT	FLOW TRANSMITTER
FS	FLOW SWITCH
FQ	FLOW TOTALIZER

TIME

KIC	TIME INDICATING CONTROLLER
KQI	RUN TIME TOTALIZER INDICATOR
KI	CLOCK

LEVEL

LC	LEVEL CONTROLLER
LI	LEVEL INDICATOR
LIC	LEVEL INDICATING CONTROLLER
LS	LEVEL SWITCH
LT	LEVEL TRANSMITTER
LE	LEVEL ELEMENT

MISCELLANEOUS

M	MOTOR
ZC	POSITION CONTROLLER
ZE	POSITION ELEMENT
ZI	POSITION INDICATOR
ZIT	POSITION INDICATOR TRANSMITTER
XCV	ACTUATED OPEN-CLOSE CONTROL VALVE
OI	STATUS INDICATOR

PRESSURE

PC	PRESSURE CONTROLLER
PCV	PRESSURE CONTROL VALVE
PE	PRESSURE ELEMENT
PI	PRESSURE INDICATOR
PIC	PRESSURE INDICATING CONTROLLER
PS	PRESSURE SWITCH
PT	PRESSURE TRANSMITTER
PDE	PRESSURE DIFFERENTIAL ELEMENT
PDT	PRESSURE DIFFERENTIAL TRANSMITTER
PDI	PRESSURE DIFFERENTIAL INDICATOR

SUBSCRIPTS – USED WITH COMPLEX LOGIC SYMBOL

I/P	CURRENT TO PNEUMATIC SIGNAL CONVERSION
E	VOLTAGE
H	HYDRAULIC
I	CURRENT (ELECTRICAL)
O	ELECTROMAGNETIC OR SONIC
P	PNEUMATIC
A	ANALOG
D	DIGITAL

SPEED

SC	SPEED CONTROLLER
SI	SPEED INDICATOR
SIC	SPEED INDICATING CONTROLLER
ST	SPEED TRANSMITTER

TEMPERATURE

TC	TEMPERATURE CONTROLLER
TCV	TEMPERATURE CONTROL VALVE
TE	TEMPERATURE ELEMENT (RTD)
TI	TEMPERATURE INDICATOR
TIC	TEMPERATURE INDICATING CONTROLLER
TS	TEMPERATURE SWITCH
TT	TEMPERATURE TRANSMITTER

GENERAL INSTRUMENT OR FUNCTION SYMBOLS

	PRIMARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS			
SHARED DISPLAY SHARED CONTROL			
COMPUTER FUNCTION			
PROGRAMMABLE LOGIC CONTROL			

1. Abbreviations of the user's choice such as ECP-1 may be used when it is necessary to specify instrument or function location.
2. Normally inaccessible or behind-the-panel devices or functions are depicted by using the same symbols but with dashed horizontal lines, i.e.

TYP. INSTRUMENTATION SYMBOLS

	INSTRUMENTATION CONNECTION TO PROCESS, OR MECHANICAL LINK, OR INSTRUMENT SUPPLY: FOLLOWING ABBREVIATIONS DENOTE TYPE OF LINE: PS PROCESS SAMPLE; AS AIR SUPPLY; GS GAS SUPPLY; ES ELECTRICAL SUPPLY
	PNEUMATIC SIGNAL OR UNDEFINED SIGNAL FOR PROCESS FLOW LINE
	ELECTRIC SIGNAL
	CAPILLARY TUBING (FILLED SYSTEM)
	HYDRAULIC SIGNAL
	INSTRUMENT TAG MOUNTED ON MAIN CONTROL PANEL LOOP NUMBER
	MOUNTED BEHIND MAIN CONTROL PANEL
ECP2	MOUNTED ON AUXILIARY CONTROL PANEL (EXPONENT INDICATES CONTROL PANEL NUMBER)
3, HS	SELECTOR HANDSWITCH– NUMBER INDICATES NUMBER OF POSITIONS
	PANEL LIGHT ALARM
I	COMPLEX LOGIC (USED WITH SUBSCRIPTS LISTED AT LEFT)
XXXX	CONTROL SIGNAL CONTINUATION – REFERENCES CONTROL LOOP NUMBER CONTINUATION
	CONTROL FUNCTION LOCATED IN PROGRAMMABLE CONTROLLER (PC) CONTROL FUNCTION: DI–DIGITAL INPUT TO PC; DO–DIGITAL OUTPUT FROM PC; AI–ANALOG INPUT TO PC; AO–ANALOG OUPUT FROM PC; OTHER CONTROL FUNCTIONS AS DESCRIBED BY ABOVE INSTRUMENTATION LETTERS LOOP NUMBER EXPONENT DESIGNATES SPECIFIC PC WHEN MORE THAN ONE

PRIMARY ELEMENTS

FE	MAGNETIC FLOW METER
LS	LEVEL SWITCH (FLOAT)
ZS	LIMIT SWITCH
TC	WELL TYPE INSTRUMENT

PIPE LINE DESIGNATION

SERVICE – LINE SIZE – MAT'L OF CONSTRUCTION – LINE NUMBER

MATL. OF CONSTRUCTION

PETB	POLYETHYLENE TUBING
CPVC	CHLORINATED POLYVINYL CHLORIDE PIPE
PVC	POLYVINYL CHLORIDE PIPE
PVC HOSE	REINFORCED POLYVINYL CHLORIDE HOSE
CS	CARBON STEEL PIPE
SS	STAINLESS STEEL PIPE
PP	POLYPROPYLENE PIPE
PVDF	POLYVINYLIDENE FLUORIDE PIPE
FRP	FIBERGLASS REINFORCED PIPE
HOSE	FLEXIBLE HOSE
BI	BLACK IRON PIPE
CU	COPPER PIPE
DI	DUCTILE IRON PIPE
RCP	REINFORCED CONCRETE PIPE
HDPE	HIGH DENSITY POLYETHYLENE

SERVICE

WW	WASTEWATER
SC	SCUM
IA	INSTRUMENT AIR
FECL	FERRIC CHLORIDE
V	VENTILATION
UR	UREA
P	POLYMER
PHO	PHOSPHORIC ACID
S	SLUDGE
RW	RIVER WATER
FW	FILTERED WATER
D	DRAIN
OVF	OVERFLOW
BW	BACKWASH
POT	POTABLE WATER
PW	PLANT WATER
SWW	SANITARY WASTEWATER
FL	FLOAT
RCW	RECYCLE WATER
CA	COMPRESSED AIR

EQUIPMENT SYMBOLS

	AIR OPERATED DIAPHRAGM PUMP
	COALESCOR
	CENTRIFUGAL PUMP
	PROCESS VESSEL (NON-PRESSURIZED)
	PROCESS VESSEL (PRESSURIZED)
	ROTARY POSITIVE DISPLACEMENT BLOWER
	CENTRIFUGAL BLOWER
	FLOW SIGHT STRAINER
	CHEMICAL METERING PUMP

EQUIPMENT ABBREVIATIONS

A	AIR STATION/PIPING DETAIL
AS	AIR STRIPPER
B	BLOWER OR BOILER
C	COMPRESSOR
CST	CONDESATE & SEDIMENT TRAP
D	DRYER
DT	DRIP TRAP
E	EVAPORATOR
F	FILTER
H	HEATER OR HOIST
HX	HEATER EXCHANGER
L	.
M	MIXER/MOTOR
N	.
P	PUMP
Q	.
R	REACTOR
RFA	RELIEF VALVE/FLAME ARRESTOR
S	SCRUBBER
SSP	SURGE SUPPRESSOR
T	TANK
V	VENTILATOR
W	EYEWASH/SHOWER
Y	.
Z	.

VALVE & PIPING SYMBOLS

- STRAIGHTWAY DIAGRAGM
- WEIR DIAPHRAGM
- CHECK
- PINCH
- GATE
- SOLENOID
- 3 WAY
- GLOBE
- CONTROL
- MOTOR OPERATED
- FLOAT OPERATED
- BALL
- HOSE CONNECTION
- EXPANSION JOINT–FLANGED TYPE
- FLEXIBLE CONNECTION
- BUTTERFLY
- NEEDLE OR METERING
- 3 WAY SOLENOID
- STRAINER, Y TYPE
- STRAINER, BASKET TYPE
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- UNION
- QUICK CONNECT COUPLER
- QUICK CONNECT ADAPTOR
- STEAM TRAP
- PLUG
- HOSE BIBB
- PRESSURE INDICATOR
- PRESSURE RELIEF
- AIR FILTER
- COMB. AIR FILTER/ REGULATOR W/GAUGE
- AIR LUBRICATOR
- AIR REGULATOR
- DIAPHRAGM OR CHEMICAL SEAL
- FOOT VALVE
- SLIDE GATE VALVE
- INJECTION/ANTI-SYPHON CHECK VALVE
- DIELECTRIC
- SELF CONTAINED CONTROL VALVE
- AUTOMATIC AIR VENT
- FLOW ORIFICE
- ROTAMETER
- REDUCING VALVE
- EDUCTOR/EJECTOR
- KNIFE GATE VALVE
- RAIN CAP
- IN-LINE MIXER
- PITOT TUBE

REVISION	DATE	DESCRIPTION	CHKD	APPR

Shaw® Shaw Environmental, Inc.

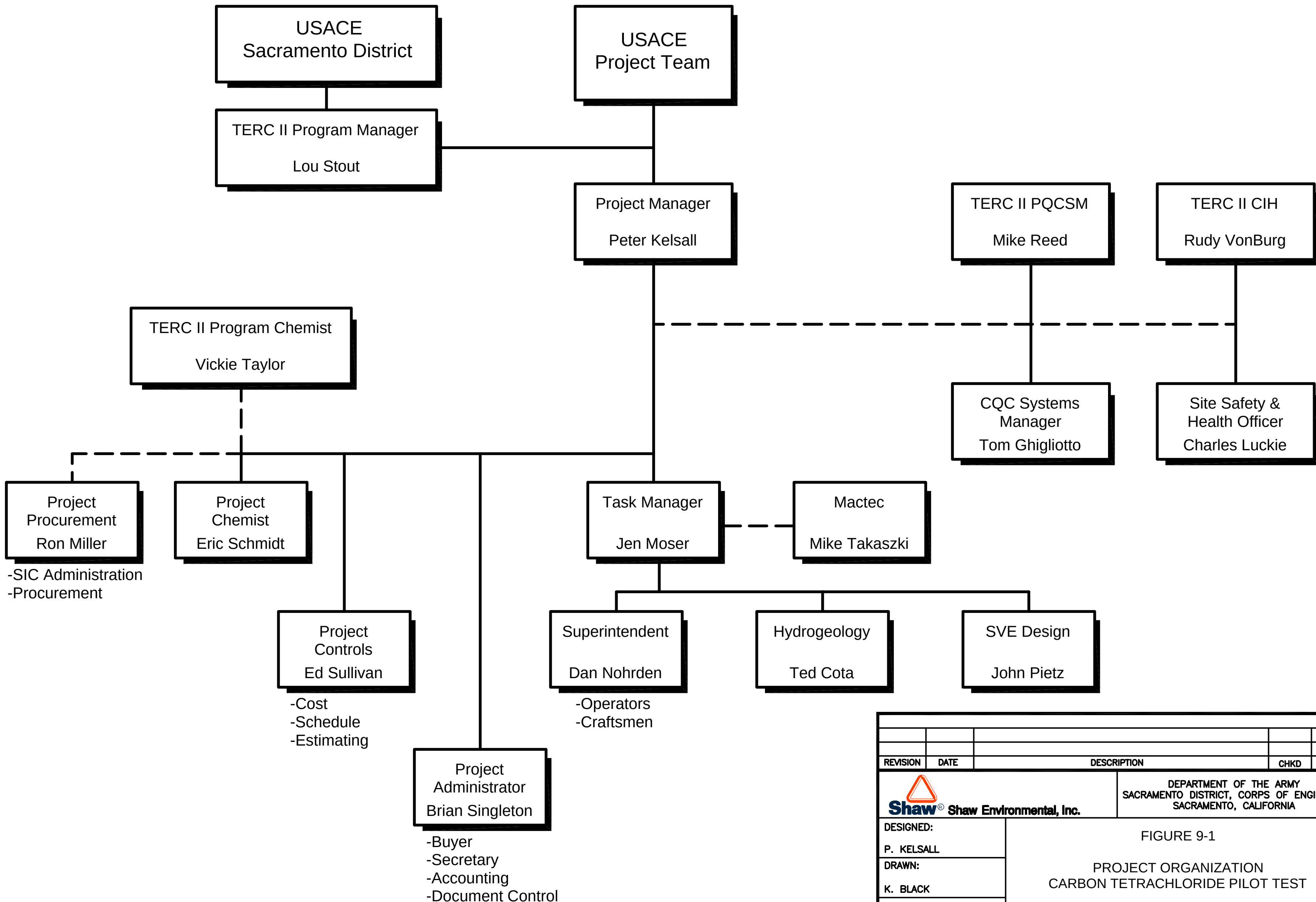
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. PIETZ
DRAWN: Z. CARPIO
CHECKED: P. KELSALL

FIGURE 5-1 - SHEET 2
OU CTP PILOT
SOIL VAPOR EXTRACTION SYSTEM
P&ID SYMBOLS

FORMER FORT ORD, CALIFORNIA

SUBMITTED:
DATE APPROVED:
SCALE:
SPEC. No.
SHEET
FILE No. 783751S1-B76



REVISION	DATE	DESCRIPTION	CHKD	APPR

Shaw® Shaw Environmental, Inc.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: P. KELSALL
DRAWN: K. BLACK
CHECKED: P. KELSALL

FIGURE 9-1

PROJECT ORGANIZATION
CARBON TETRACHLORIDE PILOT TEST

FORMER FORT ORD, CALIFORNIA

SUBMITTED:
DATE APPROVED:
SCALE:
SPEC. No.
SHEET -
FILE No. 783751SJ-A129

Forms

Date: _______________

Form 7-1
Carbon Tetrachloride Soil Vapor Extraction System Gas Monitoring
Sample Collection Log
Fort Ord - 783751

PROBE ID	SAMPLE ID	SAMPLE TYPE	BP (mm Hg)	AMBIENT TEMP (oF)	PROBE PRESSURE	SUMMA TIME START	INITIAL SUMMA VACUUM	FINAL SUMMA VACUUM	SUMMA CANISTER NUMBER	LAB ANALYSIS	AR/COC NUMBER
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										
	CTP-										

Prepared by ______________________

Shaw Environmental & Infrastructure, Inc.

Form 7-2
Analysis Request/Chain of Custody Record

Project Name/No: ____________________
Samplers: ____________________
Shipment Date: ____________________

Project Contact: ____________________
Phone: ____________________
Address: ____________________

Reference Document No. ____________
Page: ______ of ______

Laboratory: ____________________
Lab Contact: ____________________
Phone: ____________________
Address: ____________________

SAMPLE NUMBER	DATE				Matrix				No. Containers/ Preservative						SAMPLE STATION		ANALYSIS REQUESTED
	YR	MO	DA	TIME	Soil	Air	Water	Other	Unpres.	H_2SO_4	HNO_3	HCL			NAME	DEPTH	

Turn Around Time ____________________

Method of Shipment	Carrier/Waybill Number

Comments

Shaw Environmental and Infrastructure, Inc.

CHAIN OF CUSTODY RECORD

Relinquished by (print name)	*(signature)*	*(Company)*	*Date/Time*
Received by (print name)	*(signature)*	*(Company)*	*Date/Time*
Relinquished by (print name)	*(signature)*	*(Company)*	*Date/Time*
Received by (print name)	*(signature)*	*(Company)*	*Date/Time*
Relinquished by (print name)	*(signature)*	*(Company)*	*Date/Time*
Received by (print name)	*(signature)*	*(Company)*	*Date/Time*

Form 7-3
Sample Collection Log - Field Measurements
Soil Vapor Extraction System
Operable Unit Carbon Tetrachloride, Former Fort Ord

Date: ______________________ Time: ______________________
System Start Time: ______________________ System Stop Time: ______________________

Location	Type	Pressure (inches WC)	Flow Rate (scfm)	Temperature (^oF)
Pilot SVE System				
Pre-blower influent				
Extraction Wells				
MW-BW-62-A				
MW-BW-63-A				
MW-BW-68-A				
MW-BW-69-A				
MW-BW-70-A				
Monitoring Probes				
CTP-SGP-61	Interior			
CTP-SGP-62	Interior			
CTP-SGP-51	Perimeter			
CTP-SGP-52	Perimeter			
CTP-SGP-53	Perimeter			
CTP-SGP-54	Perimeter			
CTP-SGP-55	Perimeter			
CTP-SGP-56	Perimeter			
CTP-SGP-57	Perimeter			
CTP-SGP-58	Perimeter			
CTP-SGP-59	Perimeter			
CTP-SGP-60	Perimeter			
CTP-SGP-35	Shallow			
CTP-SGP-37	Shallow			
CTP-SGP-48	Shallow			

Comments: ______________________

Prepared By: ______________________

Form 7-4

Shaw™ Shaw Environmental, Inc.

FIELD ACTIVITY DAILY LOG
DAILY LOG

Daily Log				
	Date:			
	No.			
	Sheet	Of		

PROJECT NAME: FORT ORD, CA	Project Number: 783751
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS,	
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
SHAW PERSONNEL ON SITE:	
SIGNATURE:	DATE:

Appendix A

Mactec Letter Report, OU CTP SVE Pilot Study Test

MACTEC

January 22, 2004

4087030023 11

Mr. Peter Kelsall
Shaw Environmental & Infrastructure, Inc.
4005 Port Chicago Highway
Concord, California 94520-1120

OU CTP SVE Pilot Study Test

Dear Mr. Kelsall:

MACTEC has proposed that a soil vapor extraction (SVE) pilot study be performed in the vicinity of Lexington Court at the Former Fort Ord facility as part of the OU CTP RI/FS program. This letter documents the objectives of this pilot study and background of the site leading up to the Army's decision to proceed in order to assist Shaw E&I, Inc. (Shaw) with the preparation of the SVE pilot study Work Plan.

The goal of the pilot study is to reduce soil vapor concentrations at depth that represent an apparent persistent carbon tetrachloride (CT) source that continues to contaminate groundwater. However, shallow (6 foot) soil vapor concentrations have also been measured and, although they are below human health risk action levels, the pilot study will also be conducted to monitor the effectiveness of removing contaminated soil vapor at shallow depths.

The objective of conducting the pilot test is to determine if the use of SVE is an acceptable preferred alternative to remediate the source of the groundwater plume at OU CTP. The information will be reported in detail within the OU CTP FS.

Background

The Army has been investigating the presence of carbon tetrachloride (CT) in groundwater since 1997 in response to its detection in two monitoring wells (MW-B-13-180 and MW-B-14-A) during the basewide quarterly groundwater monitoring program. Since 1997, monitoring wells have been installed within the A-Aquifer, the Upper and Lower 180-Foot Aquifers, and the 400-Foot Aquifer to delineate the extent of contamination and locate its original source area. In addition to the field investigation, historical aerial photos were reviewed in an attempt to identify previous land uses that may have involved the use of CT.

Additional groundwater data in the A-Aquifer, upgradient and south of the original monitoring wells with CT contamination, suggested that the source may have been located in what is now the Preston Park housing area. Soil vapor samples were collected in July 2002 from 24 locations (CTP-SG-1 through CTP-SG-24) throughout the Preston Park housing area, generally from depths of 6 feet, 20 feet, and 60 feet, to screen the area for the presence of CT (Plate 1). A mobile laboratory, owned and operated by Centrum Analytical, was used to analyze soil vapor samples; the reporting limit for CT was 79 parts per billion by volume (ppb v/v). Of these samples, CT was detected at four samples, all located to the south of the study area in the vicinity of Lexington Court. CT concentrations ranged from 86 to 160 ppb v/v and was

MACTEC Engineering and Consulting
600 Grand Avenue, Suite 300 • Oakland, CA 94610
510-451-1001 • Fax: 510-451-3165

consistently detected at a depth of 60 feet with the exception of the detection at 45 feet at CTP-SG-05 (Plate 2). No other VOCs were detected.

To further investigate the low detections of CT in the first phase, a second phase of soil vapor investigation was conducted in March 2003 from six locations (CTP-SG-26 through CTP-SG-31), generally from depths of 6 feet, 30 feet, 50 feet, and 70 feet (Plate 1). STL Laboratories was used to analyze these samples to obtain a lower reporting limit (0.20 ppb v/v) for CT, chloroform (CF), tetrachloroethene (PCE), and trichloroethene (TCE). Lower detection levels are typically achievable in fixed-location laboratories as opposed to mobile laboratories as was used during the first phase of investigation. CT concentrations ranged from the reporting limit to 280 ppb v/v at a depth of 59 feet in this set of samples; the maximum concentration of CF, PCE, and TCE, were 14, 6.7, and 38 ppb v/v, respectively.

Based on results from the second phase of investigation, additional data was collected in May 2003 to confirm the extent of contamination in the Lexington and Ready Courts area (Plate 1). This phase of work also included the installation of 6-foot deep soil vapor probes to allow for repeated sample collection. Soil vapor samples were collected from 15 borings (CTP-SG-33 through CTP-SG-47) and from 8 soil vapor probes (CTP-SGP-35, -37, -40, -41, -42, -44, -45, and -48). Samples were again analyzed by STL laboratories as with the second phase of soil vapor investigation. CT concentrations ranged from the reporting limit to a maximum of 290 ppb v/v at a depth of 75 feet; maximum CF, PCE, and TCE concentrations were 16, 6.9, and 1.8 ppb v/v, respectively.

All soil vapor concentration data are summarized on Table 1 and illustrated on Plates 2 through 6. Plate 2 illustrates soil vapor data from the 6-foot depth, Plate 3 from depths between 19 and 30 feet, Plate 4 from depths between 40 and 50 feet, Plate 5 from depths between 55 and 66 feet, and Plate 6 from depths greater than 66 feet.

Please do not hesitate to contact me at (510) 628-3222 if you have any questions concerning this pilot study or results from the previous soil vapor investigations.

Yours very truly,

MACTEC Engineering and Consulting, Inc.

Michael Taraszki, RG, CHg
Principal Hydrogeologist

Carlene Merey, Gp
Senior Principal Environmental Scientist

MT/CM/yml:YL60360-FO

Enclosures: Table 1 – Summary of Detected Select VOCs in Soil Gas

Plate 1 – Soil Vapor Sample Locations
Plate 2 – Carbon Tetrachloride Concentrations in Soil Vapor, 6 Foot Depth
Plate 3 – Carbon Tetrachloride Concentrations in Soil Vapor, 19-30 Foot Depth
Plate 4 – Carbon Tetrachloride Concentrations in Soil Vapor, 40-50 Foot Depth
Plate 5 – Carbon Tetrachloride Concentrations in Soil Vapor, 55-60 Foot Depth
Plate 6 – Carbon Tetrachloride Concentrations in Soil Vapor, >66 Foot Depth

Table 1. Summary of Detected Select VOCs in Soil Gas
OU CTP RI/FS
Preston Park Housing Area, Former Fort Ord, California

Boring name	Date	Carbon tetrachloride	Chloroform	Tetrachloroethene	Trichloroethene
CTP-SG-01-06	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-01-20	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-01-60	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-02-06	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-02-20	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-03-06	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-03-20	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-03-60	7/10/2002	**100**	ND (205)	ND (147)	ND (93)
CTP-SG-04-06	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-04-30	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-04-60	7/11/2002	**160**	ND (205)	ND (147)	ND (93)
CTP-SG-05-06	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-05-20	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-05-45	7/12/2002	**160**	ND (205)	ND (147)	ND (93)
CTP-SG-06-06	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-06-20	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-06-49	7/12/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-07-06	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-07-20	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-07-60	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-08-06	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-08-20	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-08-45	7/12/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-09-06	7/12/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-09-20	7/12/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-09-50	7/12/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-10-06	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-10-20	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-10-60	7/12/2002	**86**	ND (205)	ND (147)	ND (93)
CTP-SG-11-06	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-11-20	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-11-60	7/12/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-12-06	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-12-20	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-12-55	7/12/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-13-06A	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-13-20	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-14-06	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-14-20	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-14-45	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-15-06	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-15-20	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-16-06	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-16-20	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-17-06	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-17-20	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-17-40	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-18-06	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-18-20	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-19-06	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-19-20	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-19-50	7/10/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-20-06	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-20-20	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-21-06	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-21-20	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)

Table 1. Summary of Detected Select VOCs in Soil Gas
OU CTP RI/FS
Preston Park Housing Area, Former Fort Ord, California

Boring name	Date	Carbon tetrachloride	Chloroform	Tetrachloroethene	Trichloroethene
CTP-SG-22-06	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-22-20	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-22-60	7/11/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-23-06	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-23-20	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-23-45	7/9/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-24-06	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-24-20	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-24-45	7/8/2002	ND (79)	ND (205)	ND (147)	ND (93)
CTP-SG-26-06	3/3/2003	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)
CTP-SG-26-29	3/3/2003	**4.4**	**0.24**	**0.48**	**0.53**
CTP-SG-26-40	3/3/2003	**10**	**0.81**	**0.42**	**1.2**
CTP-SG-26-66	3/3/2003	**14**	**1.7**	**0.51**	**2.7**
CTP-SG-26-86	3/5/2003	**18**	**2.5**	**0.78**	**4**
CTP-SG-27-06	3/12/2003	**2.7**	**0.65**	**0.96**	**0.4**
CTP-SG-27-30	3/12/2003	**18**	**1.9**	**2.6**	**3.4**
CTP-SG-27-44	3/12/2003	**21**	**2.4**	**2.3**	**3.8**
CTP-SG-27-59	3/12/2003	**27**	**3.5**	**3.4**	**5.1**
CTP-SG-27-78	3/12/2003	**31**	**4.5**	**4.1**	**6.8**
CTP-SG-28-06	3/12/2003	**6.6**	**0.42**	**1.1**	ND (0.20)
CTP-SG-28-27	3/12/2003	**24**	**1.3**	**3.6**	**0.93**
CTP-SG-28-44	3/13/2003	**35**	**2.3**	**4.2**	**38**
CTP-SG-28-59	3/13/2003	**66**	**3.9**	**6.7**	**4**
CTP-SG-29-06	3/3/2003	**12**	**2**	**0.68**	**0.67**
CTP-SG-29-19	3/3/2003	**0.2**	ND (0.20)	**0.58**	ND (0.20)
CTP-SG-29-40	3/3/2003	**85**	**4.6**	**2.8**	**7**
CTP-SG-29-60	3/3/2003	**120**	**7.3**	**3.3**	**11**
CTP-SG-30-06	3/12/2003	**9.9**	**0.56**	**0.49**	ND (0.40)
CTP-SG-30-20	3/12/2003	**27**	**1.3**	**0.95**	**0.46**
CTP-SG-30-40	3/14/2003	**81**	**3**	**2.1**	**2.2**
CTP-SG-30-59	3/14/2003	**280**	**13**	**5.3**	**12**
CTP-SG-30-78	3/14/2003	**280**	**14**	**5.6**	**14**
CTP-SG-31-06	3/5/2003	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)
CTP-SG-31-20	3/5/2003	**10**	**0.67**	**0.46**	ND (0.20)
CTP-SG-31-40	3/5/2003	**22**	**1.5**	**0.81**	**0.82**
CTP-SG-31-64	3/5/2003	**35**	**2.6**	**1.1**	**1.6**
CTP-SG-31-85	3/12/2003	**40**	**3.4**	**1.6**	**2.5**
CTP-SG-33-06	5/22/2003	**5.2**	**11**	ND (1.9)	ND (1.9)
CTP-SG-34-06	5/22/2003	ND (0.20)	ND (0.20)	ND (0.20)	**0.2**
CTP-SG-34-30	5/22/2003	**1.2**	**0.7**	**0.74**	**0.48**
CTP-SG-34-50	5/22/2003	**1.7**	**1**	**0.34**	**0.92**
CTP-SG-34-70	5/22/2003	**1.8**	**1.3**	**0.35**	**1.1**
CTP-SG-36-06	5/23/2003	**1.1**	**0.41**	**0.95**	ND (0.20)
CTP-SG-36-30	5/23/2003	**7.2**	**3**	**3.4**	ND (0.40)
CTP-SG-36-50	5/23/2003	**21**	**2.9**	**5.5**	ND (0.40)
CTP-SG-36-75	5/23/2003	**55**	**2.7**	**6.9**	**1.6**
CTP-SG-38-06	5/23/2003	**2.8**	**0.31**	ND (0.20)	ND (0.20)
CTP-SG-39-06	5/23/2003	**1.1**	**0.79**	**0.24**	ND (0.20)
CTP-SG-40-06	5/22/2003	**1**	**0.32**	**1**	ND (0.20)
CTP-SG-40-30	5/22/2003	**5.1**	**0.79**	**1.9**	ND (0.45)
CTP-SG-40-50	5/22/2003	**13**	**1.9**	**2.4**	ND (0.43)
CTP-SG-40-65	5/22/2003	**12**	**2.2**	**2**	ND (0.20)
CTP-SG-41-30	5/21/2003	**18**	**6.2**	**1.6**	ND (0.39)
CTP-SG-41-55	5/21/2003	**34**	**5.7**	**2.8**	ND (0.20)
CTP-SG-41-70	5/21/2003	**36**	**5.5**	**3**	**0.3**
CTP-SG-42-06	5/22/2003	ND (0.20)	**1.4**	**0.29**	ND (0.20)

Table 1. Summary of Detected Select VOCs in Soil Gas
OU CTP RI/FS
Preston Park Housing Area, Former Fort Ord, California

Boring name	Date	Carbon tetrachloride	Chloroform	Tetrachloroethene	Trichloroethene
CTP-SG-42-30	5/22/2003	**0.38**	**0.35**	**0.21**	ND (0.20)
CTP-SG-42-50	5/22/2003	**0.58**	ND (0.38)	(ND 0.38)	(ND 0.38)
CTP-SG-42-70	5/22/2003	**0.82**	**0.49**	(ND 0.39)	ND (0.39)
CTP-SG-43-06	5/21/2003	**8.9**	**1.2**	**0.58**	ND (0.20)
CTP-SG-43-30	5/21/2003	**40**	**5.6**	**1.7**	ND (0.20)
CTP-SG-43-50	5/21/2003	**57**	**6.7**	**1.3**	ND (0.41)
CTP-SG-43-75	5/21/2003	**290**	**16**	**4.6**	**1.8**
CTP-SG-46-06	5/23/2003	ND (0.20)	ND (0.20)	**0.25**	ND (0.20)
CTP-SG-47-06	5/23/2003	ND (0.20)	**0.4**	ND (0.20)	ND (0.20)
CTP-SGP-35	6/9/2003	**9.5**	**0.51**	**0.66**	ND (0.20)
CTP-SGP-37	6/10/2003	**16**	**0.92**	**0.5**	ND (0.20)
CTP-SGP-40	6/10/2003	**0.87**	**0.76**	**0.69**	ND (0.20)
CTP-SGP-41	6/10/2003	ND (0.20)	**0.64**	ND (0.20)	ND (0.20)
CTP-SGP-42	6/10/2003	**2.9**	**0.74**	ND (0.20)	ND (0.20)
CTP-SGP-44	6/10/2003	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)
CTP-SGP-45	6/10/2003	**4.4**	**0.29**	**0.76**	ND (0.20)
CTP-SGP-48	6/10/2003	**13**	**5.6**	**0.41**	ND (0.20)

Notes:
All Concentrations in ppb (v/v).

Fort Ord GIS - proposed_soil_gas_11x17.mxd - 1/27/04

Legend

● Soil Gas Boring Locations

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Soil Gas Boring Locations; 1999 Aerial Photo
OU CTP RI/FS
Former Fort Ord, California

PLATE
1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
JCB	4087030007 010203		05/03	

Legend

- Soil Gas Sample Locations
- Carbon Tetrachloride Concentration Contours in (ppb v/v); Dashed where inferred

CTP-SGP-45	(Carbon Tetrachloride Plume - Soil Gas Probe #45)
6/10/2003 6 feet	(Sample Date and Depth of Sample)
4.4 A ppb(v/v)	(Concentration, Qualifer, and units)

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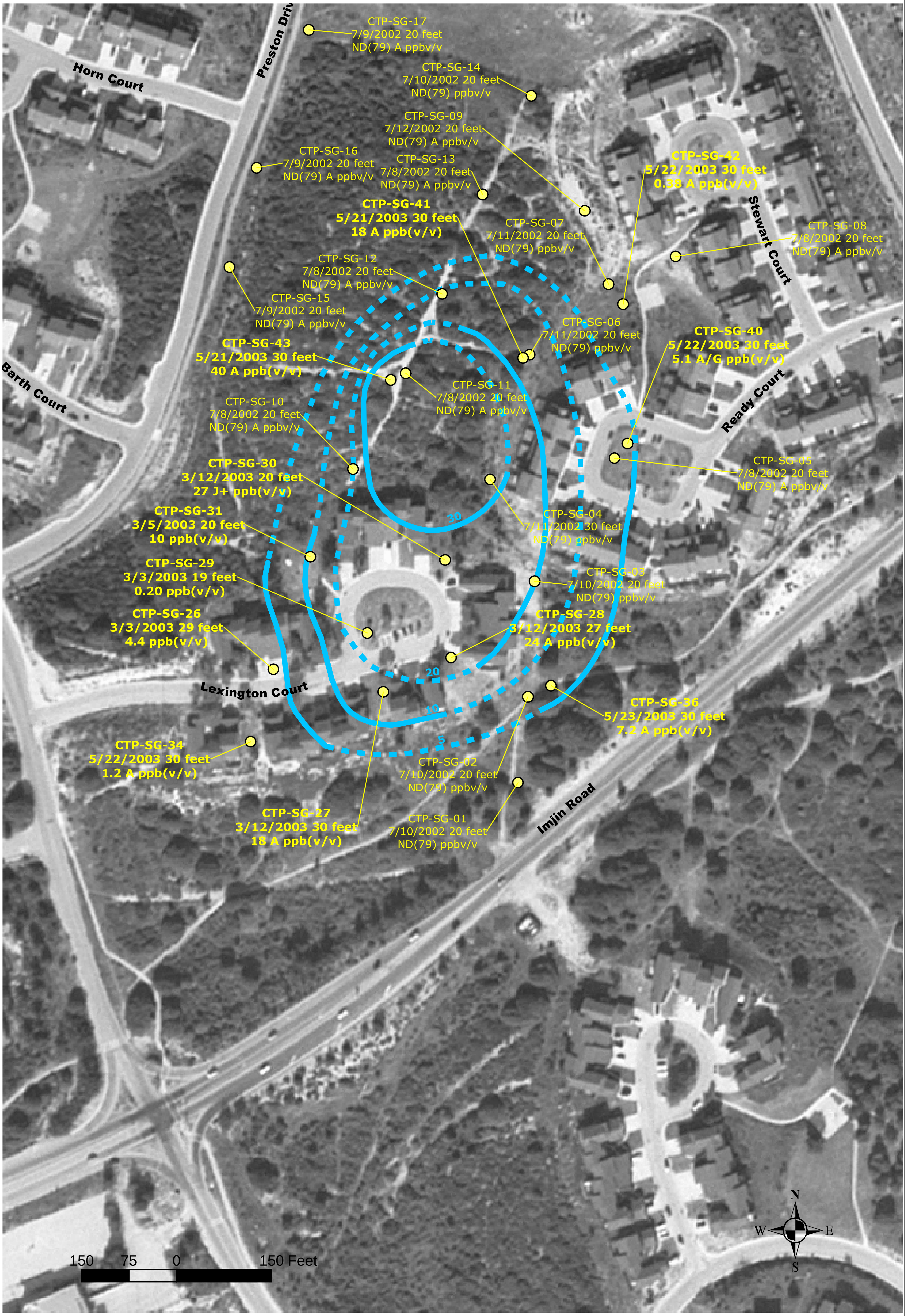
Carbon Tetrachloride Concentrations in Soil Gas at 6 feet
OU CTP RI/FS
Former Fort Ord, California

PLATE 2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
JCB	4087030007 010203		09/03	

Fort Ord GIS - soil_gasRI_6ft.mxd - September 25, 2003



Legend

- Soil Gas Sample Locations
- Carbon Tetrachloride Concentration Contours in ppb (v/v); Dashed where inferred

CTP-SGP-45	(Carbon Tetrachloride Plume - Soil Gas Probe #45)
6/10/2003 6 feet	(Sample Date and Depth of Sample)
4.4 A ppb(v/v)	(Concentration, Qualifer, and units)

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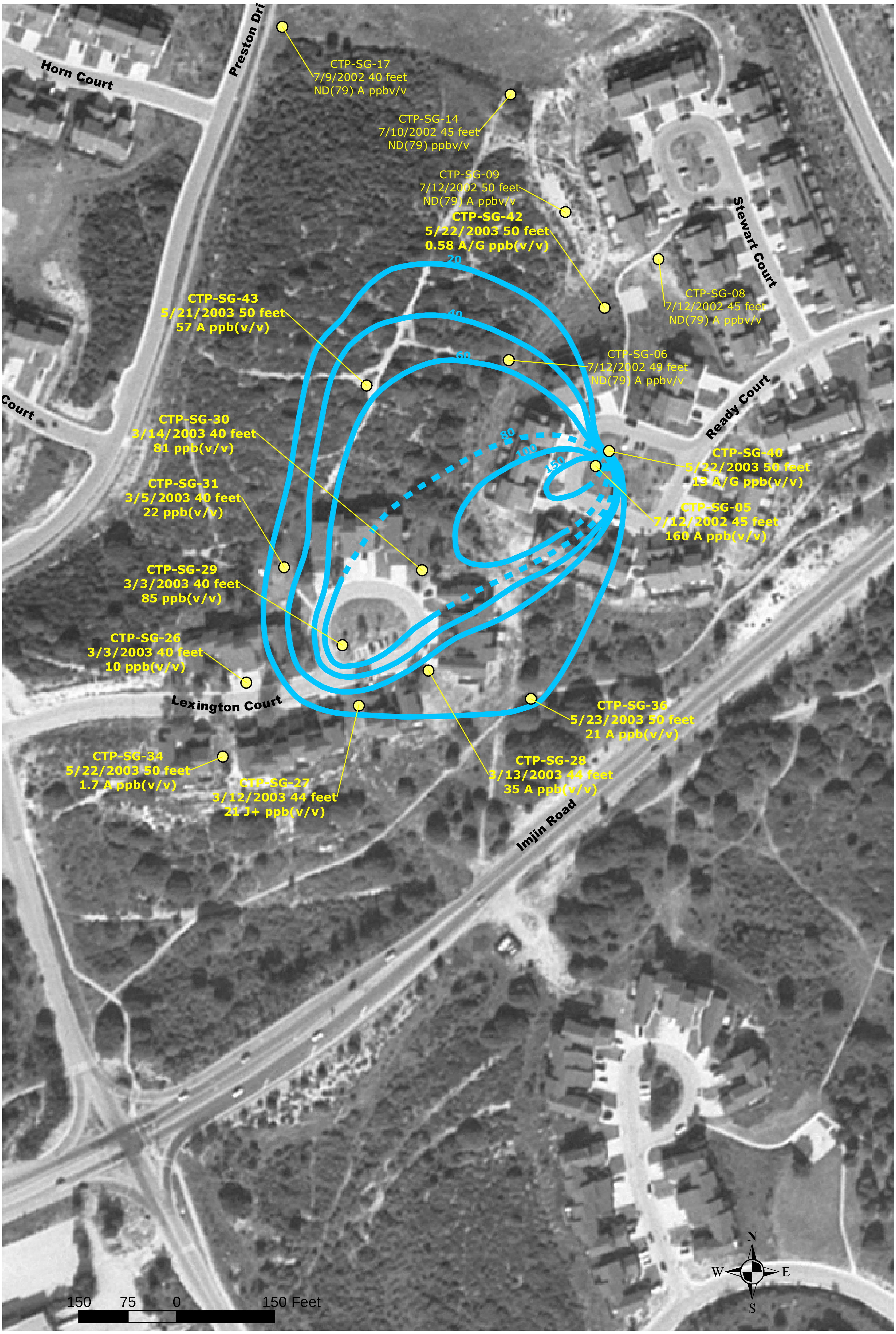
Carbon Tetrachloride Concentrations in Soil Gas from 19 to 30 feet
OU CTP RI/FS
Former Fort Ord, California

PLATE 3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
JCB	4087030007 010203		10/03	

Fort Ord GIS - Soil-GasRI_19-30.mxd - 3 October 03



Legend

Soil Gas Sample Locations

Carbon Tetrachloride Concentration Contours in ppb (v/v); Dashed where inferred

CTP-SGP-45	(Carbon Tetrachloride Plume - Soil Gas Probe #45)
6/10/2003 6 feet	(Sample Date and Depth of Sample)
4.4 A ppb(v/v)	(Concentration, Qualifer, and units)

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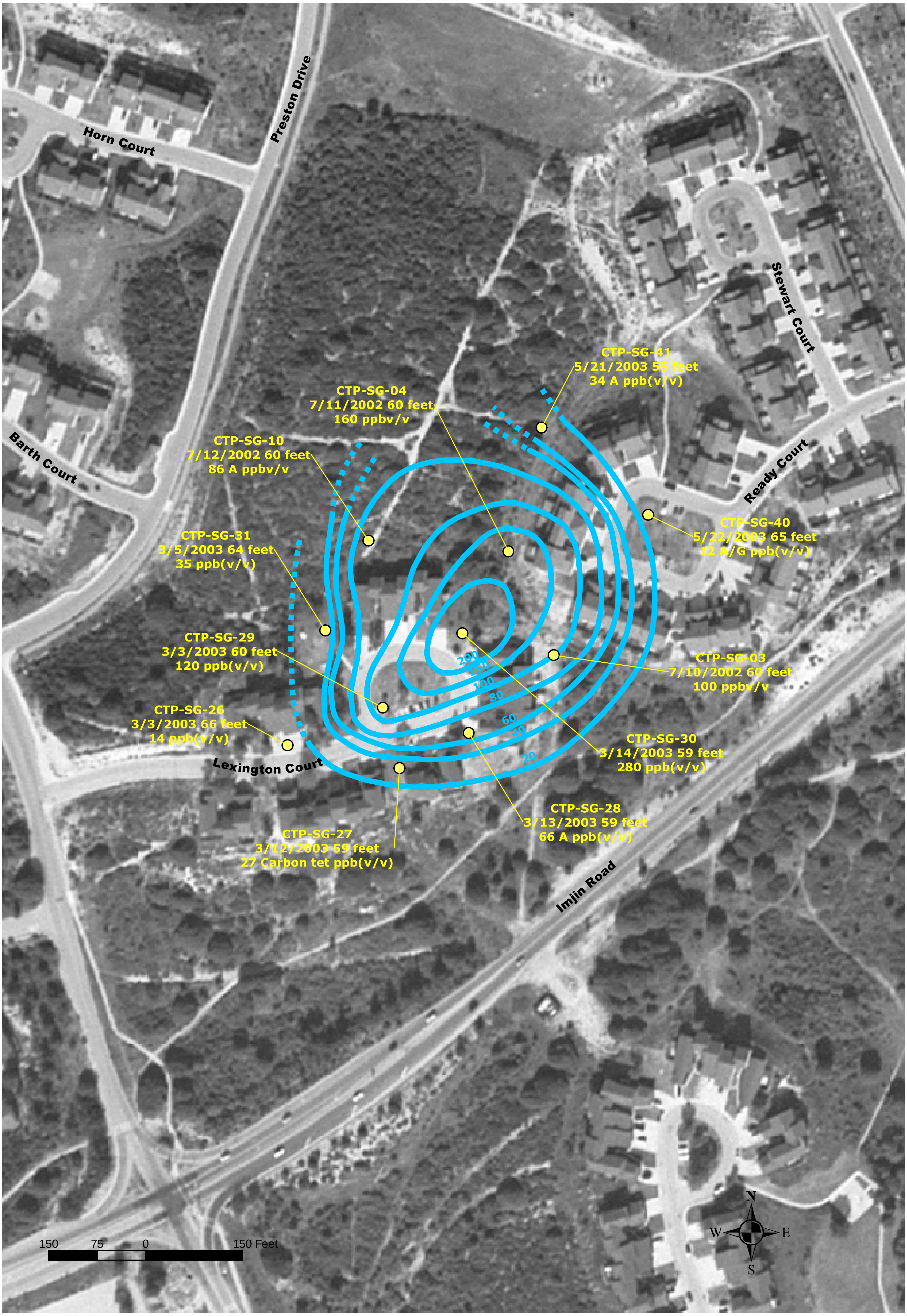
Carbon Tetrachloride Concentrations in Soil Gas from 40 to 50 feet
OU CTP RI/FS
Former Fort Ord, California

PLATE 4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
JCB	4087030007 010203		05/03	

Fort Ord GIS - soil_gasRI_40-50ft_11x17.mxd - 1 May 03



Legend

Soil Gas Sample Locations

Carbon Tetrachloride Concentration Contours in ppb (v/v); Dashed where inferred

CTP-SGP-45 (Carbon Tetrachloride Plume - Soil Gas Probe #45)
6/10/2003 6 feet (Sample Date and Depth of Sample)
4.4 A ppb(v/v) (Concentration, Qualifer, and units)

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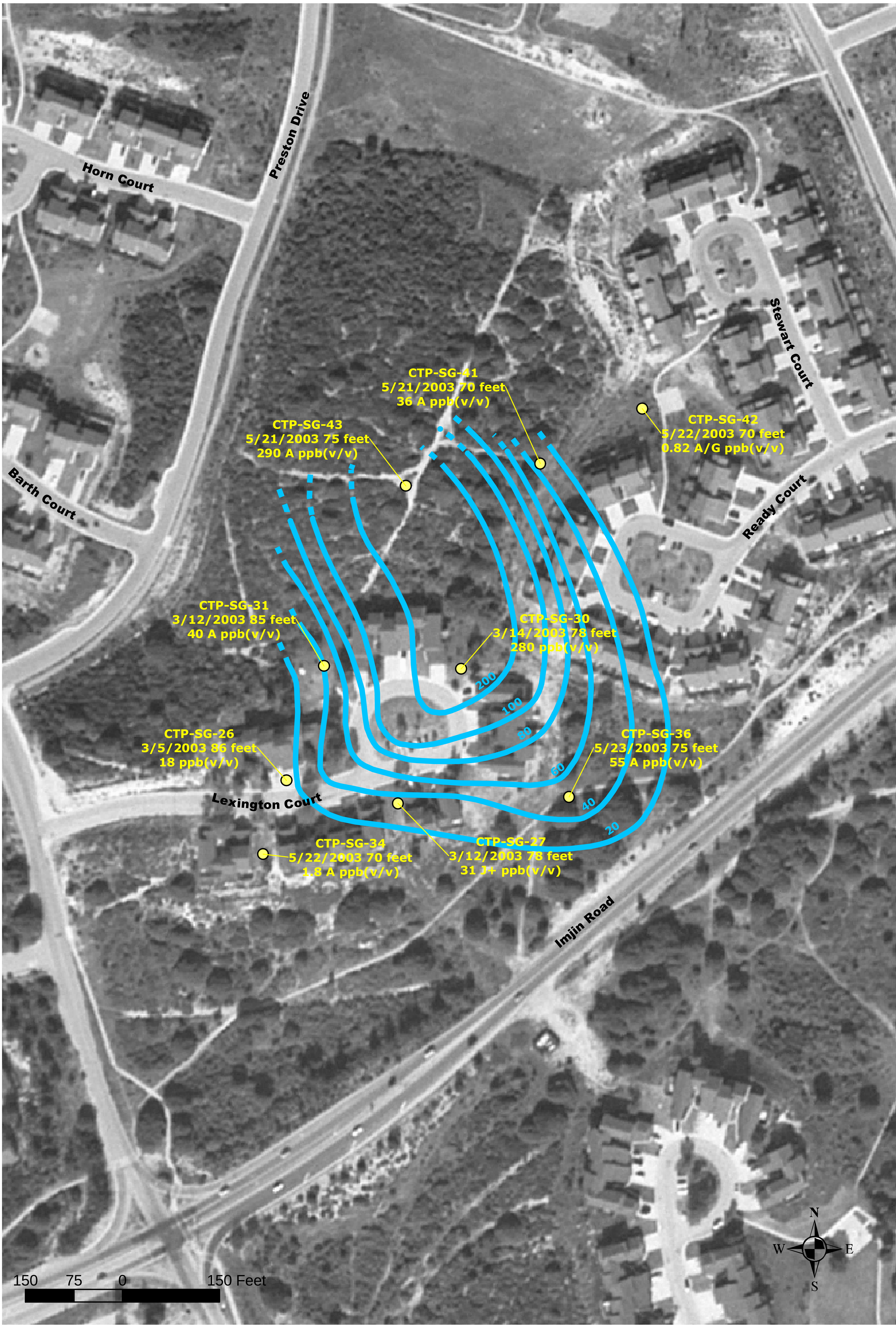
Carbon Tetrachloride Concentrations in Soil Gas between 55-66 feet
OU CTP RI/FS
Former Fort Ord, California

PLATE 5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
JCB	4087030007 010203		09/03	

Fort Ord GIS - soil_gasRI_55-66ft.mxd - September 25, 2003



Legend

Soil Gas Sample Locations

Carbon Tetrachloride Concentration Contours in ppb (v/v); Dashed where inferred

CTP-SGP-45	(Carbon Tetrachloride Plume - Soil Gas Probe #45)
6/10/2003 6 feet	(Sample Date and Depth of Sample)
4.4 A ppb(v/v)	(Concentration, Qualifer, and units)

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Carbon Tetrachloride Concentrations in Soil Gas below 66 feet
OU CTP RI/FS
Former Fort Ord, California

PLATE 6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
JCB	4087030007 010203		05/03	

Fort Ord GIS - proposed_soil_gas.mxd - 1 May 03

Appendix B

OU2 Landfill Gas Pilot Test Analyses

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1.0 Introduction

A pilot test was performed on the landfill gas (LFG) mitigation system adjacent to Area F within Operable Unit 2 (OU2) at the former Fort Ord, Marina, California. For this pilot test, flow testing was conducted on three vertical extraction wells of the LFG mitigation system to obtain estimates of the optimal operating vacuum pressure for the extraction wells in terms of radius of influence and flow rate, and the methane, nitrogen and oxygen content in the effluent gas. This appendix describes the methods used to estimate the soil permeability from vacuum pressure data measured during the flow tests of the LFG extraction wells.

2.0 Flow Testing of Extraction Wells

In May 2001, flow testing was performed on three vertical extraction wells, EW-2, EW-6, and EW-10, in the LFG mitigation system. These extraction wells were installed by IT Corporation (IT) in April 2001. The design and construction of these wells is described in the Draft Evaluation Report for the Landfill Gas Pilot Test (Shaw Environmental, Inc. [Shaw], 2003).

The flow tests of the vertical extraction wells were conducted according to the general procedures outlined in the Landfill Gas Pilot Test Work Plan and Contractor Quality Control Plan, Operable Unit 2 Landfills, Former Fort Ord, California (IT, 2001). The flow tests were performed by applying incremental vacuum pressures at an extraction well, and monitoring vacuum pressures and effluent gas temperature and composition in adjacent monitoring probes at varying distances from the extraction well. The monitoring probes were installed at a 12-foot depth and at a depth of 22 or 32 feet corresponding to the bottom elevation of the waste in Area F (Shaw, 2003).

The flow tests were performed at incremental vacuum pressures between 2.5 and 10.0 inches of water column (WC). Extraction well EW-2 was flow tested at vacuum pressures of 2.5, 5.0, and 10.0 inches WC. Extraction well EW-6 was flow tested at vacuum pressures of 2.5, 5.0, and 7.5 inches WC. Extraction well EW-10 was tested at vacuum pressures of 2.5 and 5.0 inches WC. Each flow test was conducted for approximately six hours (Shaw, 2003).

3.0 Soil Permeability Analysis of Flow Tests

The radial vacuum pressure distribution data from the flow tests were analyzed to obtain estimates of the air permeability of the shallow soils in the vicinity of the LFG mitigation system. The vacuum gauge pressures at the monitoring probes were first converted to absolute vacuum pressures using the barometric pressure measured during the tests. The corrected vacuum gauge pressures were then fitted to the transient radial pressure distribution equation for leaky confined aquifers of Beckett and Huntley (1994) using mathematics computer-aided-design software. For these analyses, the leaky confining layer was assumed to have a thickness of 10 feet (304.8 cm) and a horizontal permeability (k_h) equal to ten times the vertical permeability (k_v)

3.1 Estimated Soil Permeabilities

The results of the analyses of the vacuum pressure distribution data from the flow tests test are summarized in Table X-1 and the analyses are included in this Appendix. The soil permeabilities estimated by the Beckett and Huntley (1994) method for the monitoring probes range between 2.1 x 10^{-7} and 3.3 x 10^{-7} cm^2 (21 and 33 Darcies).

4.0 References

Beckett, G.D., and D. Huntley, 1994, "Characterization of Flow Parameters Controlling Soil Vapor Extraction," *Ground Water*, Vol. 32, No. 2, p. 239-247.

IT Corporation (IT), 2001, "Landfill Gas Pilot Test Work Plan and Contractor Quality Control Plan, Operable Unit 2 Landfills, Former Fort Ord, California," prepared for Department of the Army Corps of Engineers, Sacramento, California.

Shaw Environmental, Inc. (Shaw), 2003, "Draft Evaluation Report, Landfill Gas Pilot Test, Operable Unit 2 Landfills, Former Fort Ord, California, Revision C," prepared for Department of the Army Corps of Engineers, Sacramento, California.

Table B-1
Estimated Air Permeability of Shallow A Aquifer
Landfill Gas Pilot Tests
Operable Unit 2 Landfill
Fort Ord, California

Extraction Well	Vacuum Pressure (Inches WC)	Effluent Flow Rate (Scfm)	Elapsed Test Time (Hours)	Estimated k (cm^2)
EW-2	2.5	17.0	5.0	2.35E-07
	5.0	32.0	5.0	2.60E-07
	10.0	52.0	5.0	2.10E-07
EW-6	2.5	20.0	4.5	3.20E-07
	5.0	34.0	4.5	2.55E-07
	7.5	55.0	3.0	3.00E-07
EW-10	2.5	20.0	4.0	3.30E-07
	5.0	34.0	3.5	2.80E-07

PURPOSE:

Estimate the radial subsurface pressure change during a single-well, constant-pressure, soil vapor extraction (SVE) pilot test.

METHOD:

Subsurface pressure change (P_g) during pilot test was estimated using the transient radial pressure distribution equation for leaky confined flow condtions of Beckett and Huntley (1994):

$$P_g := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_u^{\infty}\frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

here

$$u := \frac{r^2\cdot\varepsilon\cdot\mu}{4\cdot k\cdot P_{atm}\cdot t}$$

and

$$B := \sqrt{k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m\cdot\left(\frac{m_v}{\frac{k_v\cdot\rho\cdot g}{\mu}}\right)}$$

ASSUMPTIONS:

CALCULATIONS:

Soil Properties

Permeability (k)	$k := 2.35\cdot 10^{-7}$	cm^2	
Vertical Permeability of Conf. Layer (k_v)	$k_v := 2.35\cdot 10^{-8}$	cm^2	
Thickness (m)	$m := 670.56$	cm	(22 ft)
Thickness of Conf. Layer (m_v)	$m_v := 304.8$	cm	(10 ft)
Air-filled Porosity (ε)	$\varepsilon := 0.35$	dimensionless	
Air Viscosity (μ)	$\mu := 1.8\cdot 10^{-4}$	g/cm-sec	
Air Density (ρ)	$\rho := 1.17\cdot 10^{-3}$	g/cm^3	
Ambient Atmospheric Pressure (P_{atm})	$P_{atm} := 403.5\cdot 2490.8891$	$g/cm\text{-}sec^2$	

Extraction Well

Volumetric Flow Rate (Q)	$Q := 15\cdot 471.947443$	cm^3/sec	($15\ ft^3/min$)

Observation Well

Elapsed Test Time (t)	$t := 5.0\cdot 3600$	sec	(5.0 hours)
Radial Distance from Extraction Well (r)	$r := 1, 10 .. 5000$	cm	(1 - 50 m)

Calculation of u

$$u(t,r) := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

$u(t,r) =$

	0
0	$3.705 \cdot 10^{-9}$
1	$3.705 \cdot 10^{-7}$
2	$1.337 \cdot 10^{-6}$
3	$2.904 \cdot 10^{-6}$
4	$5.072 \cdot 10^{-6}$
5	$7.839 \cdot 10^{-6}$
6	$1.121 \cdot 10^{-5}$
7	$1.517 \cdot 10^{-5}$
8	$1.974 \cdot 10^{-5}$
9	$2.491 \cdot 10^{-5}$

Calculation of B and r/B

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_v}{\frac{k_v \cdot \rho \cdot g}{\mu}}\right)}$$

$B = 1.43 \times 10^3$

$\frac{r}{B} =$

	0
0	$6.995 \cdot 10^{-4}$
1	$6.995 \cdot 10^{-3}$
2	0.013
3	0.02
4	0.026
5	0.032
6	0.038
7	0.045
8	0.051
9	0.057

Calculation of $Ei_1(x)$

$Ei_1(x)$ is exponential integral of x. For |x| < 4 an accurate value of $Ei_1(x)$ is obtained with n = u to 100.

$$Ei_1(u,t,r) := \int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$Ei_1(u,t,r) =$

	0
0	14.762
1	10.157
2	8.874
3	8.099
4	7.542
5	7.107
6	6.751
7	6.449
8	6.187
9	5.955

Calculation of Pressure Change (P_g) with Radial Distance (r)

$$P_g(u,t,r) := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$P_g(u,t,r) =$ g/cm-sec^2

	0
0	$8.279\cdot10^3$
1	$5.697\cdot10^3$
2	$4.977\cdot10^3$
3	$4.542\cdot10^3$
4	$4.23\cdot10^3$
5	$3.986\cdot10^3$
6	$3.786\cdot10^3$
7	$3.617\cdot10^3$
8	$3.47\cdot10^3$
9	$3.34\cdot10^3$

$sec^{2}\,cm^{-1}$

Pilot Test Data

Observation Point Radius (r_o)

$r_o :=$

	0
0	5.08
1	1310.64
2	1341.12
3	2804.16
4	2987.04
5	4084.32

cm

Observed Vacuum (V_o)

$V_o :=$

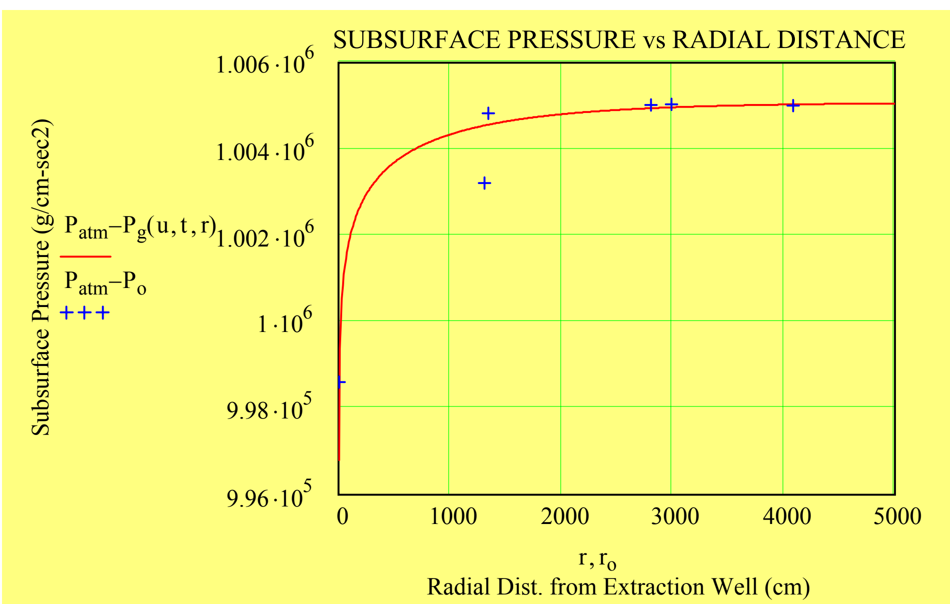
	0
0	2.600
1	0.750
2	0.100
3	0.025
4	0.020
5	0.030

in H_2O

Observed Pressure Change in gm/cm^2-sec (P_o)

$$P_o := V_o \cdot 2490.8891$$

Observed vs Calculated Subsurface Pressure



REFERENCES:

Beckett, G.D., and D. Huntley, 1994, "Characterization of Flow Parameters Controlling Soil Vapor Extraction," ***Ground Water***, Vol. 32, No. 2, p. 239-247.

Shaw Environmental, Inc.

By TFC Date 12/7/03 Subject Fort Ord CTP Pilot SVE Design Sheet No. ___ of ___.
Chkd By ______ Date ______. EW-2 SVE Pilot Test 5 in. WC - Estimated K Proj. No. 783751.

PURPOSE:

Estimate the radial subsurface pressure change during a single-well, constant-pressure, soil vapor extraction (SVE) pilot test.

METHOD:

Subsurface pressure change (P_g) during pilot test was estimated using the transient radial pressure distribution equation for leaky confined flow condtions of Beckett and Huntley (1994):

$$P_g := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_u^{\infty}\frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

here

$$u := \frac{r^2\cdot\varepsilon\cdot\mu}{4\cdot k\cdot P_{atm}\cdot t}$$

and

$$B := \sqrt{k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m\cdot\left(\frac{m_v}{\frac{k_v\cdot\rho\cdot g}{\mu}}\right)}$$

ASSUMPTIONS:

CALCULATIONS:

Soil Properties

Permeability (k)	$k := 2.6\cdot 10^{-7}$	cm^2	
Vertical Permeability of Conf. Layer (k_v)	$k_v := 2.6\cdot 10^{-8}$	cm^2	
Thickness (m)	$m := 670.56$	cm	(22 ft)
Thickness of Conf. Layer (m_v)	$m_v := 304.8$	cm	(10 ft)
Air-filled Porosity (ε)	$\varepsilon := 0.35$	dimensionless	
Air Viscosity (μ)	$\mu := 1.8\cdot 10^{-4}$	g/cm-sec	
Air Density (ρ)	$\rho := 1.17\cdot 10^{-3}$	g/cm^3	
Ambient Atmospheric Pressure (P_{atm})	$P_{atm} := 404.7\cdot 2490.8891$	$g/cm\text{-}sec^2$	

Extraction Well

Volumetric Flow Rate (Q)	$Q := 32\cdot 471.947443$	cm^3/sec	(32 ft^3/min)

Observation Well

Elapsed Test Time (t)	$t := 5.0\cdot 3600$	sec	(5.0 hours)
Radial Distance from Extraction Well (r)	$r := 1, 10 .. 5000$	cm	(1 - 50 m)

Calculation of u

$$u(t,r) := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

$u(t,r) =$

	0
0	$3.338 \cdot 10^{-9}$
1	$3.338 \cdot 10^{-7}$
2	$1.205 \cdot 10^{-6}$
3	$2.617 \cdot 10^{-6}$
4	$4.57 \cdot 10^{-6}$
5	$7.064 \cdot 10^{-6}$
6	$1.01 \cdot 10^{-5}$
7	$1.367 \cdot 10^{-5}$
8	$1.779 \cdot 10^{-5}$
9	$2.245 \cdot 10^{-5}$

Calculation of B and r/B

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_v}{\frac{k_v \cdot \rho \cdot g}{\mu}}\right)}$$

$B = 1.43 \times 10^3$

$\frac{r}{B} =$

	0
0	$6.995 \cdot 10^{-4}$
1	$6.995 \cdot 10^{-3}$
2	0.013
3	0.02
4	0.026
5	0.032
6	0.038
7	0.045
8	0.051
9	0.057

Calculation of $Ei_1(x)$

$Ei_1(x)$ is exponential integral of x. For |x| < 4 an accurate value of $Ei_1(x)$ is obtained with n = u to 100.

$$Ei_1(u,t,r) := \int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$Ei_1(u,t,r) =$

	0
0	14.762
1	10.157
2	8.874
3	8.099
4	7.542
5	7.107
6	6.751
7	6.449
8	6.187
9	5.955

Calculation of Pressure Change (P_g) with Radial Distance (r)

$$P_g(u,t,r) := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$P_g(u,t,r) =$ g/cm-sec²

	0
0	$1.596\cdot10^{4}$
1	$1.098\cdot10^{4}$
2	$9.596\cdot10^{3}$
3	$8.758\cdot10^{3}$
4	$8.156\cdot10^{3}$
5	$7.686\cdot10^{3}$
6	$7.3\cdot10^{3}$
7	$6.974\cdot10^{3}$
8	$6.69\cdot10^{3}$
9	$6.44\cdot10^{3}$

$sec^{2}\,cm^{-1}$

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By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Pilot Test Data

Observation Point Radius (r_o)

$r_o :=$ (cm)

	0
0	5.08
1	1310.64
2	1341.12
3	
4	
5	

Observed Vacuum (V_o)

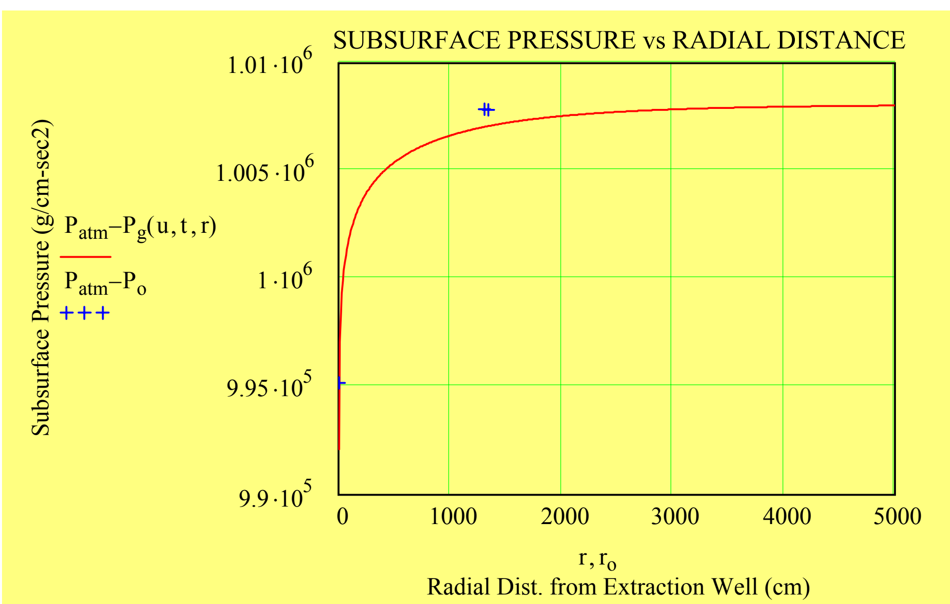
$V_o :=$ (in H_2O)

	0
0	5.170
1	0.090
2	0.100
3	
4	
5	

Observed Pressure Change in gm/cm^2-sec (P_o)

$$P_o := V_o \cdot 2490.8891$$

Observed vs Calculated Subsurface Pressure



REFERENCES:

Beckett, G.D., and D. Huntley, 1994, "Characterization of Flow Parameters Controlling Soil Vapor Extraction," ***Ground Water***, Vol. 32, No. 2, p. 239-247.

Shaw® Shaw Environmental, Inc.

By __TFC____Date 12/7/03 Subject Fort Ord CTP Pilot SVE Design________Sheet No. ___of ___.
Chkd By _____Date _______. EW-2 SVE Pilot Test 10 in. WC - Estimated K__Proj. No. 783751___.

PURPOSE:

Estimate the radial subsurface pressure change during a single-well, constant-pressure, soil vapor extraction (SVE) pilot test.

METHOD:

Subsurface pressure change (P_g) during pilot test was estimated using the transient radial pressure distribution equation for leaky confined flow condtions of Beckett and Huntley (1994):

$$P_g := \frac{Q}{4 \cdot \pi \cdot k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m} \cdot \int_u^{\infty} \frac{e^{\left[-x-\left(\frac{r^2}{4 \cdot B^2 \cdot x}\right)\right]}}{x} dx$$

here

$$u := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

and

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_v}{\frac{k_v \cdot \rho \cdot g}{\mu}}\right)}$$

ASSUMPTIONS:

CALCULATIONS:

Soil Properties

Permeability (k)	$k := 2.1 \cdot 10^{-7}$	cm^2	
Vertical Permeability of Conf. Layer (k_v)	$k_v := 2.1 \cdot 10^{-8}$	cm^2	
Thickness (m)	$m := 670.56$	cm	(22 ft)
Thickness of Conf. Layer (m_v)	$m_v := 304.8$	cm	(10 ft)
Air-filled Porosity (ε)	$\varepsilon := 0.35$	dimensionless	
Air Viscosity (μ)	$\mu := 1.8 \cdot 10^{-4}$	g/cm-sec	
Air Density (ρ)	$\rho := 1.17 \cdot 10^{-3}$	g/cm^3	
Ambient Atmospheric Pressure (P_{atm})	$P_{atm} := 403.1 \cdot 2490.8891$	$g/cm\text{-}sec^2$	

Extraction Well

Volumetric Flow Rate (Q)	$Q := 52 \cdot 471.947443$	cm^3/sec	(52 ft^3/min)

Observation Well

Elapsed Test Time (t)	$t := 5.0 \cdot 3600$	sec	(5.0 hours)
Radial Distance from Extraction Well (r)	$r := 1, 10 .. 5000$	cm	(1 - 50 m)

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By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Calculation of u

$$u(t,r) := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

$u(t,r) =$

	0
0	$4.15 \cdot 10^{-9}$
1	$4.15 \cdot 10^{-7}$
2	$1.498 \cdot 10^{-6}$
3	$3.253 \cdot 10^{-6}$
4	$5.681 \cdot 10^{-6}$
5	$8.781 \cdot 10^{-6}$
6	$1.255 \cdot 10^{-5}$
7	$1.7 \cdot 10^{-5}$
8	$2.211 \cdot 10^{-5}$
9	$2.79 \cdot 10^{-5}$

Calculation of B and r/B

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_v}{\frac{k_v \cdot \rho \cdot g}{\mu}}\right)}$$

$$B = 1.43 \times 10^3$$

$\frac{r}{B} =$

	0
0	$6.995 \cdot 10^{-4}$
1	$6.995 \cdot 10^{-3}$
2	0.013
3	0.02
4	0.026
5	0.032
6	0.038
7	0.045
8	0.051
9	0.057

Calculation of $Ei_1(x)$

$Ei_1(x)$ is exponential integral of x. For |x| < 4 an accurate value of $Ei_1(x)$ is obtained with n = u to 100.

$$Ei_1(u,t,r) := \int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$Ei_1(u,t,r) =$

	0
0	14.762
1	10.157
2	8.874
3	8.099
4	7.542
5	7.107
6	6.751
7	6.449
8	6.187
9	5.955

Calculation of Pressure Change (P_g) with Radial Distance (r)

$$P_g(u,t,r) := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$P_g(u,t,r) =$ g/cm-sec^2

	0
0	$3.212\cdot10^4$
1	$2.21\cdot10^4$
2	$1.931\cdot10^4$
3	$1.762\cdot10^4$
4	$1.641\cdot10^4$
5	$1.546\cdot10^4$
6	$1.469\cdot10^4$
7	$1.403\cdot10^4$
8	$1.346\cdot10^4$
9	$1.296\cdot10^4$

$sec^{2}\,cm^{-1}$

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By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Pilot Test Data

Observation Point Radius (r_o)

$r_o :=$

	0
0	5.08
1	1310.64
2	1341.12
3	2804.16
4	2987.04
5	

cm

Observed Vacuum (V_o)

$V_o :=$

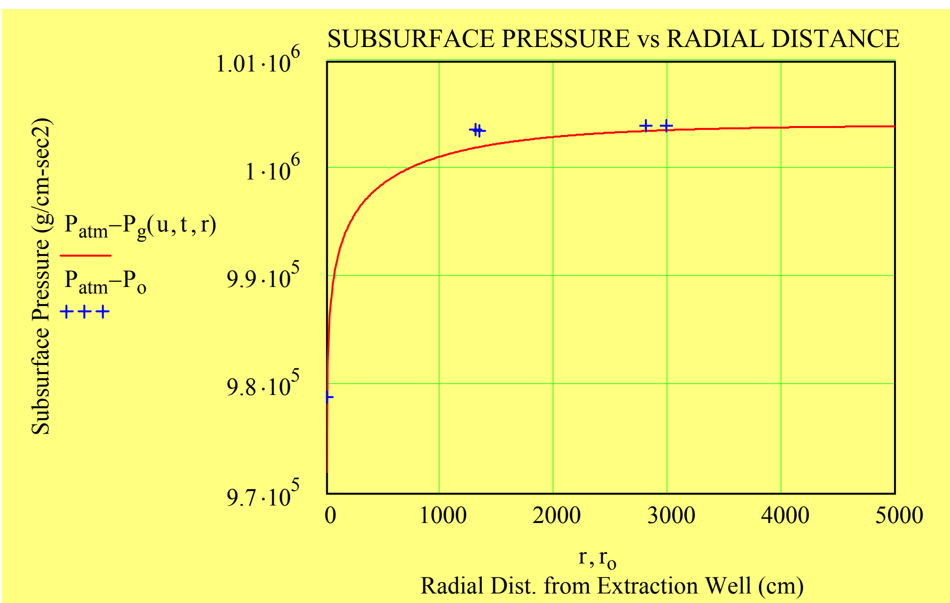
	0
0	10.100
1	0.160
2	0.205
3	0.025
4	0.015
5	

in H_2O

Observed Pressure Change in gm/cm²-sec (P_o)

$$P_o := V_o \cdot 2490.8891$$

Observed vs Calculated Subsurface Pressure



REFERENCES:

Beckett, G.D., and D. Huntley, 1994, "Characterization of Flow Parameters Controlling Soil Vapor Extraction," ***Ground Water***, Vol. 32, No. 2, p. 239-247.

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By __TFC____Date 12/7/03 Subject Fort Ord CTP Pilot SVE Design________Sheet No. ___of ___.
Chkd By _____Date _______. EW-6 SVE Pilot Test 2.5 in. WC - Estimated K _Proj. No. 783751___.

PURPOSE:

Estimate the radial subsurface pressure change during a single-well, constant-pressure, soil vapor extraction (SVE) pilot test.

METHOD:

Subsurface pressure change (P_g) during pilot test was estimated using the transient radial pressure distribution equation for leaky confined flow condtions of Beckett and Huntley (1994):

$$P_g := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_u^{\infty}\frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

here

$$u := \frac{r^2\cdot\varepsilon\cdot\mu}{4\cdot k\cdot P_{atm}\cdot t}$$

and

$$B := \sqrt{k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m\cdot\left(\frac{m_v}{\frac{k_v\cdot\rho\cdot g}{\mu}}\right)}$$

ASSUMPTIONS:

CALCULATIONS:

Soil Properties

Permeability (k)	$k := 3.2\cdot 10^{-7}$	cm^2	
Vertical Permeability of Conf. Layer (k_v)	$k_v := 3.2\cdot 10^{-8}$	cm^2	
Thickness (m)	$m := 670.56$	cm	(22 ft)
Thickness of Conf. Layer (m_v)	$m_v := 304.8$	cm	(10 ft)
Air-filled Porosity (ε)	$\varepsilon := 0.35$	dimensionless	
Air Viscosity (μ)	$\mu := 1.8\cdot 10^{-4}$	g/cm-sec	
Air Density (ρ)	$\rho := 1.17\cdot 10^{-3}$	g/cm^3	
Ambient Atmospheric Pressure (P_{atm})	$P_{atm} := 405.28\cdot 2490.889$	$g/cm\text{-}sec^2$	

Extraction Well

Volumetric Flow Rate (Q)	$Q := 20\cdot 471.947443$	cm^3/sec	(20 ft^3/min)

Observation Well

Elapsed Test Time (t)	$t := 4.5\cdot 3600$	sec	(4.5 hours)
Radial Distance from Extraction Well (r)	$r := 1, 10 .. 5000$	cm	(1 - 50 m)

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By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Calculation of u

$$u(t,r) := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

$u(t,r) =$

	0
0	$3.01 \cdot 10^{-9}$
1	$3.01 \cdot 10^{-7}$
2	$1.086 \cdot 10^{-6}$
3	$2.36 \cdot 10^{-6}$
4	$4.12 \cdot 10^{-6}$
5	$6.368 \cdot 10^{-6}$
6	$9.104 \cdot 10^{-6}$
7	$1.233 \cdot 10^{-5}$
8	$1.604 \cdot 10^{-5}$
9	$2.024 \cdot 10^{-5}$

Calculation of B and r/B

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_V}{\frac{k_V \cdot \rho \cdot g}{\mu}}\right)}$$

$B = 1.43 \times 10^3$

$\frac{r}{B} =$

	0
0	$6.995 \cdot 10^{-4}$
1	$6.995 \cdot 10^{-3}$
2	0.013
3	0.02
4	0.026
5	0.032
6	0.038
7	0.045
8	0.051
9	0.057

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By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Calculation of $Ei_1(x)$

$Ei_1(x)$ is exponential integral of x. For |x| < 4 an accurate value of $Ei_1(x)$ is obtained with n = u to 100.

$$Ei_1(u,t,r) := \int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$Ei_1(u,t,r) =$

	0
0	14.762
1	10.157
2	8.874
3	8.099
4	7.542
5	7.107
6	6.751
7	6.449
8	6.187
9	5.955

Calculation of Pressure Change (P_g) with Radial Distance (r)

$$P_g(u,t,r) := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$P_g(u,t,r) =$ g/cm-sec^2

	0
0	$8.107\cdot10^3$
1	$5.578\cdot10^3$
2	$4.873\cdot10^3$
3	$4.447\cdot10^3$
4	$4.142\cdot10^3$
5	$3.903\cdot10^3$
6	$3.707\cdot10^3$
7	$3.541\cdot10^3$
8	$3.397\cdot10^3$
9	$3.27\cdot10^3$

$sec^2\,cm^{-1}$

Shaw® Shaw Environmental, Inc.

By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Pilot Test Data

Observation Point Radius (r_o)

$r_o :=$

	0
0	5.08
1	883.92
2	1554.48
3	2712.72
4	
5	

cm

Observed Vacuum (V_o)

$V_o :=$

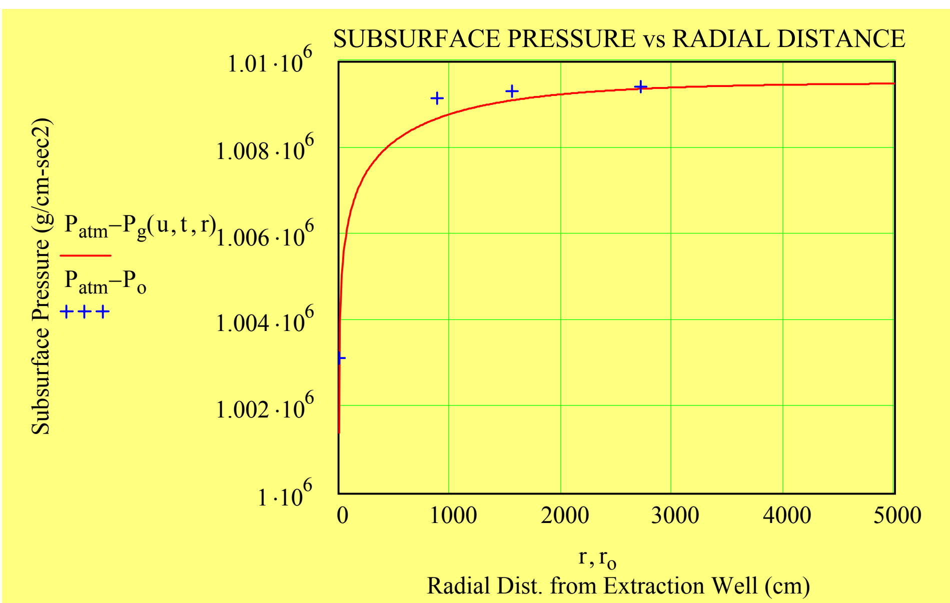
	0
0	2.560
1	0.143
2	0.080
3	0.036
4	
5	

in H_2O

Observed Pressure Change in gm/cm^2-sec (P_o)

$$P_o := V_o \cdot 2490.8891$$

Observed vs Calculated Subsurface Pressure



REFERENCES:

Beckett, G.D., and D. Huntley, 1994, "Characterization of Flow Parameters Controlling Soil Vapor Extraction," ***Ground Water***, Vol. 32, No. 2, p. 239-247.

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By __TFC_____Date 12/7/03 Subject Fort Ord CTP Pilot SVE Design_________Sheet No. ___of ___.
Chkd By _____Date _______. EW-6 SVE Pilot Test 5 in. WC - Estimated K___Proj. No. 783751___.

PURPOSE:

Estimate the radial subsurface pressure change during a single-well, constant-pressure, soil vapor extraction (SVE) pilot test.

METHOD:

Subsurface pressure change (P_g) during pilot test was estimated using the transient radial pressure distribution equation for leaky confined flow condtions of Beckett and Huntley (1994):

$$P_g := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_u^{\infty}\frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

here

$$u := \frac{r^2\cdot\varepsilon\cdot\mu}{4\cdot k\cdot P_{atm}\cdot t}$$

and

$$B := \sqrt{k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m\cdot\left(\frac{m_v}{\frac{k_v\cdot\rho\cdot g}{\mu}}\right)}$$

ASSUMPTIONS:

CALCULATIONS:

Soil Properties

Permeability (k)	$k := 2.55\cdot 10^{-7}$	cm^2	
Vertical Permeability of Conf. Layer (k_v)	$k_v := 2.55\cdot 10^{-8}$	cm^2	
Thickness (m)	$m := 670.56$	cm	(22 ft)
Thickness of Conf. Layer (m_v)	$m_v := 304.8$	cm	(10 ft)
Air-filled Porosity (ε)	$\varepsilon := 0.35$	dimensionless	
Air Viscosity (μ)	$\mu := 1.8\cdot 10^{-4}$	g/cm-sec	
Air Density (ρ)	$\rho := 1.17\cdot 10^{-3}$	g/cm^3	
Ambient Atmospheric Pressure (P_{atm})	$P_{atm} := 406.37\cdot 2490.889$	$g/cm\text{-}sec^2$	

Extraction Well

Volumetric Flow Rate (Q)	$Q := 34\cdot 471.947443$	cm^3/sec	(34 ft^3/min)

Observation Well

Elapsed Test Time (t)	$t := 4.5\cdot 3600$	sec	(4.5 hours)
Radial Distance from Extraction Well (r)	$r := 1, 10 .. 5000$	cm	(1 - 50 m)

Calculation of u

$$u(t,r) := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

$u(t,r) =$

	0
0	$3.767 \cdot 10^{-9}$
1	$3.767 \cdot 10^{-7}$
2	$1.36 \cdot 10^{-6}$
3	$2.953 \cdot 10^{-6}$
4	$5.156 \cdot 10^{-6}$
5	$7.97 \cdot 10^{-6}$
6	$1.139 \cdot 10^{-5}$
7	$1.543 \cdot 10^{-5}$
8	$2.007 \cdot 10^{-5}$
9	$2.533 \cdot 10^{-5}$

Calculation of B and r/B

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_v}{\frac{k_v \cdot \rho \cdot g}{\mu}}\right)}$$

$B = 1.43 \times 10^3$

$\frac{r}{B} =$

	0
0	$6.995 \cdot 10^{-4}$
1	$6.995 \cdot 10^{-3}$
2	0.013
3	0.02
4	0.026
5	0.032
6	0.038
7	0.045
8	0.051
9	0.057

Calculation of $Ei_1(x)$

$Ei_1(x)$ is exponential integral of x. For |x| < 4 an accurate value of $Ei_1(x)$ is obtained with n = u to 100.

$$Ei_1(u,t,r) := \int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$Ei_1(u,t,r) =$

	0
0	14.762
1	10.157
2	8.874
3	8.099
4	7.542
5	7.107
6	6.751
7	6.449
8	6.187
9	5.955

Calculation of Pressure Change (P_g) with Radial Distance (r)

$$P_g(u,t,r) := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$P_g(u,t,r) =$ g/cm-sec^2

	0
0	$1.729\cdot 10^{4}$
1	$1.19\cdot 10^{4}$
2	$1.04\cdot 10^{4}$
3	$9.488\cdot 10^{3}$
4	$8.836\cdot 10^{3}$
5	$8.326\cdot 10^{3}$
6	$7.909\cdot 10^{3}$
7	$7.555\cdot 10^{3}$
8	$7.248\cdot 10^{3}$
9	$6.977\cdot 10^{3}$

$sec^{2}\,cm^{-1}$

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By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Pilot Test Data

Observation Point Radius (r_o)

$r_o :=$

	0
0	5.08
1	883.92
2	1554.48
3	2712.72
4	3048.00
5	4023.36

cm

Observed Vacuum (V_o)

$V_o :=$

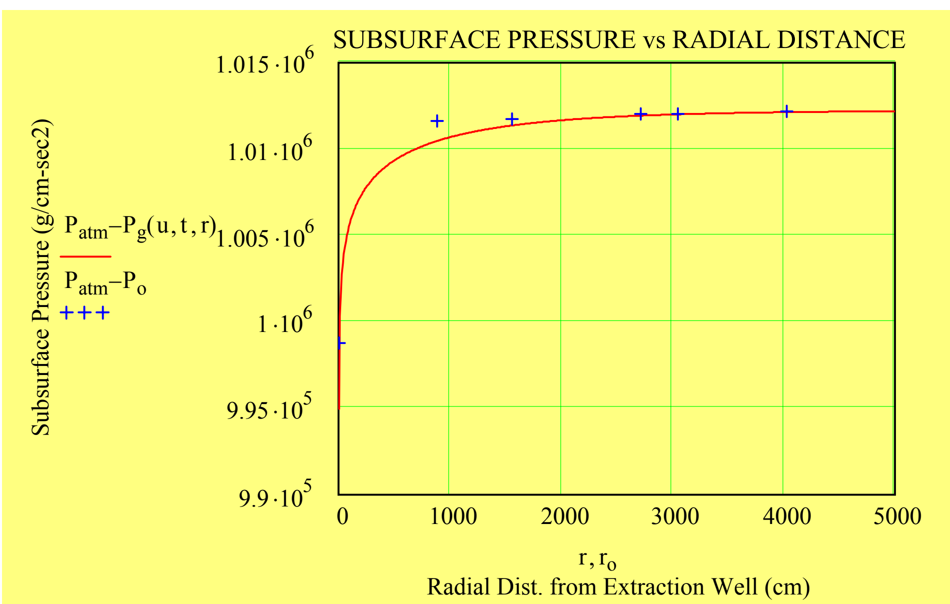
	0
0	5.400
1	0.250
2	0.200
3	0.075
4	0.075
5	0.020

in H_2O

Observed Pressure Change in gm/cm^2-sec (P_o)

$$P_o := V_o \cdot 2490.8891$$

Observed vs Calculated Subsurface Pressure



REFERENCES:

Beckett, G.D., and D. Huntley, 1994, "Characterization of Flow Parameters Controlling Soil Vapor Extraction," ***Ground Water***, Vol. 32, No. 2, p. 239-247.

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By __TFC_____Date 12/7/03 Subject Fort Ord CTP Pilot SVE Design_________Sheet No. ___of ___.
Chkd By _____Date _______.__EW-6 SVE Pilot Test 7.5 in. WC - Estimated K__Proj. No. _783751___.

PURPOSE:

Estimate the radial subsurface pressure change during a single-well, constant-pressure, soil vapor extraction (SVE) pilot test.

METHOD:

Subsurface pressure change (P_g) during pilot test was estimated using the transient radial pressure distribution equation for leaky confined flow condtions of Beckett and Huntley (1994):

$$P_g := \frac{Q}{4 \cdot \pi \cdot k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m} \cdot \int_u^{\infty} \frac{e^{\left[-x-\left(\frac{r^2}{4 \cdot B^2 \cdot x}\right)\right]}}{x} \, dx$$

here

$$u := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

and

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_v}{\frac{k_v \cdot \rho \cdot g}{\mu}}\right)}$$

ASSUMPTIONS:

CALCULATIONS:

Soil Properties

Permeability (k)	$k := 3.0 \cdot 10^{-7}$	cm^2	
Vertical Permeability of Conf. Layer (k_v)	$k_v := 3.0 \cdot 10^{-8}$	cm^2	
Thickness (m)	$m := 670.56$	cm	(22 ft)
Thickness of Conf. Layer (m_v)	$m_v := 304.8$	cm	(10 ft)
Air-filled Porosity (ε)	$\varepsilon := 0.35$	dimensionless	
Air Viscosity (μ)	$\mu := 1.8 \cdot 10^{-4}$	g/cm-sec	
Air Density (ρ)	$\rho := 1.17 \cdot 10^{-3}$	g/cm^3	
Ambient Atmospheric Pressure (P_{atm})	$P_{atm} := 406.78 \cdot 2490.889$	$g/cm\text{-}sec^2$	

Extraction Well

Volumetric Flow Rate (Q)	$Q := 55 \cdot 471.947443$	cm^3/sec	(55 ft^3/min)

Observation Well

Elapsed Test Time (t)	$t := 3.0 \cdot 3600$	sec	(3.0 hours)
Radial Distance from Extraction Well (r)	$r := 1, 10 .. 5000$	cm	(1 - 50 m)

Calculation of u

$$u(t,r) := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

$u(t,r) =$

	0
0	$4.798 \cdot 10^{-9}$
1	$4.798 \cdot 10^{-7}$
2	$1.732 \cdot 10^{-6}$
3	$3.761 \cdot 10^{-6}$
4	$6.568 \cdot 10^{-6}$
5	$1.015 \cdot 10^{-5}$
6	$1.451 \cdot 10^{-5}$
7	$1.965 \cdot 10^{-5}$
8	$2.557 \cdot 10^{-5}$
9	$3.226 \cdot 10^{-5}$

Calculation of B and r/B

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_v}{\frac{k_v \cdot \rho \cdot g}{\mu}}\right)}$$

$B = 1.43 \times 10^3$

$\frac{r}{B} =$

	0
0	$6.995 \cdot 10^{-4}$
1	$6.995 \cdot 10^{-3}$
2	0.013
3	0.02
4	0.026
5	0.032
6	0.038
7	0.045
8	0.051
9	0.057

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By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Calculation of $Ei_1(x)$

$Ei_1(x)$ is exponential integral of x. For |x| < 4 an accurate value of $Ei_1(x)$ is obtained with n = u to 100.

$$Ei_1(u,t,r) := \int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$Ei_1(u,t,r) =$

	0
0	14.762
1	10.157
2	8.874
3	8.099
4	7.542
5	7.107
6	6.751
7	6.449
8	6.187
9	5.955

Calculation of Pressure Change (P_g) with Radial Distance (r)

$$P_g(u,t,r) := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$P_g(u,t,r) =$ g/cm-sec^2

	0
0	$2.378\cdot10^4$
1	$1.636\cdot10^4$
2	$1.429\cdot10^4$
3	$1.305\cdot10^4$
4	$1.215\cdot10^4$
5	$1.145\cdot10^4$
6	$1.087\cdot10^4$
7	$1.039\cdot10^4$
8	$9.966\cdot10^3$
9	$9.593\cdot10^3$

$sec^{2}\,cm^{-1}$

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By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Pilot Test Data

Observation Point Radius (r_o) — $r_o :=$ (cm)

	0
0	5.08
1	883.92
2	1554.48
3	2712.72
4	3048.00
5	4023.36

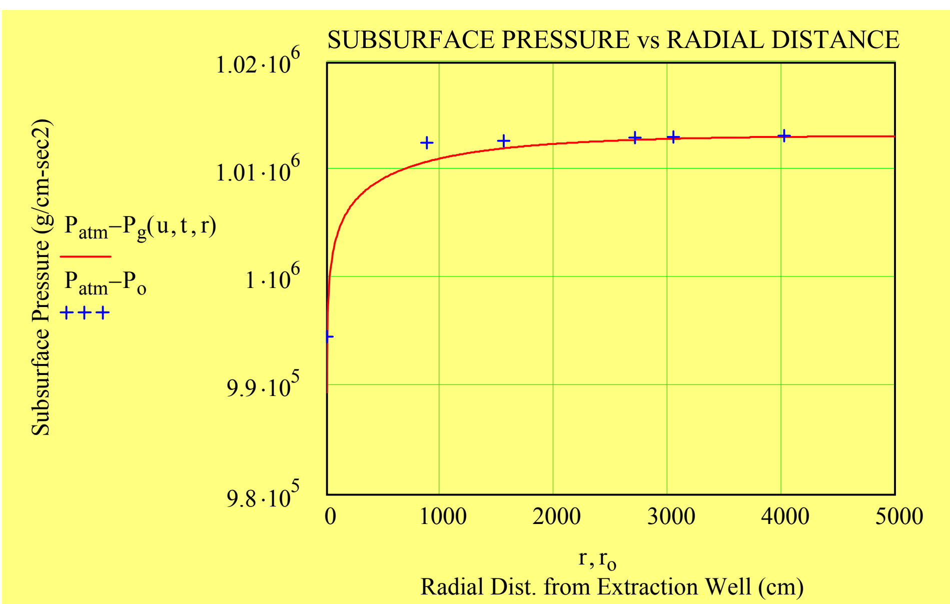
Observed Vacuum (V_o) — $V_o :=$ (in H_2O)

	0
0	7.490
1	0.270
2	0.200
3	0.090
4	0.070
5	0.015

Observed Pressure Change in gm/cm^2-sec (P_o)

$$P_o := V_o \cdot 2490.8891$$

Observed vs Calculated Subsurface Pressure



REFERENCES:

Beckett, G.D., and D. Huntley, 1994, "Characterization of Flow Parameters Controlling Soil Vapor Extraction," ***Ground Water***, Vol. 32, No. 2, p. 239-247.

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By __TFC_____Date 12/7/03 Subject Fort Ord CTP Pilot SVE Design________Sheet No. ___of ___.
Chkd By _____Date _______. EW-10 SVE Pilot Test 2.5 in. WC - Estimated K Proj. No. 783751___.

PURPOSE:

Estimate the radial subsurface pressure change during a single-well, constant-pressure, soil vapor extraction (SVE) pilot test.

METHOD:

Subsurface pressure change (P_g) during pilot test was estimated using the transient radial pressure distribution equation for leaky confined flow condtions of Beckett and Huntley (1994):

$$P_g := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_u^{\infty}\frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

here

$$u := \frac{r^2\cdot\varepsilon\cdot\mu}{4\cdot k\cdot P_{atm}\cdot t}$$

and

$$B := \sqrt{k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m\cdot\left(\frac{m_v}{\frac{k_v\cdot\rho\cdot g}{\mu}}\right)}$$

ASSUMPTIONS:

CALCULATIONS:

Soil Properties

Permeability (k)	$k := 3.3\cdot10^{-7}$	cm^2	
Vertical Permeability of Conf. Layer (k_v)	$k_v := 3.3\cdot10^{-8}$	cm^2	
Thickness (m)	$m := 670.56$	cm	(22 ft)
Thickness of Conf. Layer (m_v)	$m_v := 304.8$	cm	(10 ft)
Air-filled Porosity (ε)	$\varepsilon := 0.35$	dimensionless	
Air Viscosity (μ)	$\mu := 1.8\cdot10^{-4}$	g/cm-sec	
Air Density (ρ)	$\rho := 1.17\cdot10^{-3}$	g/cm^3	
Ambient Atmospheric Pressure (P_{atm})	$P_{atm} := 406.78\cdot2490.889$	$g/cm\text{-}sec^2$	

Extraction Well

Volumetric Flow Rate (Q)	$Q := 20\cdot471.947443$	cm^3/sec	(20 ft^3/min)

Observation Well

Elapsed Test Time (t)	$t := 4.5\cdot3600$	sec	(4.5 hours)
Radial Distance from Extraction Well (r)	$r := 1, 10 .. 5000$	cm	(1 - 50 m)

Calculation of u

$$u(t,r) := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

$u(t,r) =$

	0
0	$2.908 \cdot 10^{-9}$
1	$2.908 \cdot 10^{-7}$
2	$1.05 \cdot 10^{-6}$
3	$2.28 \cdot 10^{-6}$
4	$3.981 \cdot 10^{-6}$
5	$6.153 \cdot 10^{-6}$
6	$8.796 \cdot 10^{-6}$
7	$1.191 \cdot 10^{-5}$
8	$1.549 \cdot 10^{-5}$
9	$1.955 \cdot 10^{-5}$

Calculation of B and r/B

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_v}{\frac{k_v \cdot \rho \cdot g}{\mu}}\right)}$$

$B = 1.43 \times 10^3$

$\frac{r}{B} =$

	0
0	$6.995 \cdot 10^{-4}$
1	$6.995 \cdot 10^{-3}$
2	0.013
3	0.02
4	0.026
5	0.032
6	0.038
7	0.045
8	0.051
9	0.057

Calculation of $Ei_1(x)$

$Ei_1(x)$ is exponential integral of x. For |x| < 4 an accurate value of $Ei_1(x)$ is obtained with n = u to 100.

$$Ei_1(u,t,r) := \int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$Ei_1(u,t,r) =$

	0
0	14.762
1	10.157
2	8.874
3	8.099
4	7.542
5	7.107
6	6.751
7	6.449
8	6.187
9	5.955

Calculation of Pressure Change (P_g) with Radial Distance (r)

$$P_g(u,t,r) := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$P_g(u,t,r) =$ g/cm-sec^2

	0
0	$7.861\cdot 10^3$
1	$5.409\cdot 10^3$
2	$4.725\cdot 10^3$
3	$4.313\cdot 10^3$
4	$4.016\cdot 10^3$
5	$3.785\cdot 10^3$
6	$3.595\cdot 10^3$
7	$3.434\cdot 10^3$
8	$3.294\cdot 10^3$
9	$3.171\cdot 10^3$

$sec^{2}\,cm^{-1}$

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By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______._____________________________________Proj. No. ________.

Pilot Test Data

Observation Point Radius (r_o)

$r_o :=$

	0
0	5.08
1	609.60
2	2651.76
3	2956.56
4	3048.00
5	

cm

Observed Vacuum (V_o)

$V_o :=$

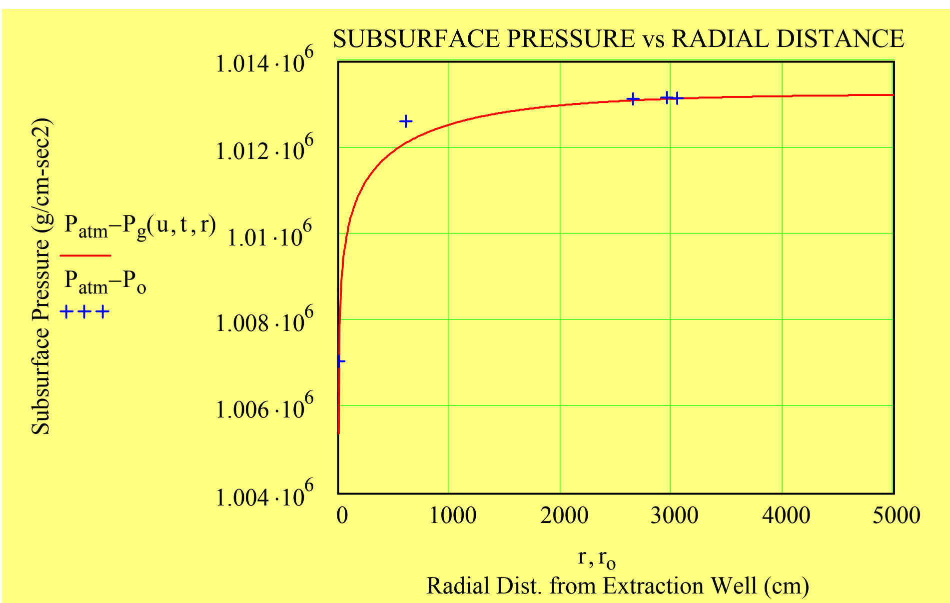
	0
0	2.480
1	0.250
2	0.044
3	0.031
4	0.040
5	

in H_2O

Observed Pressure Change in gm/cm^2-sec (P_o)

$$P_o := V_o \cdot 2490.8891$$

Observed vs Calculated Subsurface Pressure



REFERENCES:

Beckett, G.D., and D. Huntley, 1994, "Characterization of Flow Parameters Controlling Soil Vapor Extraction," ***Ground Water***, Vol. 32, No. 2, p. 239-247.

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By __TFC_____Date 12/7/03 Subject Fort Ord CTP Pilot SVE Design_________Sheet No. ___of ___.
Chkd By _____Date _______. EW-10 SVE Pilot Test 5 in. WC - Estimated K__Proj. No. 783751___.

PURPOSE:

Estimate the radial subsurface pressure change during a single-well, constant-pressure, soil vapor extraction (SVE) pilot test.

METHOD:

Subsurface pressure change (P_g) during pilot test was estimated using the transient radial pressure distribution equation for leaky confined flow condtions of Beckett and Huntley (1994):

$$P_g := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_u^\infty \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

here

$$u := \frac{r^2\cdot\varepsilon\cdot\mu}{4\cdot k\cdot P_{atm}\cdot t}$$

and

$$B := \sqrt{k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m\cdot\left(\frac{m_v}{\frac{k_v\cdot\rho\cdot g}{\mu}}\right)}$$

ASSUMPTIONS:

CALCULATIONS:

Soil Properties

Permeability (k)	$k := 2.8\cdot10^{-7}$	cm^2	
Vertical Permeability of Conf. Layer (k_v)	$k_v := 2.8\cdot10^{-8}$	cm^2	
Thickness (m)	$m := 670.56$	cm	(22 ft)
Thickness of Conf. Layer (m_v)	$m_v := 304.8$	cm	(10 ft)
Air-filled Porosity (ε)	$\varepsilon := 0.35$	dimensionless	
Air Viscosity (μ)	$\mu := 1.8\cdot10^{-4}$	g/cm-sec	
Air Density (ρ)	$\rho := 1.17\cdot10^{-3}$	g/cm^3	
Ambient Atmospheric Pressure (P_{atm})	$P_{atm} := 406.78\cdot2490.889$	$g/cm\text{-}sec^2$	

Extraction Well

Volumetric Flow Rate (Q)	$Q := 34\cdot471.947443$	cm^3/sec	($34\ ft^3/min$)

Observation Well

Elapsed Test Time (t)	$t := 3.5\cdot3600$	sec	(3.5 hours)
Radial Distance from Extraction Well (r)	$r := 1, 10 .. 5000$	cm	(1 - 50 m)

Calculation of u

$$u(t,r) := \frac{r^2 \cdot \varepsilon \cdot \mu}{4 \cdot k \cdot P_{atm} \cdot t}$$

$u(t,r) =$

	0
0	$4.406 \cdot 10^{-9}$
1	$4.406 \cdot 10^{-7}$
2	$1.591 \cdot 10^{-6}$
3	$3.454 \cdot 10^{-6}$
4	$6.032 \cdot 10^{-6}$
5	$9.323 \cdot 10^{-6}$
6	$1.333 \cdot 10^{-5}$
7	$1.805 \cdot 10^{-5}$
8	$2.348 \cdot 10^{-5}$
9	$2.963 \cdot 10^{-5}$

Calculation of B and r/B

$$B := \sqrt{k \cdot \left(\frac{\rho \cdot g}{\mu}\right) \cdot m \cdot \left(\frac{m_v}{\frac{k_v \cdot \rho \cdot g}{\mu}}\right)}$$

$B = 1.43 \times 10^3$

$\frac{r}{B} =$

	0
0	$6.995 \cdot 10^{-4}$
1	$6.995 \cdot 10^{-3}$
2	0.013
3	0.02
4	0.026
5	0.032
6	0.038
7	0.045
8	0.051
9	0.057

Calculation of $Ei_1(x)$

$Ei_1(x)$ is exponential integral of x. For |x| < 4 an accurate value of $Ei_1(x)$ is obtained with n = u to 100.

$$Ei_1(u,t,r) := \int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$Ei_1(u,t,r) =$

	0
0	14.762
1	10.157
2	8.874
3	8.099
4	7.542
5	7.107
6	6.751
7	6.449
8	6.187
9	5.955

Calculation of Pressure Change (P_g) with Radial Distance (r)

$$P_g(u,t,r) := \frac{Q}{4\cdot\pi\cdot k\cdot\left(\frac{\rho\cdot g}{\mu}\right)\cdot m}\cdot\int_{u(t,r)}^{100} \frac{e^{\left[-x-\left(\frac{r^2}{4\cdot B^2\cdot x}\right)\right]}}{x}\,dx$$

$P_g(u,t,r) =$ g/cm-sec^2

	0
0	$1.575\cdot10^{4}$
1	$1.084\cdot10^{4}$
2	$9.468\cdot10^{3}$
3	$8.641\cdot10^{3}$
4	$8.047\cdot10^{3}$
5	$7.583\cdot10^{3}$
6	$7.203\cdot10^{3}$
7	$6.88\cdot10^{3}$
8	$6.601\cdot10^{3}$
9	$6.354\cdot10^{3}$

$sec^{2}\,cm^{-1}$

Shaw® Shaw Environmental, Inc.

By __________Date ______Subject ________________________________Sheet No. ___of ___.
Chkd By _____Date ______.______________________________________Proj. No. ________.

Pilot Test Data

Observation Point Radius (r_o)

$r_o :=$ (cm)

	0
0	5.08
1	609.60
2	2651.76
3	2956.56
4	3048.00
5	4907.28

Observed Vacuum (V_o)

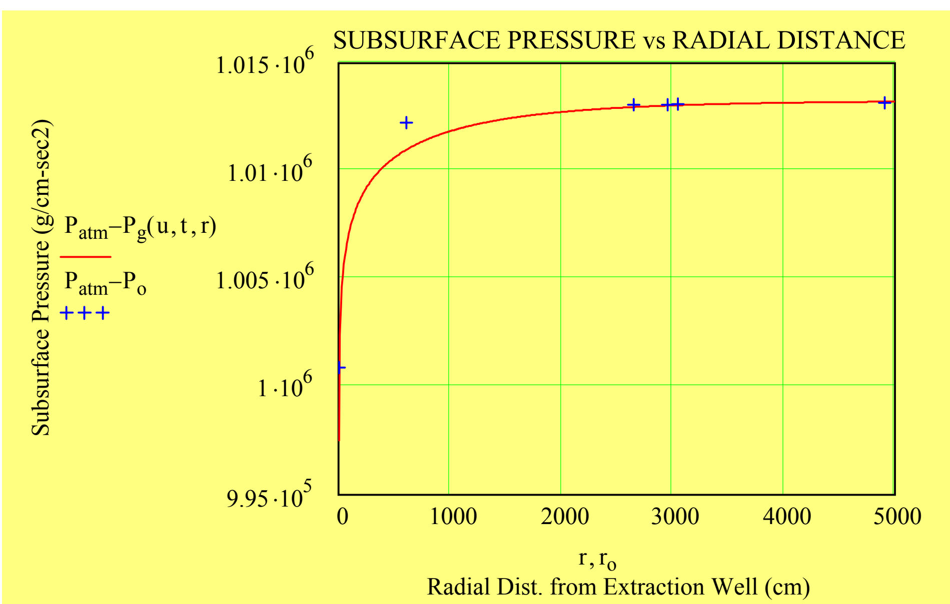
$V_o :=$ (in H_2O)

	0
0	4.960
1	0.410
2	0.070
3	0.080
4	0.058
5	0.035

Observed Pressure Change in gm/cm^2-sec (P_o)

$$P_o := V_o \cdot 2490.8891$$

Observed vs Calculated Subsurface Pressure



REFERENCES:

Beckett, G.D., and D. Huntley, 1994, "Characterization of Flow Parameters Controlling Soil Vapor Extraction," ***Ground Water***, Vol. 32, No. 2, p. 239-247.

Appendix C

OU CTP SVE Modeling Results

Table of Contents

List of Figures

1.0 Introduction

A numerical vadose zone airflow model was developed for Operable Unit Carbon Tetachloride Plume (OU CTP) at the Former Fort Ord in Marina, California. The airflow model was used to support the design of a pilot soil vapor extraction (SVE) well system to remediate soils above the water table in the suspected source area for the carbon tetratchloride (CT) groundwater plume. This appendix describes the design of the airflow model, the methods that were used to develop the pilot SVE well system design, and summarizes the results of SVE well field design simulations.

2.0 Model Design

This section describes the principal design elements of the OU CTP airflow model. These design elements include the model code that was selected to develop the airflow model, the major assumptions in the model design, the model grid and layering, the boundary conditions used in the model, and the vadose zone properties assigned to each model layer.

The OU CTP airflow model was designed, constructed, and calibrated in accordance with the American Society for Testing and Materials (ASTM) guidelines for vadose zone airflow modeling (ASTM, 1995) and generally accepted industry practice for numerical groundwater modeling (Anderson and Woessner, 1992). The ASTM guidelines were developed as part of a cooperative agreement between the U.S. Environmental Protection Agency (EPA), the U.S. Geological Survey (USGS), and the U.S. Navy.

2.1 Model Code

The model code that was used to develop the OU CTP airflow model is MODAIR, a three-dimensional, finite-difference, airflow model developed by S.S. Papadopulos and Associates, Inc. (S.S. Papadopulos). MODAIR is an adaptation of the groundwater flow model code MODFLOW (McDonald and Harbaugh, 1988) for vadose zone airflow simulations. MODAIR was selected for development of the OU CTP airflow model because it is well documented and based on the model code MODFLOW. MODFLOW was developed by the USGS, has been verified for a wide range of field problems (EPA, 1993), and is widely used in groundwater investigations (Anderson and Woessner, 1992).

2.2 Assumptions of Model Design

The following simplifying assumptions were made in the design of the OU CTP airflow model:

The unsaturated zone is considered to be under confined flow conditions.

The elevation component of pneumatic head is insignificant.

Air phase permeability is independent of pressure and the Klinkenberg effect is negligible.

Water movement and consolidation of the soils is insignificant, and soil porosity is constant with respect to time.

There is no significant airflow across the water table.

The water table is at an approximate depth of 100 feet.

The shallow soils have a uniform horizontal and vertical air permeability.

2.3 Model Grid

The model grid constructed for the OU CTP airflow model is a eight-layer, 40-row by 40-column, uniformly spaced, finite-difference grid (Figure X-1). The i-direction of the model grid is oriented in a north-south direction with the grid origin (upper left-hand corner) at site coordinates X = 5,747,300 feet East, Y = 2,138,540 feet North. The row and column spacing of the model grid are a uniform 40 feet (1219 centimeters [cm]).

2.4 Model Layers

Airflow in the suspected OU CTP source area is simulated in the model grid by eight layers (Figure X-2):

Layer 1 represents the connection between the vadose zone and the atmosphere
Layer 2 through 7 represents the shallow soils in the suspected OU CTP source area
Layer 8 represents the water table.

Layer 1 is a constant-pressure boundary that simulates the interaction of the atmosphere with the vadose zone (Section X.2.6)

The shallow soils in the suspected OU CTP source area were subdivided into six layers in the model grid to more accurately simulate vertical airflow in the soils. The thickness of these model layers are 10, 20, 20, 20, 20 and 10 feet, respectively (Figure X-2).

Layer 8 is a no-flow boundary that which represents the top of the top of water table (Section X.2.6). The top elevation of this layer is at a depth of 100 feet, the approximate depth of the water table in the suspected CTP source area.

2.5 Flow Conditions

Flow conditions in the DBA V airflow model are simulated as confined (MODFLOW layer type LAYCON=0). The transmissivities calculated for these layers remain constant for the entire model simulation period (McDonald and Harbaugh, 1988). Airflow in the unsaturated zone is considered to be confined as a simplifying assumption in the model design (Section X.2.2).

2.6 Boundary Conditions

The following boundary conditions are used in the OU CTP airflow model:

Upper boundary of model – constant-pressure boundary
Lower boundary of model – no-flow boundary
Lateral boundaries of layers 2, 3, 4, and 5 – no-flow boundaries.

The upper boundary of the model grid (layer 1) is a constant-pressure boundary. This boundary is assigned a constant-pressure at atmospheric pressure (1.0 atmosphere [atm]) and represents the interaction of the atmosphere with the vadose zone.

The lower boundary of the model grid is a no-flow boundary, which represents the top of the top of water table. Vertical airflow between the unsaturated zone and the water table is assumed to be relatively insignificant as a simplifying assumption in the model design (Section X.2.2).

The north, south, east, and west boundaries of layers 2, 3, 4, 5, and 6 are constant-pressure boundaries (Figure X-3). These boundaries are assigned a constant-pressure at atmospheric pressure (1.0 atm).

2.7 Air Permeability

A uniform air permeability of 3×10^{-7} cm^2 was used for all layers in the OU CTP airflow model. This value of air permeability was estimated from SVE pilot tests of the shallow soils in the Operable Unit 2 (OU2) Landfill Gas Mitigation System (Appendix X). Horizontal permeability values are equal to vertical permeability values in all model layers. Uniform values of horizontal and vertical air permeability were used as a simplifying assumption in the model design (Section X.2.2).

3.0 SVE Well System Simulations

The airflow model was used to estimate the number and location of the vent wells needed for the pilot OU CTP SVE system. These wells will be installed to maintain an approximate 0.1 inch of water column (WC) vacuum over the suspected OU CTP source area where CT concentrations in soil gas are greater than 20 parts per billion by volume (ppbv). The model was also used to estimate the required operating vacuums for the individual extraction wells and the total airflow rate from the SVE system.

3.1 Simulation of SVE Well System Operation

Operation of the SVE system was simulated by adding constant-pressure nodes (well nodes) to layers 6 and 7 of the airflow model to represent the vertical vent wells screened over an approximate depth interval between 70 and 100 feet. The number, location, and operating vacuums of the well nodes representing the wells were then varied in successive simulations to achieve a significant vacuum (0.1 inch WC) over the suspected CTP source area where CT concentrations in soil gas are greater than 20 ppbv.X.3.2 Results of SVE Well System Simulations:

The airflow simulations indicated that at least five vent wells would be required for the pilot SVE system. The results of the airflow simulation for a five well SVE system are shown in Figures E-4 and E-8. These figures show the location of the vent wells, the steady-state vacuum solution, and the suspected OU CTP source area where CT concentrations in soil gas are greater than 20 ppbv. The airflow simulations show that a 0.1 inch WC vacuum could be maintained over the suspected CTP source area with a five vent system operating at wellhead vacuum of 8 in. WC. The total airflow rate solution for this simulation is 670 actual cubic feet per minute (acfm).

4.0 References

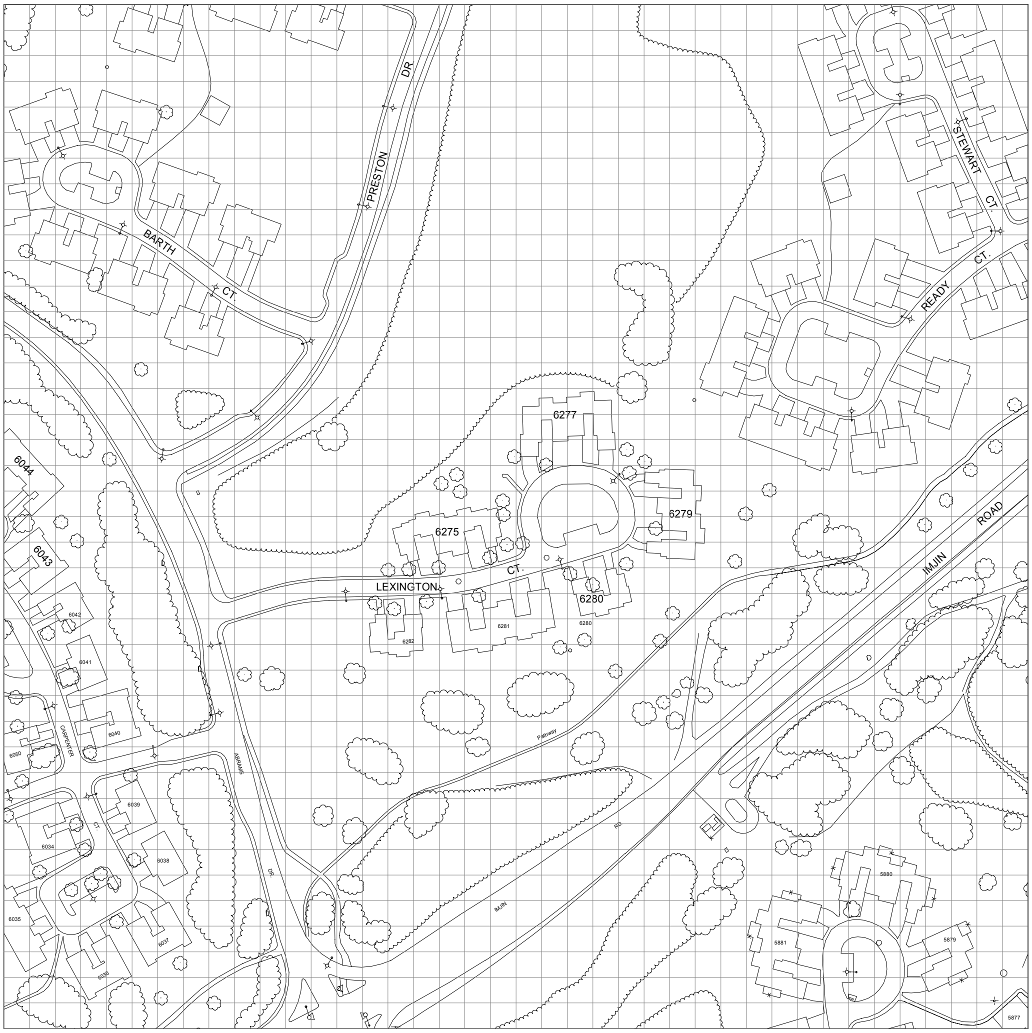
American Society for Testing and Materials (ASTM), 1995, "Standard Guide for Simulation of Subsurface Airflow Using Ground-Water Flow Modeling Codes," ASTM Standard D 5719-95, 5 pp.

Anderson, Mary P., and W.W. Woessner, 1992, Applied Groundwater Modeling, Academic Press, Inc., San Diego, CA, 381 pp.

McDonald, M.G., and A.W. Harbaugh, 1988, "A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model," Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, Chapter A1, 576 pp.

S.S. Papadopulos & Associates, Inc., 1996, Modair Version 1.0, Software for Modeling Air Flow in Unsaturated Soils, SSP&A Software.

U.S. Environmental Protection Agency (EPA), 1993, A Manual of Instructional Problems for the U.S.G.S. MODFLOW Model, EPA/600/R93/010, EPA.



0 150 300 450 600

SCALE IN FEET

OFFICE	DRAWN BY		CHECKED BY	APPROVED BY	DRAWING NUMBER
DNV	T. Cota	01/07/04			783751-SRF-001

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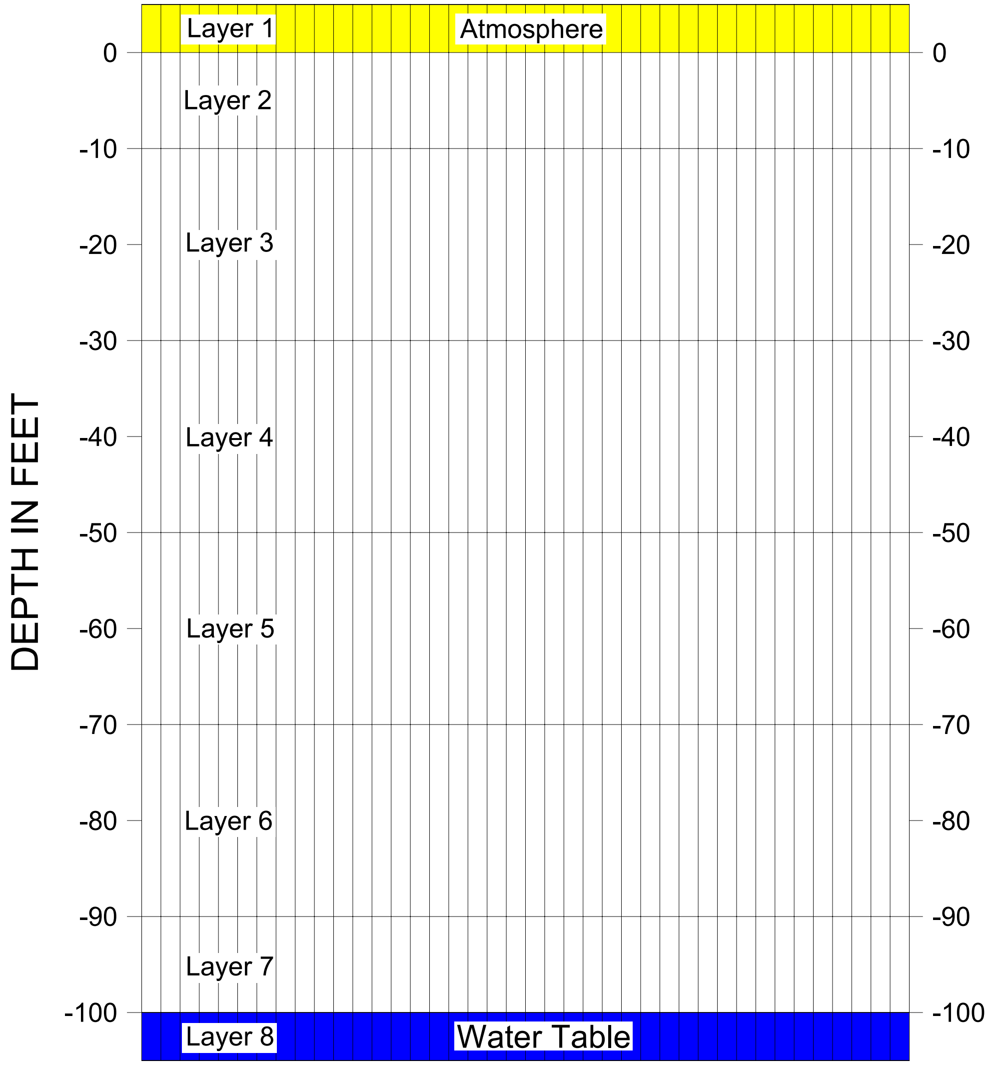
MONTEREY COUNTY, CALIFORNIA

FIGURE C-1
FINITE-DIFFERENCE GRID
OU CTP SOURCE AREA AIRFLOW MODEL



OFFICE DNV | DRAWN BY T. Cota | 01/07/04 | CHECKED BY | APPROVED BY | DRAWING NUMBER 783751-SRF-002

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FORMER FORT ORD
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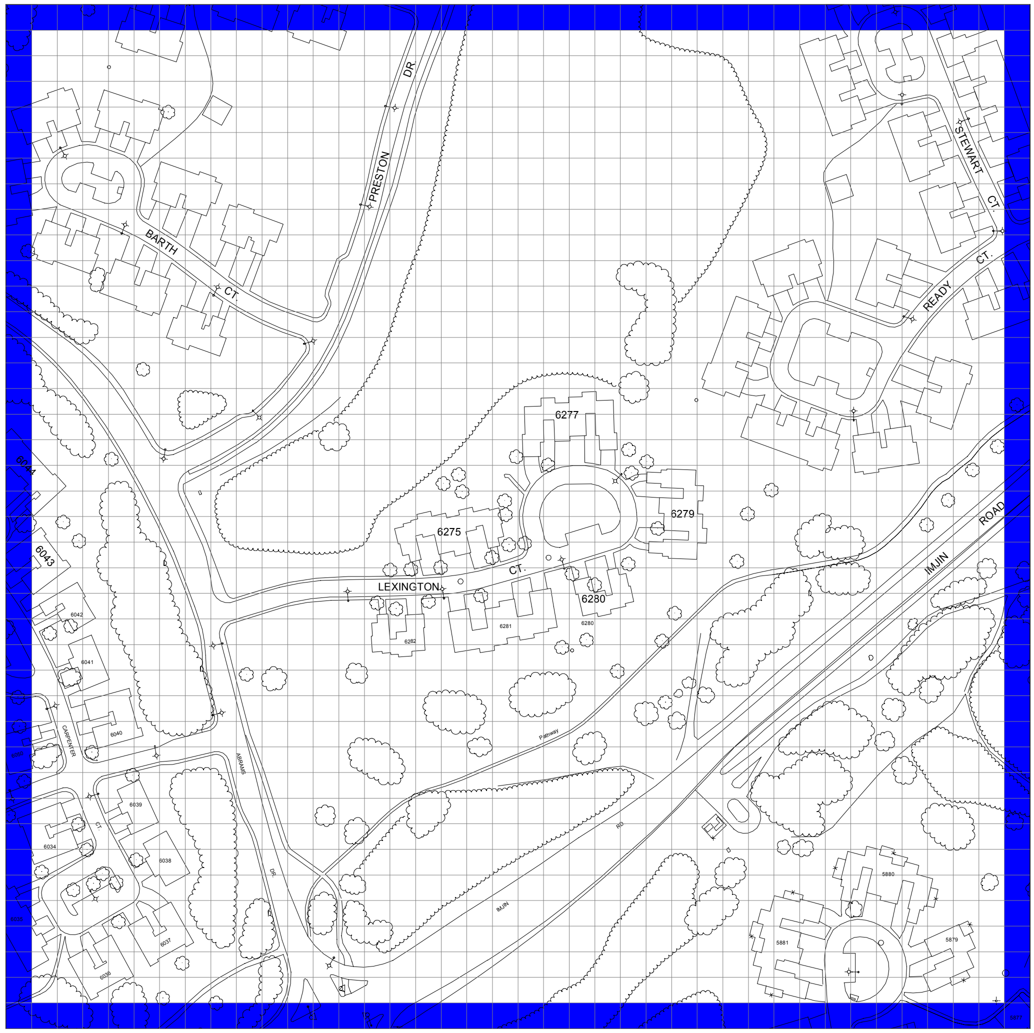
FIGURE C-2
MODEL GRID LAYERS
OU CTP SOURCE AREA AIRFLOW MODEL

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
DNV	T. Cota 01/07/04			783751-SRF-003



0 150 300 450 600

SCALE IN FEET

LEGEND

Constant-Pressure (1.0 atm) Boundary

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FIGURE C-3
LATERAL BOUNDARY CONDITIONS
LAYERS 2-6
OU CTP SOURCE AREA AIRFLOW MODEL

0 150 300 450 600

SCALE IN FEET

LEGEND

0.1	Vacuum Contour (in. H20)
	Effective SVE Remediation Area
	20 ppbv Carbon Tetrachloride Conc. in Soil Gas Below 66
	Existing SVE Well
	New SVE Well

Shaw
Shaw E & I, Inc.

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FIGURE C-4
VACUUM SOLUTION
15 FT BELOW GROUND SURFACE (LAYER 3)
OU CTP SOURCE AREA AIRFLOW MODEL

OFFICE	DRAWN BY		CHECKED BY	APPROVED BY	DRAWING NUMBER
DNV	T. Cota	01/07/04			783751-SRF-004

DRAWING NUMBER	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE
783751-SRF-005			T. Cota 01/07/04	DNV

SCALE IN FEET

LEGEND

0.1 Vacuum Contour (in. H20)

Effective SVE Remediation Area

20 ppbv Carbon Tetrachloride Conc. in Soil Gas Below 66 Feet

Existing SVE Well

New SVE Well

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FIGURE C-5
STEADY-STATE VACUUM SOLUTION
35 FT BELOW GROUND SURFACE (LAYER 4)
OU CTP SOURCE AREA AIRFLOW MODEL

OFFICE DNV | DRAWN BY T. Cota | 01/07/04 | CHECKED BY | APPROVED BY | DRAWING NUMBER 783751-SRF-006

LEGEND

0.1 — Vacuum Contour (in. H20)

Effective SVE Remediation Area

20 ppbv Carbon Tetrachloride Conc. in Soil Gas Below 66 Feet

Existing SVE Well

New SVE Well

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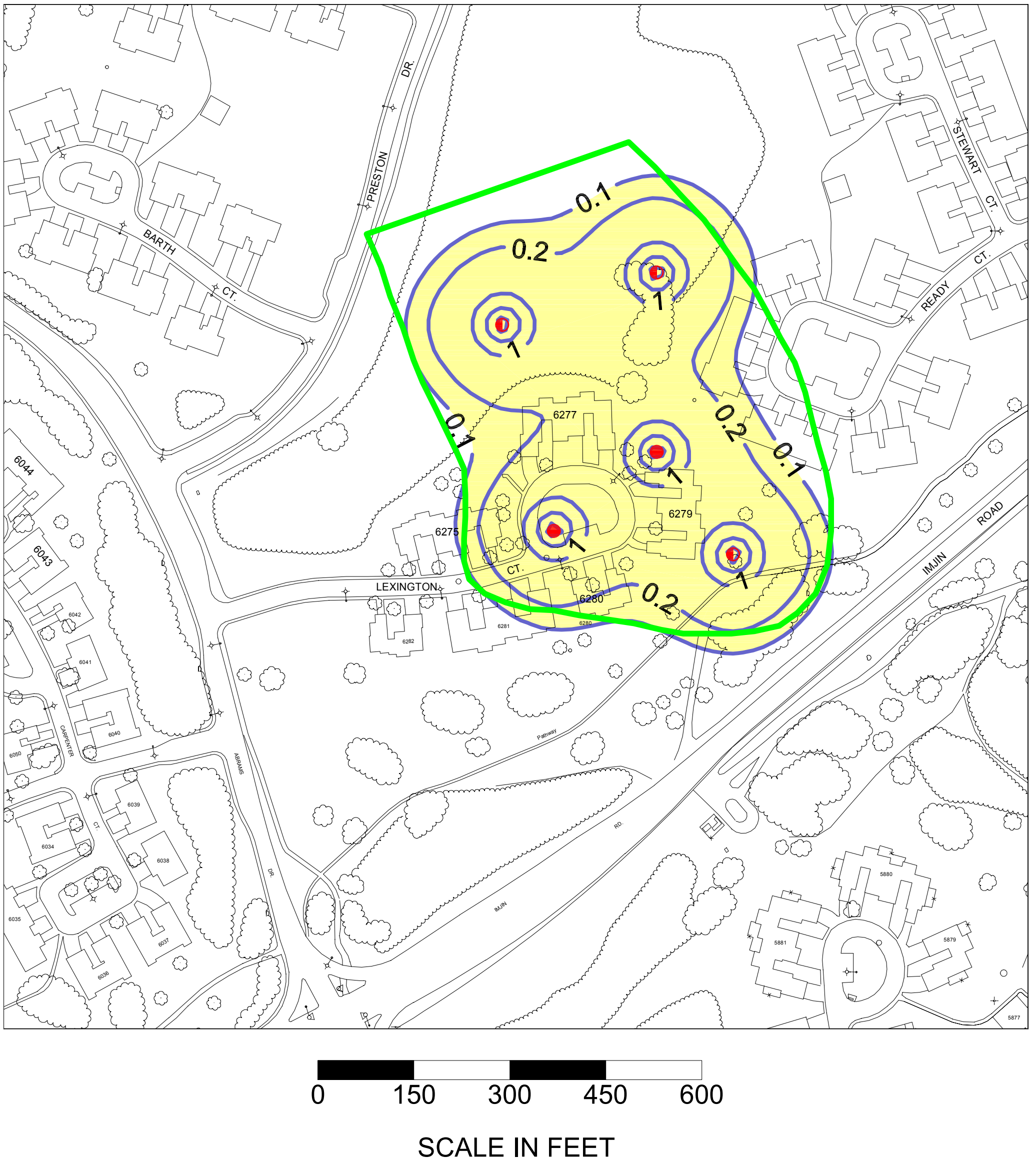
FIGURE C-6
STEADY-STATE VACUUM SOLUTION
55 FT BELOW GROUND SURFACE (LAYER 5)
OU CTP SOURCE AREA AIRFLOW MODEL

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
DNV	T. Cota 01/07/04			783751-SRF-007



LEGEND

- 0.1 — Vacuum Contour (in. H20)
- Effective SVE Remediation Area
- 20 ppbv Carbon Tetrachloride Conc. in Soil Gas Below 66 Feet
- Existing SVE Well
- New SVE Well

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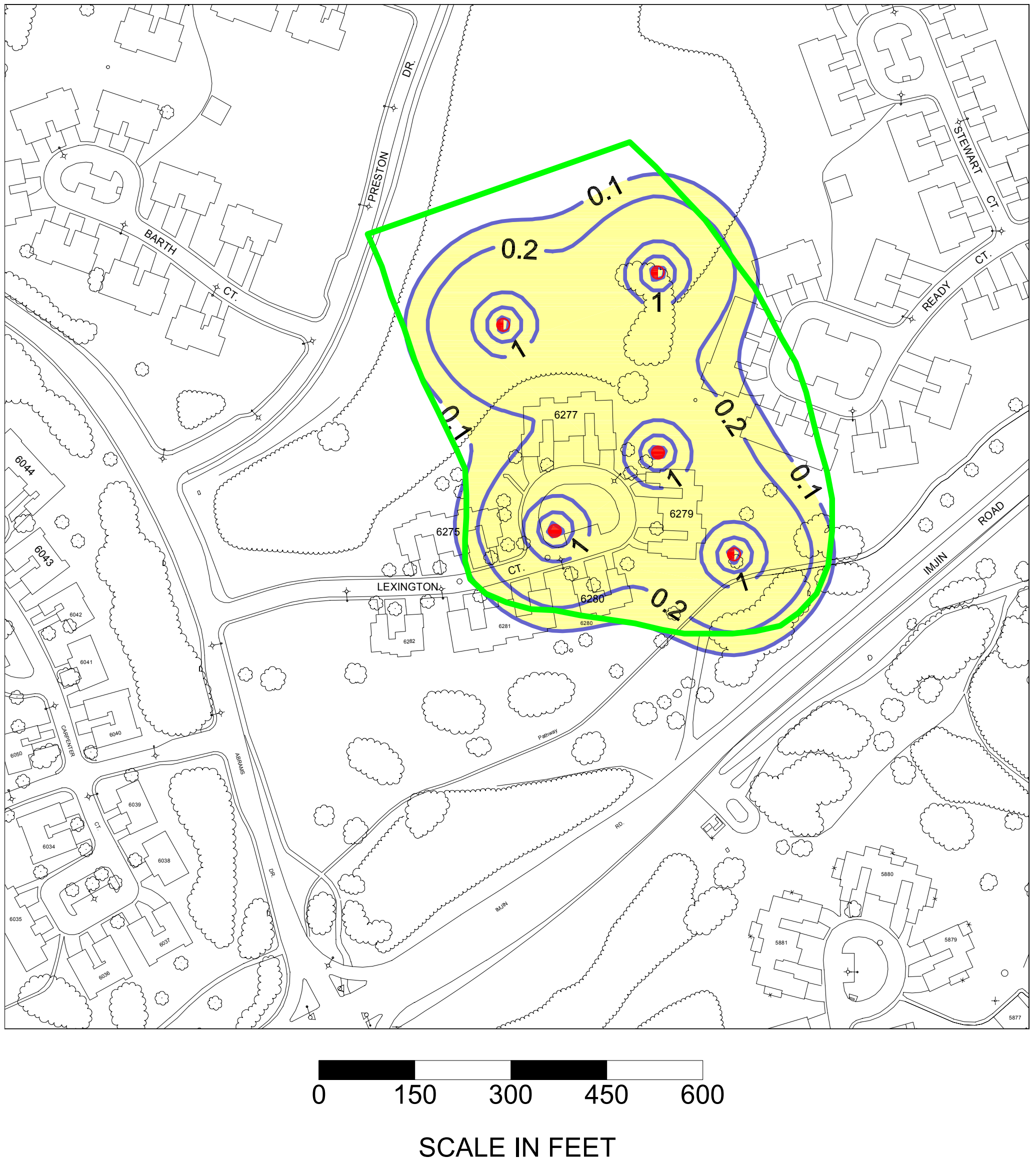
FIGURE C-7
STEADY-STATE VACUUM SOLUTION
75 FT BELOW GROUND SURFACE (LAYER 6)
OU CTP SOURCE AREA AIRFLOW MODEL

OFFICE DNV | DRAWN BY T. Cota 01/07/04 | CHECKED BY | APPROVED BY | DRAWING NUMBER 783751-SRF-008



LEGEND

- 0.1 Vacuum Contour (in. H20)
- Effective SVE Remediation Area
- 20 ppbv Carbon Tetrachloride Conc. in Soil Gas Below 66 Feet
- Existing SVE Well
- New SVE Well

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FIGURE C-8
STEADY-STATE VACUUM SOLUTION
90 FT BELOW GROUND SURFACE (LAYER 7)
OU CTP SOURCE AREA AIRFLOW MODEL

Appendix D

Construction Specifications

Table of Contents

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Submittals

1.1.2 Submittal Procedures

1.1.3 Submittal Approval

1.1.4 Schedules

1.1.5 Product Information

1.1.6 Drawings

1.1.7 Reports

1.1.8 Records

1.2 SUBMITTALS

1.2.1 Shaw Environmental and Infrastructure (Shaw) Approved Submittals

1.2.1.1 Shaw approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items designated by Shaw.

1.2.1.2 Upon completion of review of submittals requiring Shaw approval, the submittals will be identified as having received approval by being so stamped and dated. Six copies of the submittal will be retained by Shaw and two copies of the submittal will be returned to the Subcontractor.

1.2.2 Information Only Submittals

1.2.2.1 Submittals not requiring Shaw approval will be for information only (FIO).

1.2.2.2 Normally submittals for information only will not be returned. Approval of Shaw is not required on information only submittals. Shaw reserves the right to require the Subcontractor to resubmit any item found not to comply with the contract. This does not relieve the Subcontractor from the obligation to furnish material conforming to the drawings and specifications and will not prevent Shaw from requiring removal and replacement of nonconforming material incorporated in the work. This does not relieve the Subcontractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.3 SUBMITTALS PROCEDURES

1.3.1 Submit schedules, product information, drawings, reports, and records as required in the particular section of the Work.

1.3.2 All items listed as ITA submittals in the specification will be mailed directly to the addressee shown below as directed.

Project Manager
Shaw E&I
P.O. Box 1698
Marina, CA 93933-1698

1.3.3 Except as noted in the specification, five copies for items listed as FIO submittals will be submitted to Shaw by correspondence at the address provided above. Items not to be submitted in quintuplicate, such as samples and test cylinders, will also be submitted to Shaw.

1.3.4 Transmit each submittal, as specified in the applicable specification section, by correspondence written on company letterhead.

1.3.5 Identify Project, Subcontractor, or Subcontractor supplier; pertinent drawing and detail number and specification number, as appropriate. Units of weights and measures used on submittals will be the same used in the Contract Drawings.

1.3.6 Apply Subcontractor’s stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work.

1.3.7 For each submittal for review, allow 35 calendar days, excluding delivery time to and from Shaw.

1.3.8 Each submittals will be complete and sufficient in detail to allow ready determination of compliance with Contract Requirements. Variations from Contract Documents, and product or system limitations which may be detrimental to successful performance of the completed Work, will be identified.

1.3.9 Provide space for review stamps.

1.3.10 Prior to submittal, all items will be checked and approved by the Subcontractor's Quality Control (CQC) representative. Each item will be stamped, signed, and dated by the CQC representative indicating action taken.

1.3.11 Revise, resubmit, and identify changes made since previous submission.

1.3.12 Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.

1.4 SUBMITTAL APPROVAL

1.4.1 Approved Submittals

1.4.1.1 Shaw approval of submittals will not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory.

1.4.1.2 Approval will not relieve the Subcontractor of the responsibility for any error which may exist, as the Subcontractor under the Construction Quality Control requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of work.

1.4.2 Disapproved Submittals

The Subcontractor will make corrections required by Shaw and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Subcontractor considers any correction indicated on the submittals to constitute a change to the Contract, a notice in accordance with the Contract Clause "Changes" will be submitted promptly to Shaw.

1.4.3 Withholding of Payment

Payment for materials incorporated in the Work will not be made if required approvals have not been obtained.

1.5 SCHEDULES

1.5.1 Submit a master construction schedule in duplicate within seven calendar days of Notice to Proceed. The schedule will:

- List major work activities
- Identify critical path items

- Show appropriate logic ties between activities
- Identify intermediate milestones in addition to construction completion.
- Indicate submittal dates required for drawings, product information, and delivery dates, including those furnished by Shaw.

1.5.2 Revise and resubmit the schedule whenever it no longer represents the reality of the actual construction progress, identifying changes since previous version.

1.5.3 Submit two-week look-ahead schedules on a weekly basis prior to the weekly progress meeting. Indicate estimated percentage of completion for each item of Work at each submission.

1.6 PRODUCT INFORMATION

1.6.1 Proposed Products List

1.6.1.1 Within 15 days after date of Shaw-Subcontractor Agreement Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model of each product.

1.6.1.2 For products specified by reference standards, submit name of manufacturer, model/catalog designation, and reference standards.

1.6.2 Product Data

1.6.2.1 Submit eight copies of product information including product data, catalog cuts, and other descriptive data.

1.6.2.2 Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to the Work.

1.6.2.3 Submittals on component items forming a system or that are interrelated will be submitted at one time as a single submittal to demonstrate that the items have been properly coordinated and will function as a unit.

1.6.3 Manufacturer's Installation Instructions

1.6.3.1 When specified in individual specification sections, submit printed instructions for installation to Shaw in quantities specified for Product Data.

1.6.3.2 Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.6.4 Certificates of Compliance

1.6.4.1 Where required, submit three copies of certificates as proof of compliance of materials with specification requirements. Indicate material or product conforms to or exceeds specified requirements and submit supporting reference data, affidavits, and certifications as appropriate.

1.6.4.2 Each certificate will be signed by an official authorized to certify on behalf of the manufacturing company.

1.6.4.3 Each certificate will contain the following information:

- The name and address of the subcontractor
- The project name and location
- The quantity of the product and date(s) of shipment or delivery to which the certificates apply.

1.7 DRAWINGS

1.7.1 Submit one reproducible and one print of the drawing for approval. Reproducible will be brownlike diazo or sepia and prints will be blueprint.

1.7.2 Submit as-built drawings and associated electronic data files with the final application for payment. As-builts will be drafted on mylar and electronic data files will be compatible with the latest release of AutoCAD.

1.8 REPORTS

1.8.1 Variations

Submit written request to and obtain approval from Shaw in advance of variations to the scope of work, specification, or drawing which may affect the quality or safe and timely completion of the work.

1.8.2 Daily Activity Report

Prepare an activity report daily, and submit it the morning of the following work day. The report will contain the following information:

- Identification of each significant work activity performed during the day
- Number of workers
- Major pieces of equipment
- Test results
- Events, if any, which may impact the performance of the Work.

1.8.3 Material Status Report

Submit a material status report weekly with material description, vendor, purchase order number, delivery date, and quantity. Identify and justify any significant variances from original quantities.

1.9 RECORDS

1.9.1 Submit record of quantities daily.

1.9.2 Submit certified payrolls weekly.

1.9.3 Submit three copies of test records and results.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01440

SUBCONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

1.1.1 References

1.1.2 Submittals

1.1.3 Quality Control Project Requirements

1.1.4 General Quality Control

1.1.5 Acceptance of Plan

1.1.6 Control

1.1.7 Tests

1.1.8 Completion Inspection

1.1.9 Documentation

1.1.10 Sample Forms

1.1.11 Notification of Noncompliance

1.2 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D3740	Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E329	Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

US ARMY CORP OF ENGINEERS (USACE) Contractor Quality Control/Chemical Data Quality Management Plan, QC, (CDQMP), Total Environmental Restoration Contract DACW05-95-D-0001, Sacramento District

Shaw Environmental and Infrastructure (Shaw), Work Plan and Contractor Quality Control/Sampling and Analysis Plan (Work Plan), Carbon Tetrachloride SVE Pilot Test, Fort Ord, California

1.2 SUBMITTALS

1.2.1 Prepare submittals in accordance with Section 01300, SUBMITTALS.

1.2.2 Submit the following qualifications, designations, and certifications, reporting to Shaw prior to the execution of work.

- The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

- A copy of the letter to the subcontractor's Quality Control (QC) Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the QC Manager, including authority to stop work which is not in compliance with the Contract. The QC Manager will issue letters of direction to various QC representatives outlining duties, authorities, and responsibilities. Copies of these letters will also be furnished to Shaw. Shaw will forward these documents to the Government for review .

1.3 QUALITY CONTROL PROJECT REQUIREMENTS

Comply with the Quality Control (QC) program requirements included in the following documents:

- CDQMP
- Work Plan

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 GENERAL QUALITY CONTROL

Shaw is responsible for QC and maintains an effective QC system in compliance with the CQC/CDQMP. The QC system consists of plans, procedures, and organization necessary to produce an end product which complies with Contract requirements. The system incorporates construction operations, both onsite and offsite, and is keyed to the proposed construction sequence. All work performed on this delivery order will be performed in accordance with the CQC/CDQMP and the CQC/SAP.

Subcontractors may be required to provide task-specific work plans. Under all circumstances, the subcontractor will be required to comply with the CQC and site-specific QC plans. The Subcontractor's project superintendent will be held responsible for the quality of work on the job and is subject to removal by Shaw for non-compliance with quality requirements specified in the Contract. The project manager is the individual responsible for the overall management of the project, including quality and production.

3.2 ACCEPTANCE OF PLAN

Acceptance of the Subcontractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. Shaw reserves the right to require the Subcontractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.3 NOTIFICATION OF CHANGES

After acceptance of the CQC Plan, the Subcontractor will notify Shaw in writing of any proposed change. Proposed changes are subject to acceptance by Shaw.

3.4 CONTROL

Subcontractor QC is the means by which Shaw ensures that the construction, including that of subcontractors and suppliers, complies with Contract requirements. At least three phases of control will be conducted by the CQC System Manager for each definable feature of work as follows:

3.4.1 Preparatory Phase

This phase will be performed prior to beginning work on each definable feature of work and will include:

- A review of each paragraph of applicable specifications.
- A review of the Contract drawings.
- A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- Review of provisions that have been made to provide required control inspection and testing.
- Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.

- A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

- A review of the appropriate activity hazard analysis to assure safety requirements are met.

- Discussion of procedures for controlling quality of the work including repetitive deficiencies. Documentation of construction tolerances and workmanship standards for that feature of work.

- A check to ensure that the portion of the plan for the work to be performed has been accepted by Shaw.

- Discussion of the initial control phase.

- The Government will be notified at least 72 hours in advance of beginning the preparatory control phase. This phase will include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions will be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Subcontractor will instruct applicable workers as to the acceptable level of workmanship required in order to meet Contract specifications.

3.4.2 Initial Phase

This phase will be accomplished at the beginning of a definable feature of work. The following will be accomplished:

- A check of work to ensure that it is in full compliance with Contract requirements. Review minutes of the preparatory meeting.

- Verify adequacy of controls to ensure full Contract compliance. Verify required control inspection and testing.

- Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

- Resolve all differences.

- Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

- The Government will be notified at least 72 hours in advance of beginning the initial phase. Separate minutes of this phase will be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase will be indicated for future reference and comparison with follow-up phases.

- The initial phase will be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.4.3 Follow-up Phase

Daily checks will be performed to assure control activities are providing continued compliance with Contract requirements, until completion of the particular feature of work. The checks, which include passed and/or failed test results, will be made a matter of record in the CQC documentation. Final follow-up checks will be conducted and deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Subcontractor will not build upon or conceal non-conforming work.

3.4.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases will be conducted on the same definable features of work if:

- The quality of on-going work is unacceptable

- There are changes in the applicable CQC staff

- Onsite production supervision or work crew

- Work on a definable feature is resumed after a substantial period of inactivity

- Other problems develop.

3.5 TESTS

3.5.1 Testing Procedure

Shaw and/or its Subcontractors will perform specified or required tests to verify that control measures are adequate to provide a product which conforms with Contract requirements. Testing will be performed in accordance with the CQC/CDQMP. Upon request, Shaw and/or its Subcontractor will furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified.

Shaw will procure the services of a USACE approved testing laboratory or establish an approved testing laboratory at the project site. Shaw will perform the following activities and record and provide the following data:

- Verify that testing procedures comply with Contract requirements.

- Verify that facilities and testing equipment are available and comply with testing standards.

- Check test instrument calibration data against certified standards.

- Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

- Results of all tests taken, both passing and failing tests, will be recorded on the CQC daily report for the date taken. Specification paragraph reference, three dimensional location where tests were taken (i.e., station, off-set, and elevation), and the sequential control number identifying the test will be given. (The test number of any test which is a retest, verifying corrections of any failures will be the failed test number followed by an "A." If necessary, following retest numbers will be followed by "B", "C", etc.) If approved by Shaw, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility will be provided directly to Shaw. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this Contract.

3.5.2 Testing Laboratories

3.5.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the Contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel will meet criteria detailed in ASTM D3740 and ASTM E329.

3.5.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Subcontractor will reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Subcontractor.

3.5.3 Onsite Laboratory

The Government reserves the right to utilize the Subcontractor's control testing laboratory and equipment to conduct assurance tests and check the Subcontractor's testing procedures, techniques, and test results.

3.5.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the Subcontractor. Samples of materials for test verification and acceptance testing by the Government will be delivered to the Government's Designated Laboratory.

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.6 COMPLETION INSPECTION

3.6.1 Pre-Final Inspection

At the completion of work or any increment thereof established by these specifications, the CQC System Manager will conduct an inspection of the work and develop a "Punch List" of items which do not conform to the approved drawings and specifications. Such a list of deficiencies will be included in the CQC documentation and will include the estimated date by which the deficiencies will be corrected. Once this is accomplished, Shaw will notify the Government that the facility is complete and is ready for the Government's "Prefinal" inspection. The Government will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Prefinal Punch List" will be developed as a result of this inspection. The Shaw CQC System Manager will ensure that items on this list have been corrected and so notify the Government so that a "Final" inspection with the customer can be scheduled. Any items noted on the "Final" inspection will be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time slated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.6.2 Final Acceptance Inspection

The Subcontractor's Quality Control inspection personnel, his superintendent or other primary management person and an Shaw representative will be in attendance at this inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by Shaw based upon notice from the Subcontractor. This notice will be given to Shaw at least 14 days prior to the final acceptance inspection and must include the Subcontractor's assurance that all specific items previously identified to the Subcontractor as being acceptable, along with all remaining work performed under the Contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Subcontractor to have all contract work acceptably complete for this inspection will be cause for Shaw to bill the Subcontractor for the Government's additional inspection cost in accordance with the contract clause entitled "Inspection of Construction."

3.7 DOCUMENTATION

3.7.1 Shaw and its Subcontractors will maintain current records providing factual evidence that required QC activities and/or tests have been performed. These records will include the work of subcontractors and suppliers and will be on an acceptable form that includes, as a minimum, the following information:

- Subcontractor/supplier and their area of responsibility.
- Operating plant/equipment with hours worked, idle, or down for repair.
- Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
- Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- Submittals reviewed, with Contract reference, by whom, and action taken.
- Offsite surveillance activities, including actions taken.
- Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- Instructions given/received and conflicts in plans and/or specifications.
- Subcontractor's verification statement.

3.7.2 These records will indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records will cover both conforming and deficient features and will include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. The original and one copy of these records in report form will be furnished to Shaw daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. All calendar days will be accounted for throughout the life of the Contract. The first report following a day of no work will be for that day only. Reports will be signed and dated by the Subcontractor's QC manager. The report from the QC Manager will include copies of test reports and copies of reports prepared by all subordinate QC personnel. Copies of Contract required reports will be forwarded to the Government by Shaw.

3.8 SAMPLE FORMS

Sample forms will be provided by Shaw.

3.9 NOTIFICATION OF NONCOMPLIANCE

Shaw will notify the Subcontractor of any detected noncompliance with the foregoing requirements. The Subcontractor will take immediate corrective action after receipt of such notice. Such notice, when delivered to the Subcontractor at the work site, will be deemed sufficient for the purpose of notification. If the Subcontractor fails or refuses to comply promptly, Shaw may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Subcontractor.

END OF SECTION

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

1.1.1 References

1.1.2 General Requirements

1.1.3 Availability and Use of Utility Services

1.1.4 Protection and Maintenance of Traffic

1.1.5 Subcontractor's Temporary Facilities

1.1.6 Plant Communication

1.1.7 Temporary Safety Fencing

1.1.8 Cleanup

1.1.9 Decontamination Area

1.1.10 Dust Suppression

1.2 REFERENCES

1.2.1 Shaw Environmental and Infrastructure (Shaw), Work Plan and Contractor Quality Control/Sampling and Analysis Plan (Work Plan), Carbon Tetrachloride SVE Pilot Test, Fort Ord, California

.

1.2.2 Shaw, Site Safety and Health Plan (SSHP), Fort Ord, California, Rev 7.

1.3 GENERAL REQUIREMENTS

1.3.1 Subcontractor Storage Area: Before beginning work, indicate the proposed number of trailers and storage area requirements. Indicate if the use of a supplemental or other staging area is desired. Due to sensitive species concerns, proposed fenced areas and their access routes require approval by Shaw prior to construction.

1.3.2 Identification of Employees: The Subcontractor's employees engaged on the work are required to display identification as approved and directed by Shaw. Prescribed identification will immediately be delivered to Shaw for cancellation upon release of any employee. When required, the Subcontractor will obtain and provide fingerprints of persons employed on the project. Subcontractor and personnel will wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.3.3 Employee Parking: Park privately owned vehicles in an area designated by Shaw. Parking area will be within reasonable walking distance of the construction site.

1.4 AVAILABILITY AND USE OF UTILITY SERVICES

1.4.1 Payment for Utility Services: Government will provide utility service available to the Subcontractor from existing outlets and supplies. The amount of each utility service consumed will be charged to or paid for by the Subcontractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by Shaw.

1.4.2 Meters and Temporary Connections: Provide and maintain necessary temporary connections, distribution lines, and meter bases (Government will provide meters) required to measure the amount of each utility used for the purpose of determining charges. Notify Shaw, in writing, five working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Subcontractor's temporary wiring installation. Under no circumstance will the Subcontractor make the final electrical connection.

1.4.3 Advance Deposit: Pay an advance deposit for utilities consisting of an estimated month's usage or a minimum of $250.00 to Shaw. The last monthly bills for the fiscal year will normally be offset by the deposit, and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning October 1, will require a new deposit. Notification of the due date for this deposit will be mailed to the Subcontractor prior to the end of the current fiscal year.

1.4.4 Final Meter Reading: Before completion and final acceptance of the work by the Government, notify Shaw, in writing, five working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meter(s). The Subcontractor will then remove all the temporary distribution lines, meter base(s), and associated equipment. The Subcontractor will pay all outstanding utility bills before final acceptance of the work by the Government.

1.4.5 Sanitation: Provide and maintain within the construction area minimum field-type sanitary facilities approved by Shaw. Government or Shaw restroom facilities will not be available to Subcontractor's personnel.

1.4.6 Telephone: Make arrangements and pay costs for telephone facilities.

1.5 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction, Shaw will be responsible for traffic control and provide access and temporary relocated or detour roads as necessary to maintain traffic. The Subcontractor's traffic on roads selected for hauling material to and from the site will interfere as little as possible with public traffic. The Subcontractor will investigate the adequacy of existing roads and the allowable load limit on these roads. The Subcontractor will be responsible for the repair of any damage to roads caused by Subcontractor construction operations. The Subcontractor will be responsible for replacement of sections of road removed by the Subcontractor to complete this work.

1.5.1 General: Conduct operations as to offer the least possible obstruction and inconvenience to pedestrian and vehicular traffic. Do not have under construction a greater amount of work than can be prosecuted properly with due regard for the rights of the public. The length of construction for purposes of traffic control will be defined as any section of public street or public right-of-way upon which the full width of existing roadway is not available for vehicular or pedestrian traffic because of interference from construction equipment, excavation, stockpiled material, or untraversable areas.

1.5.2 Protection of Pedestrian Traffic: Protect the public from construction activities.

1.6 SUBCONTRACTOR'S TEMPORARY FACILITIES

1.6.1 Administrative Field Offices: Provide and maintain administrative field office facilities within the construction area at a site designated by Shaw. Government office facilities will not be available to the Subcontractor's personnel.

1.6.2 Storage Area: Use the fenced equipment storage area indicated on the Site Plan. Trailers, materials, or equipment will not be placed or stored outside the fenced area unless approved by Shaw. At the end of each work day mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, and materials will be left in an organized manner as approved by Shaw.

1.6.3 Supplemental Storage Area: If needed, Shaw will designate another or supplemental area for the Subcontractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity to the construction site but will be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Subcontractor will be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

1.6.4 Appearance of Trailers: Provide trailers with a clean and neat exterior appearance and in a state of good repair. Trailers which, in the opinion of Shaw, require exterior painting or maintenance will not be allowed on the military property.

1.6.5 Maintenance of Storage Area: Maintain storage areas and fencing around storage areas in a state of good repair and proper alignment. Do not traverse with construction equipment or other vehicles grassed or unpaved areas which are not established roadways.

1.6.6 Security Provisions: Adequate outside security lighting will be provided at the Subcontractor's temporary facilities. Subcontractor is responsible for the security of its own equipment; in addition, the Subcontractor will notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

1.7 PLANT COMMUNICATION

Whenever the Subcontractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, install a satisfactory means of communication, such as telephone or other suitable devices. The devices will be made available for use by Government personnel.

1.8 TEMPORARY SAFETY FENCING

If specified or required to protect the public, provide a temporary safety fencing around the work area. As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. The safety fencing will be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10-foot centers, constructed at the approved location. Maintain the safety fencing during the duration of the Subcontract and, upon completion and acceptance of the work, remove from the work site.

1.9 CLEANUP

Dirt or mud tracked onto paved or surfaced roadways will be cleaned away upon completion. Materials resulting from demolition activities which are salvageable will be stored within the fenced area or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, will be neatly stacked.

1.9.1 Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

1.9.2 Collect and remove waste materials, debris, and rubbish from site weekly.

1.9.3 Furnish a minimum of one 2-cubic-yard capacity waste bin for rubbish disposal and provide for weekly disposal service at a minimum. Locate the waste bin near the construction facilities. Arrange for disposal service on an as-needed basis.

1.10 DECONTAMINATION AREA

1.10.1 Use Shaw equipment decontamination facilities within the contamination reduction zone for removing contaminants from vehicles and equipment leaving the work area.

1.10.2 Collect decontamination wastewater in storage tank.

1.10.3 Do not allow wastewater to run off of the site onto rights-of-way or adjacent property.

1.10.4 Personnel engaged in vehicle decontamination will wear protective equipment including disposable clothing and respiratory protection as required by the SSHP.

1.10.5 Consider the decontamination area a hazardous work area; Any item taken into the exclusion zone, will be contaminated and decontaminated before removing item from the area. Clean all contaminated vehicles, equipment, and materials prior to leaving the site.

1.11 DUST SUPPRESSION

1.11.1 Conduct operations and maintain the site so as to minimize the creation and dispersion of dust.

1.11.2 Use dust control throughout the work, especially during soil excavation, handling and transport, rough grading, and placement of final cover.

1.11.3 Provide clean water, free from salt, oil, or other deleterious material for on-site dust control in any area.

1.11.4 Supply water spraying equipment capable of accessing all work areas.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Products

1.1.2 Transportation and Handling

1.1.3 Storage and Protection

1.1.4 Product Options

1.1.5 Substitutions

1.2 PRODUCTS

1.2.1 Do not use materials and equipment removed from existing premises, except as specifically permitted.

1.2.2 Provide interchangeable components of the same manufacture for components being replaced.

1.3 TRANSPORTATION AND HANDLING

1.3.1 Transport and handle Products in accordance with manufacturer’s instructions.

1.3.2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

1.3.3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.4 STORAGE AND PROTECTION

1.4.1 Store and protect Products in accordance with manufacturer’s instructions, with seals and labels intact and legible.

1.4.2 Store sensitive Products in weather tight, climate controlled enclosures.

1.4.3 For exterior storage of fabricated Products, place on sloped supports, above ground.

1.4.4 Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

1.4.5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of Product.

1.4.6 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

1.4.7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

1.4.8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

1.5.1 Products specified by reference standards or by description only: any Product meeting those standards or description.

1.5.2 Products specified by naming one or more manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

1.5.3 Products specified by naming one or more manufacturers with a provision for substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.5.4 “Or Equal”

- Where the phrase “or equal” or “or approved equal” occurs in the Contract Documents, do not assume materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by Shaw Environmental and Infrastructure (Shaw).
- The decision of Shaw is final.

1.6 SUBSTITUTIONS

1.6.1 Shaw will consider requests for Substitutions only within 30 days after Notice to Proceed.

1.6.2 Substitutions may be considered when a Product becomes unavailable through no fault of the Subcontractor.

1.6.3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

1.6.4 A request constitutes a representation that the Subcontractor:

- Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.

- Will provide the same warranty for the Substitution as for the specified Product.

- Will coordinate installation and make changes to other work which may be required for the Work to be complete with no additional cost to the Government.

- Waives claims for additional costs or time extension which may subsequently become apparent.

- Will reimburse the Government for review or redesign services by Shaw associated with re-approval by authorities.

1.6.5 Substitutions will not be considered when they are indicated or implied on drawing or product data submittal, without separate written request, or when acceptance will require substantial revision to the Contract Documents.

1.6.6 Do not order or install substitute products without written acceptance.

1.6.7 Only one request for substitution for each product will be considered. When substitution is not accepted, provide specified product.

1.6.8 Shaw will determine acceptability of substitutions.

1.6.9 Identify product by Specification Section and Article numbers. Provide manufacturer's name and address, trade name of product, and model or casting number. List fabricators and suppliers as appropriate.

1.6.10 Give itemized comparison of proposed substitution with specified product, listing variations, and reference to Specification Section and Article numbers.

1.6.11 Give quality and performance comparison between proposed substitution and the specified product.

1.6.12 Give cost data comparing proposed substitution with specified product, and amount of net change to Contract Sum.

1.6.13 List availability of maintenance services and replacement materials.

1.6.14 State effect of substitution on construction schedule, and changes required in other work or products.

1.6.15 Request for substitution constitutes a representation that Subcontractor has investigated proposed product and has determined that it is equal to or superior in all respects to specified products (or that the cost reduction offered is ample justification for accepting the offered substitution).

1.6.16 Provide same warranty for substitution as for specified product.

1.6.17 Coordinate installation of accepted substitute, making such changes as may be required for Work to be complete.

1.6.18 Certify that cost data presented are complete and include related costs.

1.6.19 Waive claims for additional costs related to substitution which may later become apparent.

1.6.20 Substitution Submittal Procedure:

- Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
- Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.
- Shaw will notify Subcontractor in writing of decision to accept or reject request.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

.

END OF SECTION

SECTION 02521

SOIL VAPOR EXTRACTION WELLS

PART 1 GENERAL

1.1 SECTION INCLUDES

Vertical soil vapor extraction wells, well heads, connection pipe, seals, and vaults.

1.2 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2488	Description and Identification of Soils (Visual - Manual Procedure)
ASTM D 3034	Polyvinyl Chloride (PVC) Pipe

1.3 SUBMITTALS

1.3.1 Prepare submittals in accordance with Section 01300, SUBMITTALS.

1.3.2 Submit product data for the following materials:

- Bentonite pellets
- Pea gravel
- Well materials
- Well head assembly (by Shaw Environmental and Infrastructure[Shaw])
- Well head connection (by Shaw)

1.3.3 Submit prior to field work:

- Driller qualifications, including the driller's license number
- Proposed method of drilling
- Names, qualifications and safety record for any proposed onsite subcontractor

1.3.4 Submit proposed variances from regulations and procedures.

1.3.5 Submit a driller's daily work report or daily ticket, including the following information:

- Time on job
- Standby time and down time
- Well number
- Footage drilled
- Footage constructed
- Materials used

- Other activities

1.3.6 Shaw will obtain and submit permits (if required) before mobilizing to site.

1.3.7 Final Well Log: (Provided by Shaw)

Include the following:

- Project title and number
- Description of the installed well
- Date of drilling
- Borehole diameter
- Depth of bottom of casing and bottom of borehole
- Casing diameter and wall thickness, and length installed
- Perforated or screened interval
- Description of geologic materials encountered (ASTM D 2488)
- Presence or absence of water
- Drilling advancement rates
- Time, depth, and description of unusual occurrences or problems during drilling
- Type, size, and quantity of gravel pack installed
- Coordinates (California State Plane) of well
- Name of logger (Shaw)

1.4 QUALITY ASSURANCE

1.4.1 Provide experienced competent driller and crew on site during drilling and well installation activities.

1.4.2 Drilling and well installation will be supervised by Shaw.

1.4.3 Do not change proposed field personnel without written permission from Shaw.

PART 2 PRODUCTS

2.1 VERTICAL WELLS

2.1.1 Wells: Pipes, couplings, end caps, and fittings: PVC, Schedule 40 (ASTM D1785), square flush-threaded with o-ring, 4-inch-diameter, 8 threads per inch (tpi).

2.1.2 Screens: PVC, Schedule 40 (ASTM D1785), square flush-threaded with o-ring, 4-inch-diameter, 8 tpi, machine-slotted, 1/8-inch slots, 30 feet, each well.

2.2 Wellhead Assembly

2.2.1 CES Landtec Accu-Flo (supplied by Shaw).

2.3 Wellhead Connection

2.3.1 Components: compression adaptor, flexible coupling, compatible with the wellhead model.

2.4 SEALING MATERIALS

2.4.1 Gravel pack: 3/8-inch crushed or natural washed pea gravel.

2.4.2 Bentonite-cement grout: One sack (94 lbs) of Type II Portland cement and 3 to 5 percent bentonite powder for each 4-1/2 to 6-1/2 gallons of clean water.

2.4.3 Bentonite Seal: 3/8-inch chip.

2.5 CONCRETE WELL VAULT

2.5.1 Supplied and installed by Shaw.

PART 3 EXECUTION

3.1 DRILLING

3.1.1 Drilling Methods: Provide a minimum borehole diameter of 8 inches to the maximum depth of 90 feet.

3.1.2 Boring Depths: Actual depths will depend on conditions encountered during drilling.

3.1.3 Obstructed Borings: If obstructions are encountered during borehole advancement, do not attempt to penetrate obstruction. Shaw will determine which of the following courses of action to be taken.

3.1.3.1 Abandonment: Abandon borehole by backfilling with bentonite slurry and relocate borehole at the direction of Shaw. No submittals will be required.

3.1.3.2 Completion: Complete borehole and install well to the depth obtained.

3.2 WELL INSTALLATION

3.2.1 Drill borehole so as to permit installation of well casing assembly in a plumb and true line.

3.2.2 Well Casing: Assemble the solid and perforated casing sections together. Center casing assembly in borehole. Maintain casing assembly vertically plumb during backfilling of borehole.

3.2.2.1 Perforated Casing: Pipe lengths vary and will be determined based on data obtained during drilling activities. Order perforated casing pipe with end cap prefabricated, and field trim excess length to fit the borehole.

3.2.2.2 Joints: Flush thread with O-ring.

3.2.3 Gravel Pack: To prevent bridging, pour pea gravel carefully into annular space to the design level above the top of the well screen, as determined by volume measurements and sounding with a weighted tape. Remove drill rods slowly, at the same rate that the pea gravel is placed. Sound frequently enough so that placement is accurate to within 0.2 foot.

3.2.4 Bentonite Seal: Pour bentonite pellets gradually and carefully to the design level as determined by volume measurements and sounding with a weighted tape.

3.2.5 Bentonite-Cement Grout: Wait 30 minutes after placing bentonite seal, then place bentonite-cement grout to design level of the bottom of well box.

3.3 WELLHEAD INSTALLATION

3.3.1 Follow manufacturer's recommendations for wellhead installation.

3.4 FIELD QUALITY CONTROL

3.4.1 No field testing is required.

3.4.2 Verify personnel, equipment, and materials match approved submittals.

3.4.3 Verify that boreholes are straight and plumb.

3.5 CLEAN UP, CLEANING, AND DECONTAMINATION

3.5.1 Do not combine waste materials (e.g. cement bags) with drilling mud and cuttings.

3.5.2 Clean up and remove waste materials from each drill site before demobilization from the project site.

3.5.3 Steam-clean drilling equipment, scrub with brush and laboratory-grade detergent and water solution and rinse with potable water prior to initial use and before departing site.

END OF SECTION

SECTION 02830

FENCING

PART1 GENERAL

1.1 SECTION INCLUDES

1.1.1 References

1.1.2 Submittals

1.1.3 Delivery, Storage, and Handling

1.1.4 Chain Link Fence

1.1.5 Barbed Wire Fence

1.1.5 Concrete

1.1.6 Padlocks

1.1.7 Installation

1.2 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A121	Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A176	Stainless and Heat-Resisting Chromium-nickel Steel Plate, Sheet, and Strip
ASTM A478	Chromium-nickel Stainless and Heat-Resisting Steel Weaving and Knitting Wire
ASTM A666	Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM A702	Barbed Wire Fence Posts
ASTM C94	Ready-Mixed Concrete
ASTM F883	Padlocks

AMERICAN WELDING SOCIETY (AWS)

AWS WZC Welding Zinc-Coated Steels

California Department of Transportation (CALTRANS), Standard Specifications

City of Salinas (SALINAS) Department of Public Works, Design Standards and Standard Specifications

1.3 SUBMITTALS

1.3.1 Prepare submittals in accordance with Section 01300, SUBMITTALS.

1.3.2 Submit manufacturer=s data sheets and installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

Store and handle in accordance with manufacturer=s instructions.

PART2 PRODUCTS

2.1 CHAIN LINK FENCE

2.1.1 Fabric: Zinc coated, 6 feet wide, CALTRANS Specification Section 80-4.01B

2.1.2 Gates: CALTRANS Specification Section 80-4.01D

2.1.3 Posts and Braces: Metal, zinc-coated, CALTRANS Specification Section 80-4.01A

2.1.4 Accessories: CALTRANS Specification 80-4.01C

2.2 BARBED WIRE FENCE

2.2.1 Barbed Wire: 12 2-gauge Class 1, CALTRANS Specification Section 80-3.01C

2.2.2 Gates: CALTRANS Specification 80-3.01E

2.2.3 Posts and Braces: Zinc-coated metal, CALTRANS Specification Section 80-3.01A

2.2.4 Accessories: CALTRANS Specification Section 80-3.01F

2.3 CONCRETE: CALTRANS Specification Section 80-3.01F and 80-4.01C

2.4 PADLOCKS: ASTM F883, Type PO1, Grade 2, Size 1-3/4 inch, keyed alike.

PART3 EXECUTION

3.1 INSTALLATION

3.1.1 Barbed Wire Fence: CALTRANS Specification Section 80-3.02, 10-foot post spacing.

3.1.2 Chain Link Fence: CALTRANS Specification Section 80-4.02, SALINAS Standard Plan 42, 10-foot post spacing, Type CL-6.

3.1.3 Gates: CALTRANS Specification Section 80-4.01D, double swing gate with 6-foot leaves.

3.1.4 Grounding: Install one ground per each fence enclosure.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

Portland cement concrete (PCC), formwork, reinforcement, and curing.

1.2 REFERENCES

1.2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A185	Welded Steel Wire Fabric for Concrete Reinforcement
ASTM A615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement
ASTM C33	Concrete Aggregates
ASTM C94	Ready-Mixed Concrete
ASTM C150	Portland Cement

1.2.2 AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301	Structural Concrete for Buildings
ACI 305R	Hot Weather Concrete
ACI 308	Standard Practice for Curing Concrete

1.3 SUBMITTALS

1.3.1 Prepare submittals in accordance with Section 01300, SUBMITTALS. As used herein, the notation ITA means to submit for Shaw Environmental and Infrastructure's approval; FIO means to submit for information only.

1.3.2 Submit the following information 7 working days prior to scheduled use:

1.3.2.1 Concrete mix design (ITA):

- Dry weights of cement and saturated surface-dry-weights of fine and coarse aggregates per cubic yard of concrete.
- Type, name, and quantity of admixtures per cubic yard of concrete.

- Quantity of water per cubic yard of concrete.
- Evidence that materials to be used and proportions proposed will produce the quality of concrete required.

1.3.3 Variance from the approved design must be approved by the Engineer.

1.4 PROJECT RECORD DOCUMENTS

1.4.1 Accurately record locations of embedded pipes and components that are concealed from view.

1.5 QUALITY ASSURANCE

1.5.1 Perform work in accordance with ACI 301.

1.5.2 Acquire cement and aggregate from same source for concrete work.

1.5.3 Conform to ACI 305R when concreting during hot weather.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

2.1.1 Cement: Domestic portland cement (ASTM C150), Type IIA - Air Entraining.

2.1.2 Fine Aggregate: Natural sand (ASTM C33), with no deleterious material such as cryptocrystalline quartz or other material that could cause structural problems with the concrete.

2.1.3 Coarse Aggregate: Well-graded crushed stone (ASTM C33), Size No. 67, with no deleterious material such as cryptocrystalline quartz or other material that could cause structural problems with the concrete.

2.1.4 Water: Potable, clean, and free from deleterious materials, acids, alkalis, oils, or organic matter.

2.2 CONCRETE MIX

2.2.1 Concrete Mix: Minimum 3,000 pounds per square inch (psi) compressive strength after 28 days, unless otherwise stated on the Drawings. Not mixed for more than 45 minutes (ASTM C94), delivered with premix delivery tickets with batching start time, beginning and end of pour, and any changes to mix in the field.

2.3 REINFORCEMENT

2.3.1 Steel Rebar: #4 and #5, ASTM A615.

2.3.2 Welded Steel Wire Mesh: 10 gage, 6 inches on center, ASTM A185.

2.4 FORMWORK

2.4.1 Form Materials: Soft plywood, PS1 D Grade Group 3 pine species; Grade B lumber with grade stamp clearly marked or prefabricated forms as approved by Engineer.

2.5 FORMWORK ACCESSORIES

2.5.1 Form Ties: Removable or snap-off type, metal, adjustable length.

2.5.2 Form Release Agent: Colorless mineral oil that will not stain concrete or absorb moisture.

2.5.3 Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place when placing concrete.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

3.1.2 Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

3.1.3 Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

3.1.4 Apply form release agent on formwork in accordance with manufacturer's recommendations.

3.1.5 Clean formed cavities of debris prior to placing concrete.

3.1.6 Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through cleanout ports.

3.2 PLACING CONCRETE AND REINFORCEMENT

3.2.1 Place reinforcement in the exact positions shown on the Drawings. Secure overlaps of the reinforcement with annealed iron wire ties. Ensure that reinforcement, inserts, and embedded parts are not disturbed during concrete placement.

SECTION 02686

SOIL VAPOR MONITORING PROBES

PART 1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Soil Vapor Monitoring Probes and Bollards

1.2 REFERENCES

ASTM D1785	Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
ASTM D 2488	Description and Identification of Soils (Visual - Manual Procedure)

1.3 SUBMITTALS

1.3.1 Prepare submittals in accordance with Section 01300, SUBMITTALS.

1.3.2 Submit product data for the following materials:

- Bentonite pellets
- Pea gravel
- Probe materials

1.3.3 Submit prior to field work:

- Driller qualifications, including the driller's license number
- Proposed method of drilling
- Names, qualifications and safety record for any proposed onsite subcontractor

1.3.4 Submit proposed variances from regulations and procedures.

1.3.5 Submit a driller's daily work report or daily ticket, including the following information:

- Time on job
- Standby time and down time
- Well number
- Footage drilled
- Footage constructed
- Materials used
- Other activities.

1.3.6 Shaw will obtain and submit permits (if required) before mobilizing to site.

1.3.7 Final Well Log: (Provided by Shaw Environmental and Infrastructure[Shaw])

Include the following:

- Project title and number
- Description of the installed well
- Date of drilling
- Borehole diameter
- Depth of bottom of casing and bottom of borehole
- Casing diameter and wall thickness, and length installed
- Perforated or screened interval
- Description of geologic materials encountered (ASTM D 2488)
- Presence or absence of water
- Drilling advancement rates
- Time, depth, and description of unusual occurrences or problems during drilling
- Type, size, and quantity of gravel pack installed
- Coordinates (California State Plane) of well
- Name of logger Shaw

1.4 QUALITY ASSURANCE

1.4.1 Provide experienced and competent driller and crew on site during drilling and probe installation activities.

1.4.2 Drilling and well installation will be supervised by Shaw.

1.4.3 Do not change proposed field personnel without written permission from Shaw.

PART 2 PRODUCTS

2.1 MONITORING PROBES

2.1.1 Probes: Pipes, couplings, end caps, and fittings: PVC, Schedule 40 (ASTM D1785), square flush-threaded with o-ring, 3/4-inch-diameter, 8 threads per inch (tpi).

2.1.2 Valves: 3/4-inch brass gas valves, ¾-inch x 3/16-inch bushing reducer, 3/16-inch tapered hose barb threaded onto ¾-inch PVC probe.

2.1.3 Screens: PVC, Schedule 40 (ASTM D1785), square flush-threaded with o-ring, 3/4-inch-diameter, 8 tpi, machine-slotted, 0.02-inch slots, 5 feet, each probe.

2.2 SEALING MATERIALS

2.2.1 Gravel Pack: 3/8-inch crushed or natural washed pea gravel.

2.2.2 Bentonite Seal: 3/8-inch chips.

2.2.3 Surface Seal: Concrete in accordance with Section 03300, CAST-IN-PLACE CONCRETE.

2.3 PROTECTIVE CASING FOR MONITORING PROBES

2.3.1 Locking, steel 12-inch-diameter standpipe, minimum 5 feet long.

2.3.2 Locks: Master-keyed alike, with waterproof color-coded tags labeled "Soil Vapor Monitoring Probe."

2.4 IDENTIFICATION

2.4.1 Stamp and paint probe cluster number on well cover.

2.5 BOLLARDS

2.5.1 Schedule 40 carbon steel pipe (ASTM A53), 4-inch-diameter, concrete-filled.

2.5.2 Paint: reflective yellow.

PART 3 EXECUTION

3.1 DRILLING

3.1.1 Drilling Methods: Provide a minimum borehole diameter of 8 inches to the maximum depth of 85 feet.

3.1.2 Boring Depths: Actual depths will depend on conditions encountered during drilling.

3.1.3 Obstructed Borings: If obstructions are encountered during borehole advancement, do not attempt to penetrate obstruction. Shaw will determine which of the following courses of action to be taken.

3.1.3.1 Abandonment: Abandon borehole by backfilling with bentonite slurry and relocate borehole at the direction of Shaw. No submittals will be required.

3.1.3.2 Completion: Complete borehole and install well to the depth obtained.

3.2 WELL INSTALLATION

3.2.1 Drill borehole so as to permit installation of well casing assembly in a plumb and true line.

3.2.2 Well Casing: Assemble the solid and perforated casing sections together. Center casing assembly in borehole. Maintain casing assembly vertically plumb during backfilling of borehole.

3.2.2.1 Perforated Casing: Pipe lengths vary and will be determined based on data obtained during drilling activities. Order perforated casing pipe with end cap prefabricated, and field trim excess length to fit the borehole.

3.2.2.2 Joints: Flush thread with O-ring.

3.2.3 Gravel Pack: To prevent bridging, pour pea gravel carefully into annular space to the design level above the top of the well screen, as determined by volume measurements and sounding with a weighted tape. Remove drill rods slowly, at the same rate that the pea gravel is placed. Sound frequently enough so that placement is accurate to within 0.2 foot.

3.2.4 Bentonite Seal: Pour bentonite pellets gradually and carefully to the design level as determined by volume measurements and sounding with a weighted tape.

3.2.5 Bentonite-Cement Grout: Wait 30 minutes after placing bentonite seal, then place bentonite-cement grout to design level of the bottom of well box.

3.3 FIELD QUALITY CONTROL

3.3.1 No field testing is required.

3.3.2 Verify personnel, equipment, and materials match approved submittals.

3.3.3 Verify that boreholes are straight and plumb.

3.4 CLEAN UP, CLEANING, AND DECONTAMINATION

3.4.1 Do not combine waste materials (e.g. cement bags) with drilling mud and cuttings.

3.4.2 Clean up and remove waste materials from each drill site before demobilization from the project site.

3.4.3 Steam-clean drilling equipment, scrub with brush and laboratory-grade detergent and water solution and rinse with potable water prior to initial use and before departing site.

END OF SECTION

3.2.2 Place concrete in accordance with ACI 301.

3.2.3 Tool edges with ordinary edging tools to a smooth radius.

3.3 CONCRETE FINISHING

3.3.1 Concrete surfaces to receive a broom finish.

3.4 CURING AND PROTECTION

3.4.1 Immediately after placement, protect concrete from premature drying, excessively hot temperature, and mechanical injury.

3.4.2 Cure concrete in accordance with ACI 308.

3.5 PATCHING

3.5.1 Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

3.5.2 Patch imperfections as directed in accordance with ACI 301.

3.6 DEFECTIVE CONCRETE

3.6.1 Defective Concrete: Not conforming to dimensions, with excessive honeycomb, debris, bulges, or depressions.

3.6.2 Repair or replacement of defective concrete will be determined by Engineer.

END OF SECTION

SECTION 15480
PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All piping as shown on the Contract Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to, the following:

1. Gas piping
2. Gas condensate piping (drainage and force main)
3. Air supply piping
4. Road crossings

1.02 REFERENCES

A. ASTM D1785 Standard Specifications for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

B. ASTM D2466 Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

C. ASTM D2564 Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe Fittings

D. ASTM D2467 Standard Specification for Socket -Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

E. ASTM D2464 Standard Specification for Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

F. ASTM D3915 Standard Specifications for Polyvinyl Chloride (PVC) and Related Plastic Pipe and Fittings Compounds

G. ASTM F656 Standard Practice for Primers for Use in Solvent Cement Joints at Polyvinyl Chloride (PVC) Plastic Pipe Fittings

H. ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings

I. ASTM D3350 Standard Specification for Polyethylene (PE) Plastic Pipe and Fittings Materials

J. ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

K. ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

L. ASTM D1248 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials

M. ASTM D2241 Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

N. ANSI B16.5 Steel Pipe Flanges, Flanged Valves, and Fittings

O. ASTM F405 Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings

P. ASTM F667 Standard Specification for Large Diameter Corrugated Polyethylene Tubing and Fittings

Q. AASHTO M252 Standard Specification for Corrugated Polyethylene Drainage Tubing

R. AASHTO M294 Standard Specification for Corrugated Polyethylene Pipe, 12- to 24-inch Diameter

S. ASTM A53 Specification for Welded and Seamless Steel Pipe

T. ASTM A120 Specification for Welded and Seamless Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized)

U. ANSI B16.3 Cast-Iron Threaded Fittings, Class 150 and 300

V. ASTM B43 Specification for Seamless Red Brass Pipe, Standard Sizes

W. ANSI B31.1 Safety Code for Pressure Piping

X. ASTM D2513 Standard Specification for High Density Polyethylene (HDPE) pipe and fittings.

1.03 SUBMITTALS

A. Product Data: Within 15 calendar days after the CONTRACTOR has received the OWNER's Notice to Proceed, submit

1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's Specifications, catalog cuts, and other data needed to prove compliance with the specified requirements.
3. Manufacturer's recommended installation procedures which, when approved by the OWNER/ENGINEER, will become the basis for accepting or rejecting actual installation procedures used on the work.

B. Shop Drawings: Within 15 calendar days after the CONTRACTOR has received the OWNER's Notice to Proceed, submit Shop Drawings and other data as required to indicate method of constructing, installing and supporting piping except where such details are fully shown on the Contract Drawings.

C. Upon completion of this portion of the work, and as a condition of its acceptance, deliver to the OWNER/ENGINEER operation and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Regulatory Requirements:

1. Without additional cost to the OWNER, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.
2. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction.
3. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern unless otherwise directed by the OWNER/ENGINEER.

C. In addition to complying to the specified requirements, comply with the directions of the OWNER/ENGINEER.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle and store all piping in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE:

A. Provide Schedule 40 and Schedule 80 PVC pipe complying with ASTM D 1785.

B. PVC Fittings:

1. Provide Schedule 40 PVC fittings 8 inches and smaller complying with ASTM D 2466, socket-type.
2. Provide PVC fittings 10 inches and larger rated for minimum pressure of 80 psig at 73°F and injection molded from Type 1 PVC.
3. Provide Schedule 80 PVC fittings complying with ASTM D 2467 for socket-type and ASTM D 2464 for threaded-type.

C. PVC Flanges:

1. Provide 150-pound, flat-face, socket-type Schedule 80 PVC flanges. Diameter and drilling of flanges shall comply with ANSI B16.5 for Class 150.
2. Provide full-face, neoprene flange gaskets, 1/16-inch thick with "A" scale hardness of 45 to 60 durometer.
3. Provide correct number and sizes of steel hexagon bolts, washers, and hexagon nuts, electrogalvanized with zinc or cadmium.

D. PVC Solvent Primer: Provide solvent primer as recommended by PVC product supplier and complying with ASTM F 656.

E. PVC Solvent Cement: Provide medium-bodied solvent cement as recommended by PVC product supplier and complying with ASTM D 2564.

2.02 FLEXIBLE PIPE COUPLINGS

A. Provide flexible couplings for pipe expansion/contraction compensation as shown on the Contract Drawings, Industrial Tube Corporation Model IT-6000 or ENGINEER approved equal.

B. Provide stainless steel hose band-clamps of correct size with hexagonal and slotted adjusting screw.

2.03 FLEX HOSE

A. Provide flex hose for well head assemblies as shown on the Contract Drawings, industrial vacuum loader hose by Salem-Republic Rubber Company (800.686.4199), or ENGINEER approved equal, for medium-vacuum, methane applications. Hose shall be provided with soft cuffs, with inside diameter to match the outside diameter of PVC or HDPE pipe to be connected. Minimum bend radius shall provide permanent 90° bend between wellhead and lateral pipe, without causing internal damage or kinking. Hose shall be fabricated from a polyester reinforced styrene-butadiene rubber (SBR) and neoprene rubber (NR) blend, with embedded high-tensile steel wire. Outer cover shall be resistant to UV, ozone, and weathering for long-term, exposed service.

B. Provide stainless steel hose band-clamps of correct size with hexagonal and slotted adjusting screw.

2.04 POLYETHYLENE (PE) PIPE

A. Provide PE pipe of SDR indicated on the Contract Drawings complying with ASTM D 2513 and ASTM D 3350, D 3287, and F 714, where applicable made from resins conforming to ASTM D 1248.

B. PE Fittings:

1. Provide PE fittings complying with ASTM D2513 and ASTM D3350 and D3261, where applicable made from resins conforming to ASTM D1248.
2. Provide PE fittings of the same manufacturer and resin material as PE pipe.
3. Provide fabricated fittings fabricated from PE pipe with an SDR which are equal to or one rating heavier (thicker wall) than the pipe to which they are joined.

C. PE Resin:

1. Provide PE products made from a high density, high modulus resin conforming with cell classification PE 345434C or better in accordance with ASTM D3350.

2.05 CONDENSATE PIPING

1. Condensate drain lines and force mains for the field condensate sumps shall be HPDE, SDR 11, fabricated from materials as specified in paragraph 2.04 of this section.

2. Air supply lines for the field condensate sumps shall be HPDE, SDR 9, fabricated from materials as specified in paragraph 2.04 of this section.

2.06 CORRUGATED METAL PIPE

A. All corrugated metal pipe to be used for road crossing encasements for the main header pipe shall be 16 gauge galvanized steel or aluminum pipe.

B. Corrugated metal pipes are intended to contain all pipes at each road crossing, with sufficient clearance to allow future movement or removal.

2.07 VALVES

A. Gate Valves:

1. Provide PVC body and trim valves with non-rising stem, as manufactured by Asahi-America or approved equal.

B. Butterfly Valves:

1. Provide PVC, wafer-type butterfly valves with nitrile seals, Asahi-America, +GF+, or ENGINEER approved equal.
2. 4 Inch and Smaller: Provide lever-operated handle.
3. 6 Inch and Larger: Provide gear-operated handle.

C. Check valves:

1. 2 inch and smaller: Provide PVC, true union body, threaded or socket ball check valves, with viton seals.
2. 3 inch and larger: Provide PVC, flanged, double disc check valves, Technocheck or ENGINEER approved equal.

D. Condensate Ball valves, 2 inch and smaller: Provide PVC, true union body, threaded or socket type valves, with Teflon seats and nitrile seals.

E. Air and Condensate Isolation butterfly valves, 2-inch: Provide CSR HDPE Time Saver Valve, SDR 11 System, or ENGINEERED approved equal, with Viton seats and seals for condensate applications. Provide air and condensate isolation valves at each isolation valve location.

F. True Unions: Provide PVC Sch 80 unions, threaded or socket type, with Viton O-rings.

G. Header Monitoring Ports: Provide polypropylene quick-disconnect couplings, Colder Products or ENGINEER approved equal, 1/8-inch female shut-off with 1/4-inch male NPT end. Ports to match extraction wellhead monitoring ports.

H. Provide propane valves as shown in the Contract Drawings.

2.08 PIPE SUPPORTS

A. Provide the pipe supports as shown on the Contract Drawings, specified, and required to adequately support and secure all piping systems and to minimize stress to all equipment connections, pipe, valves, and fittings.

1. Provide pipe supports fabricated from metal framing channel and fittings with electrogalvanized zinc or cadmium finish, as supplied by Unistrut, Superstrut, or ENGINEER approved equal.
2. Pipe supports shall provide clearance between guides and the outside diameter of the pipes, to allow free sliding.

2.09 GRADE BOXES

A. Header isolation valves: Provide rectangular valve box and lid, Christy Fibrelyte FL36 or ENGINEER approved equal, at each header isolation valve.

B. Condensate sumps: Provide a concrete vault, Christy R27x36 or ENGINEER approved equal, at each sump location to house sump-head and all necessary compressed air and condensate piping, valves, and instruments, as shown on the Contract Drawings. Provide each vault with non-traffic rated, aluminum or galvanized steel double-leaf access doors. Doors shall be hinged and spring assisted, with stainless steel hardware, locking support arm, and neoprene weather seal.

C. Monitoring ports: Provide circular valve box and lid, Christy Fibrelyte FL8 or ENGINEER approved equal, at each header monitoring point.

2.10 PIPE TRENCH BACKFILL MATERIALS

A. Materials will be designated by the OWNER/ENGINEER, and is that material removed from excavation or on-site sources, predominantly non-expansive soils free from roots and other deleterious matter.

2.11 OTHER MATERIALS

A. Provide all other materials, not specifically described but required for a complete and proper installation, as selected by the CONTRACTOR subject to the approval of the OWNER/ENGINEER.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which the work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected. Notify the OWNER/ENGINEER of such conditions and proposed corrective action before correcting unsatisfactory conditions.

3.02 PREPARATION

A. Lay out the piping systems in careful coordination with the Contract Drawings, determining proper elevations and locations for all components of the system and using only the minimum number of fitting bends to produce a satisfactorily functioning system. In special cases and with the approval of the OWNER/ENGINEER, bends in piping shown on the Contract Drawings may be eliminated by gradual deflection of straight pipe runs.

B. Follow the general layout shown on the Contract Drawings in all cases except where other work may interfere or field conditions deviate from conditions shown in Contract Drawings.

C. Obtain the approval of the OWNER/ENGINEER for the layout of all piping systems before and during pipe installation.

3.03 INSTALLATION

A. General:

1. Proceed as rapidly as other sitework activities will permit.
2. Thoroughly clean piping materials before installation. Cap pipe openings to exclude rodents and dirt until final connections have been made.
3. Cut pipe accurately, and work into place without springing or forcing.
4. Install gas piping at a minimum of 3 percent slope unless otherwise noted on the Contract Drawing or approved by the OWNER/ENGINEER.
5. Provide sufficient expansion and contraction compensation, flexible couplings, and devices necessary for a flexible piping system, whether or not shown on the Contract Drawings.

B. Equipment Access: Install piping, equipment, and accessories to permit access for maintenance. Relocate items as necessary to provide such access, and without additional cost to the OWNER.

C. Flange Connections: Install gaskets centered on flanges and tighten bolts to torque requirements recommended by flange and/or valve manufacturer. Replace flanges damaged by overtightening, at no cost to the OWNER.

D. Flexible couplings:

1. Install flexible couplings as pipe laying and pipe anchors are being installed at locations shown on the Contract Drawings. Flexible couplings shall be compressed or expanded to meet temperature conditions at the time of installation as shown on the Contract Drawings.
2. Bevel and clean both pipe ends.
3. Insert pipe ends into coupling cuffs 2-1/2 inches.
4. Install and tighten (but do not overtighten) hose clamps.

E. Polyvinyl chloride (PVC) pipe and fitting:

1. Construct PVC piping system using solvent cemented joints made in accordance with the pipe manufacturer's instructions.
2. Inspect PVC pipe and fittings for cleanliness and damage prior to placing and joining. Remove and replace all damaged piping materials.
3. Wipe clean both inside and outside surfaces of the two ends to be joined and remove dirt, oil, and foreign materials.
4. Ensure that primer and cement are kept free of contaminants.
5. Allow cemented joints to cure in accordance with the times recommended by the pipe manufacturer.
6. Do not test, stress, pull, or lay new joints on ground until joint has sufficiently cured.
7. Visually inspect each new joint for misalignments, gaps, or voids in joint.
8. Paint all exposed PVC piping and fittings. Do not paint any moving parts.

F. Polyethylene (PE) pipe and fitting:

1. Construct PE piping systems using butt fusion methods in accordance with the pipe and fusion equipment manufacturer's instructions. Allow for additional lengths of pipe for expansion and contraction.
2. Provide appropriate fusion equipment for pipe size under construction.
3. Inspect PE pipe and fittings for cleanliness and damage prior to placing and joining. Remove and replace all damaged piping material.
4. Wipe clean both inside and outside surfaces of the two ends to be joined and remove dirt and foreign materials.
5. After cutting pipe ends, do not touch newly-faced surfaces.
6. Ensure that fusion tools are free of contaminants.
7. Heat the surfaces to be joined simultaneously and fuse together in accordance with time and temperature requirements recommended by the material manufacturer.
8. Allow butt fused joints to cool for time duration recommended by manufacturer.
9. Do not remove new joint from fusion equipment for an additional three minutes.
10. Do not test, stress, pull, or lay new joint on ground for 10 minutes after removal from fusion unit.
11. Visually inspect each new joint for misalignments, gaps, or voids in joint. Bead thickness and melt pattern shall comply with manufacturer's recommendations. Joints not meeting OWNER's/ENGINEER's approval shall be cut out and remade at no additional cost to the OWNER.

3.04 PIPE SUPPORTS

A. Space supports for horizontal pipes as shown on the Contract Drawings.

B. Arrange pipe supports to prevent excessive pipe deflection, and to avoid excessive bending stress.

C. Anchor pipe supports in concrete slabs or footings, as shown on the Contract Drawings.

D. Space wood blocks for supporting piping within the encased road crossings and elevated crossing to prevent excessive pipe deflection, and to avoid excessive bending stress.

3.05 VALVES

A. Locate and arrange valves to provide complete adjustment between fully open to fully closed position.

B. Install valves in at least the following locations:

1. On both sides of apparatus and equipment.
2. For shutoff of branch mains.
3. Where shown on the Contract Drawings.

C. Locate valves for easy accessibility and maintenance.

D. Install valves in closed position, with valve stems vertical.

3.06 TRENCHING AND BACKFILLING

A. Contractor shall conform to all requirements for Trench and Site Safety.

B. Perform excavation of every description and of whatever substances encountered to depth indicated or as otherwise shown and specified. Grade trench bottoms to suit required piping slopes. Grade as necessary to prevent surface water from flowing into trenches. Remove any water accumulating therein by pumping or other approved methods. Notify the OWNER/ENGINEER immediately of any continuous water flow into trench. Sheet and brace excavations as necessary to fully protect workmen and adjacent structures and permit proper installation of work. Under no circumstances lay pipe or install appurtenances in water, without approval of the OWNER/ENGINEER. The presence of ground water in soil or the necessity of sheeting or bracing of excavations shall not constitute a condition for which any increase may be made in contract price.

C. Excavate trenches to the necessary width for proper laying of pipe. Backfill overdepths using methods and procedures specified for backfilling the lower portion of trenches. When wet or unstable material is encountered at bottom of trench, remove such material to depth required as directed by OWNER/ENGINEER and backfill to proper grade with suitable approved material. Grade bottom of trench accurately to provide uniform bearing and support for each piping section at every point along its entire length. Remove stones and all other protrusions from trench bottom.

D. Place bedding material to dimensions shown in drawings. Bedding material shall be carefully placed in bottom of trench, so as to ensure a uniform thickness below the pipe.

E. Backfill pipe trenches with the backfill materials shown and specified, and compact as shown and/or specified.

F. After backfill is completed, remove unused excavated and backfill materials to areas designated by OWNER/ENGINEER.

3.07 PRESSURE TESTING

A. Before pressure testing, blow the pipe clean of dirt and debris and remove from systems equipment which would be damaged by test pressure. Replace equipment after testing. Systems may be tested in sections.

B. Pressure tests shall be performed on the following piping systems and specified parameters:

1. Collection piping: Compressed air, with a test pressure of 10 psi.
2. 2-inch HDPE condensate forcemain piping: Water, with a test pressure of 100 psi
3. Air supply piping: Water, with a test pressure of 150 psi

C. Conduct all pressure testing in accordance with the pipe manufacturer’s recommendations and procedures. Test pressures shall be contained for a minimum of 1-hour, with no change in pressure, except that calculated due to temperature change.

D. Locate and repair all leaks. Correct leaks by replacing faulty materials with new material.

E. Repeat pressure testing until all piping systems pass. Perform additional pressure tests after repair of each system at no cost to the OWNER.

F. Test solenoid and pressure relief valves for proper operation at settings indicated. Test pressure relief valves three times.

G. The CONTRACTOR will be responsible for notifying the OWNER/ENGINEER at least 48 hours in advance so that the OWNER/ENGINEER may be present during testing.

3.08 PROTECTION

A. Protect all installations and materials from damage until final acceptance by the OWNER/ENGINEER.

B. Prevent debris from entering into piping systems during installation.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Piping: Measurement for HDPE piping will be from, and including, the flex hose at the well heads to the inlet to the butterfly valve located at the inlet to the knockout pot on the Blower/Flare skid for each size of pipe. Measurement will include all trenching, pipe joining and installation, backfilling, compaction, testing, fittings, valves, grade boxes, and other appurtenances needed to complete the piping system as shown on the Contract Drawings.

B. Condensate Air Supply/Force Main Piping: Measurement for HDPE condensate and air supply piping installed outside the Blower/Flare Facility will include all trenching, pipe joining and installation, backfilling, compaction, testing, fittings, valves, grade boxes, and other appurtenances needed to complete the HDPE piping systems as shown on the Contract Drawings.

C. Encased Road Crossings: Measurement for encased road crossings will be by length of corrugated metal pipe in place, and will include all additional trenching, pipe installation, backfilling, compaction, testing, and other appurtenances needed to complete the above and below ground encased road crossings as shown on the Contract Drawings.

D. Flare Facility Piping: Measurement for providing and installing and piping, condensate piping, air piping, and propane piping shown within the Blower/Flare Facility shall be based on the lump sum price for furnishing all labor and materials for Equipment Complex piping, valves, and fittings.

4.02 PAYMENT

A. Piping: Payment for piping shall be based on the unit price quoted per linear foot in the Bid Schedule for each pipe size and constitutes full compensation for furnishing all labor, equipment, materials, and incidentals necessary to install the piping in accordance with the Contract Drawings, as specified, and as may otherwise be required.

B. Condensate Air Supply/Force Main Piping: Payment for piping shall be based on the unit price quoted per linear foot in the Bid Schedule and constitutes full compensation for furnishing all labor, equipment, materials, and incidentals necessary to install the HDPE piping in accordance with the Contract Drawings, as specified, and as may otherwise be required.

C. Encased Road Crossings: Payment for encased road crossings shall be based on the unit price quoted per linear foot in the Bid Schedule for "Road Crossings" and constitutes full compensation for all labor, equipment, materials, and installation in accordance with the Drawings.

D. Flare Facility Piping: Payment for Flare Facility Piping (piping, condensate piping, air piping, and propane piping) shown for the Equipment Complex shall be by the lump sum quoted in the Bid Schedule.

END OF SECTION

Appendix E

Activity Hazard Analysis

ACTIVITY HAZARD ANALYSIS
INSTALLATION OF EXTRACTION AND TREATMENT SYSTEM

Activity	Potential Hazards	Recommended Controls
• Mobilization/Demobilization	• Physical: Injury from heavy equipment; heavy lifting. Pinch points; slip, trip, and fall hazards.	• Train equipment operators. • Minimize work and personnel in vicinity of equipment. • Provide ergonomic training, institute good housekeeping procedures • Keep feet and hands clear of moving/suspended materials and equipment.
• UXO Clearing	• Potential encounter with UXO, animals, poisonous plants, snakes and insects. (Poison Oak prevalent)	• Use trained UXO personnel as needed. • Use proper UXO and avoidance procedures as provided in the BOEWP. • Use caution with wild animals; learn to recognize poisonous plants, wear insect repellant. • Wear PPE required by SSHO.
• Brush clearing	• Cuts, slashes, dismemberment • Potential encounter with animals, poisonous plants, snakes and insects. (Poison Oak prevalent)	• Keep personnel in area to a minimum • Use only trained equipment operators, • Wear required PPE, safety glasses, face shields. • Use caution with wild animals; learn to recognize poisonous plants, wear insect repellant.
• Chainsaw cutting	• Cuts, slashes, dismemberment, fire, noise • Potential encounter with animals, poisonous plants, snakes and insects. (Poison Oak prevalent)	• Use only chainsaws with automatic brakes and anti-kickback. • Wear proper PPE, chaps, safety glasses, face shields. • Wear appropriate hearing protection. • Follow manufacturer's safety instructions
• Loading/hauling operations	• Physical contact with moving equipment, flying debris, vehicle traffic, dust, noise. • Heavy lifting of pipes, fittings and/or equipment	• Use only trained operators. • Wear required PPE • Wear Hi-visibility safety vests, use spotter to guide operators when necessary • Secure and cover loads.
• Cutting/welding/installing HDPE pipe	• Fumes, burns, heavy lifting repetitive motion	• Inspect welding equipment daily for proper maintenance and operations • Observe ergonomic precautions regarding lifting and repetitive motion • Wear proper PPE

ACTIVITY HAZARD ANALYSIS
INSTALLATION OF EXTRACTION AND TREATMENT SYSTEM

Activity	Potential Hazards	Recommended Controls
• Drilling Operations • Changing flights	• Contact with heavy equipment, underground utility lines, vehicle traffic, noise • Pinch points and fall hazards • Inhalation exposure to VOCs and other gases • Strains, sprains, slips, fall, injured hands, dropped equipment. • Dermal contact with contaminated soils • Loose clothing.	• Inspect equipment daily for safe operation • Minimize personnel in area of operating equipment • Conduct checks for underground utilities prior to set up and use. Pothole by hand to 5 ft prior to drilling. • Wear proper PPE assigned by the SSHO. • Periodically monitor/test the atmosphere to make sure vapors are not collecting on the ground at unsafe levels • Observe all drilling precautions.
• Installing extraction wells and monitoring probes	• Dermal contact with contaminated soils • Inhalation exposure to VOCs and other gases • Inhalation of cement and silica dust.	• Minimize personnel in area of operating equipment • Periodically monitor/test the atmosphere to make sure vapors are not collecting on the ground at unsafe levels • Avoid breathing of dust • Wear PPE required by SSHO
• Heavy equipment operation (forklift/crane/backhoe/ trenching equipment)	• Physical contact with equipment • Training.	• Inspect equipment daily for safe operation • Use only trained operators (certified) • Minimize personnel in area of operating equipment
• Fueling	• Fire, exposure to fuel vapors	• Only UL/FM-approved safety cans shall be used to store fuel • Do not fuel equipment while it is operating • Fire extinguishers shall be readily available • Stand upwind during fueling • Do not fuel near any ignition source.
• Trenching	• Physical contact with equipment • Uneven terrain • Trench failure	• Conduct checks for u/g utilities prior to set up and use. Pothole by hand to depth of trench every 50 ft or less. • Assess any uneven terrain for proper equipment support • Minimize personnel in area of trench and equipment • Wear proper PPE and Hi-visibility safety vests assigned by the SSHO.

ACTIVITY HAZARD ANALYSIS
INSTALLATION OF EXTRACTION AND TREATMENT SYSTEM

Activity	Potential Hazards	Recommended Controls
• Constructing pad and setting up treatment system	• Physical: Injury from heavy equipment; heavy lifting. Pinch points; slip, trip, and fall hazards.	• Train equipment operators. • Minimize work and personnel in vicinity of equipment. • Conduct checks for underground utilities prior to construction and set up. • Provide ergonomic training, institute good housekeeping procedures • Keep feet and hands clear of moving/suspended materials and equipment.
• Installing electrical components	• Fire, explosion hazards, electrocution	• Implement lockout/tagout procedures • Work to be conducted by qualified/certified electrician • Work and materials will conform to the latest rules of the National Board of Fire Underwriters' Code, regulations of the State Fire Marshal, and applicable local and state codes.
• Decontamination/Pressure washing/Steam cleaning	• Dermal contact with contaminated soils and water • Physical contact with pressurized streams (injection hazard) • Physical contact with hot water/steam/objects • Burns and flying debris	• Wear appropriate PPE; follow SOP for decontamination procedures • PPE may include face shields, chemical resistant coveralls, latex or nitrile gloves • Stage equipment for decontamination securely • Separate contaminated and decontaminated equipment into the proper zones. Cleaned equipment shall not be stored in the EZ or CRZ. • Decontamination stations shall be located at least 10 feet or more from operating equipment.

ACTIVITY HAZARD ANALYSIS
INSTALLATION OF EXTRACTION AND TREATMENT SYSTEM

PPE TO BE USED	MONITORING REQUIREMENTS	OTHER REQUIREMENTS
• Level D PPE • Street clothes or coveralls, Steel-toed work boots (except UXO personnel), Safety glasses, Hearing protection (if necessary), Hardhat, Leather gloves	• Periodically monitor/test the atmosphere to make sure vapors are not collecting on the ground at unsafe levels.	• Meet training requirements below • If additional skin protection from poisonous plants or potentially contaminated water is required, then upgrade to Modified Level B • Upgrade to Level C if monitoring shows the presence of VOCs or other gases above action limits
• Modified Level D PPE • Same as Level D with the addition of Tyvek™ coveralls with elastic wrists and ankles, nitrile gloves (inner), splash shield (if necessary).	• Periodically monitor/test the atmosphere to make sure vapors are not collecting on the ground at unsafe levels.	• Upgrade to Level C if monitoring shows the presence of VOCs or other gases above action limits
• Level C PPE • Same as Modified Level D with the addition of a full faced APR.	• Periodically monitor/test the atmosphere to make sure vapors are not collecting on the ground at unsafe levels. • Monitor for heat and cold stress	• Medically cleared and certified to wear a respirator and trained in the proper use and care of respirators

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Drill rigs • Backhoes, crane, forklift, trencher • HDPE Fusion cutter/fusion machine • Chain saws • Compressors • Hydrostatic testers • Blower • Water truck • Fire extinguishers • Traffic cones • Delineators • Signs • Barricades • Radios • Hand tools • High pressure washers • Steam cleaners • First Aid Kits • Eyewash Stations	• Pre-maintenance checks of equipment and documented inspection check off lists. • Proper registrations and certifications for equipment and equipment operators. • Proper certifications of workers on the site. • Underground utility inspections. • Daily inspection of the project site by the site superintendent.	• 40 hour HAZWOPER trained • Additional 8 hours Supervisor training. • 3 days of supervised hazardous waste site experience. • Bloodborne pathogens training • First-aid/CPR (2 individuals on site) • Mobilization and site-specific orientation. • Tailgate Safety Meetings • Hazard communication • Instruction on Manufacturer's safety requirements for equipment assigned, • Training on specific jobs, tools or equipment. • Competent person for trenching and excavation

ACTIVITY HAZARD ANALYSIS
SAMPLING OF MONITORING PROBES AND EXTRACTION WELLS

Activity	Potential Hazards	Recommended Controls
• Mobilizing and equipment staging	• Pinch points; slip, trip and fall hazards • Biological hazards, insects, snakes, animals and poison oak • Heavy lifting • Fire.	• Good housekeeping practices shall be performed. • Keep work areas picked up and clean as feasible. • Use proper PPE • Avoidance procedures in SSHP • Use proper lifting techniques • Lifts greater than 60 pounds require assistance or mechanical equipment; size up the lift • Fire extinguishers shall be readily accessible and maintained.
• Purging and sampling	• Inhalation exposure to VOCs and other gases • Potential encounter with insects (e.g. spiders) that have made homes inside the protective casing and vaults. • Contact with potentially contaminated materials and gas	• Stay upwind when opening protective casing and vaults • Test the atmosphere before purging and sampling to make sure vapors are not at unsafe levels • Wear PPE assigned by the SSHO. Upgrade PPE when directed by SSHO • Perform remote venting during purging • Wear nitrile gloves during purging and sampling • Inspect protective casing and vaults for insects • Proper decontamination procedures shall be followed • Label all containers.
• Moving and shipping collected samples	• Heavy lifting • Slip, trip and fall hazards	• Use proper lifting techniques • Lifts greater than 60 pounds require assistance or mechanical equipment; size up the lift • Good housekeeping practices shall be performed • Keep work areas picked up and clean as feasible • Label all containers • Store collected sample containers in secure area.

ACTIVITY HAZARD ANALYSIS
SAMPLING OF MONITORING PROBES AND EXTRACTION WELLS

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Hand tools, radios • Level D PPE (hardhat, safety vest, safety glasses, steel toed boots, hearing protection) • Sampling equipment (probes, collection pipe/tube, sampling pump and sample containers) • Project vehicle.	• Equipment calibration • Pre-maintenance • Visual prior to use • Post-maintenance.	• Hazardous waste operations (40 hour and 8 hour refresher training) • Hazard communication training • Site safety orientation • Daily tailgate safety meeting.

ACTIVITY HAZARD ANALYSIS
TRENCHING/EXCAVATION

Activity	Potential Hazards	Recommended Controls
• Mobilization/Demobilization	• Physical; Injury from heavy equipment; heavy lifting • Pinch points; slip, trip and fall hazards	• Train equipment operators. Minimize work and personnel in vicinity of equipment. Provide ergonomic training • Institute good housekeeping procedures; keep feet and hands clear of moving/suspended materials and equipment.
• Heavy Equipment Operations	• Contact with heavy equipment, vehicle traffic, overhead utility lines, underground utilities • Potential UXO encounters	• Inspect equipment daily for safe operating conditions. Do not use faulty equipment. Minimize personnel in area of equipment use • Use positive shut down means for repairs, manual lubrications, securing attachments and/or refueling operations. Lockout/tagout if necessary • Getting on or off equipment while it is in motion is prohibited. Do not permit equipment to operate unattended • Use UXO clearance/escort prior to and during heavy equipment operations.
• Clearing/Grubbing	• Cuts, slashes, dismemberment, fire	• Use only chainsaws with an automatic brake and anti-kick back. Chain shall not move when the engine is idling. Turn chainsaw off while walking through heavy brush, wet surfaces, and when adjacent to other personnel. Inspect equipment before use. • Operators will wear proper PPE (i.e, eye, ear, hand, foot, safety shoes); leg protection required as a minimum • Hold the saw with both hands during cutting; never use to cut above the operators shoulder height. Use only trained personnel.
• Excavation Operations (Manual)	• Burn/Shock hazard	• Personnel will wear approved electrical safety equipment while performing shoveling tasks • Qualified electrician shall perform an inspection on the

ACTIVITY HAZARD ANALYSIS
TRENCHING/EXCAVATION

Activity	Potential Hazards	Recommended Controls
	• Falling into trench and trench collapses	integrity of all energized lines to assure of it safety for workers • PG&E will be on standby to shut down energy in the event of an emergency • The Program CIH shall be onsite to oversee activity • Personnel will stay clear of the excavation. Nobody shall be allowed to enter the excavation • Store spoils a minimum of 4 feet away from excavation edge. Excavations greater than 4 feet shall use sloping or benching, etc. • Shoring shall be utilized for excavation deeper than 5 feet in depth.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
• Vehicles • Fire extinguishers, First aid kits • Blocking, bracing and shoring materials • Manual hand tools • Mechanized equipment • Geophysical instrumentation • Personal Protective Equipment (PPE) • Communications equipment	• Daily preventative maintenance and operational checks • First aid kits and fire extinguishers • Daily trench and excavation inspections	• 40-hour qualification per 29 CFR 1910.120 • 8-hour refresher training • UXO personnel EOD training • Tailgate safety meetings • Site-specific orientation • Lead awareness training • Poison oak awareness training • Trench and excavation competent person

Appendix F

Vendor Submittals

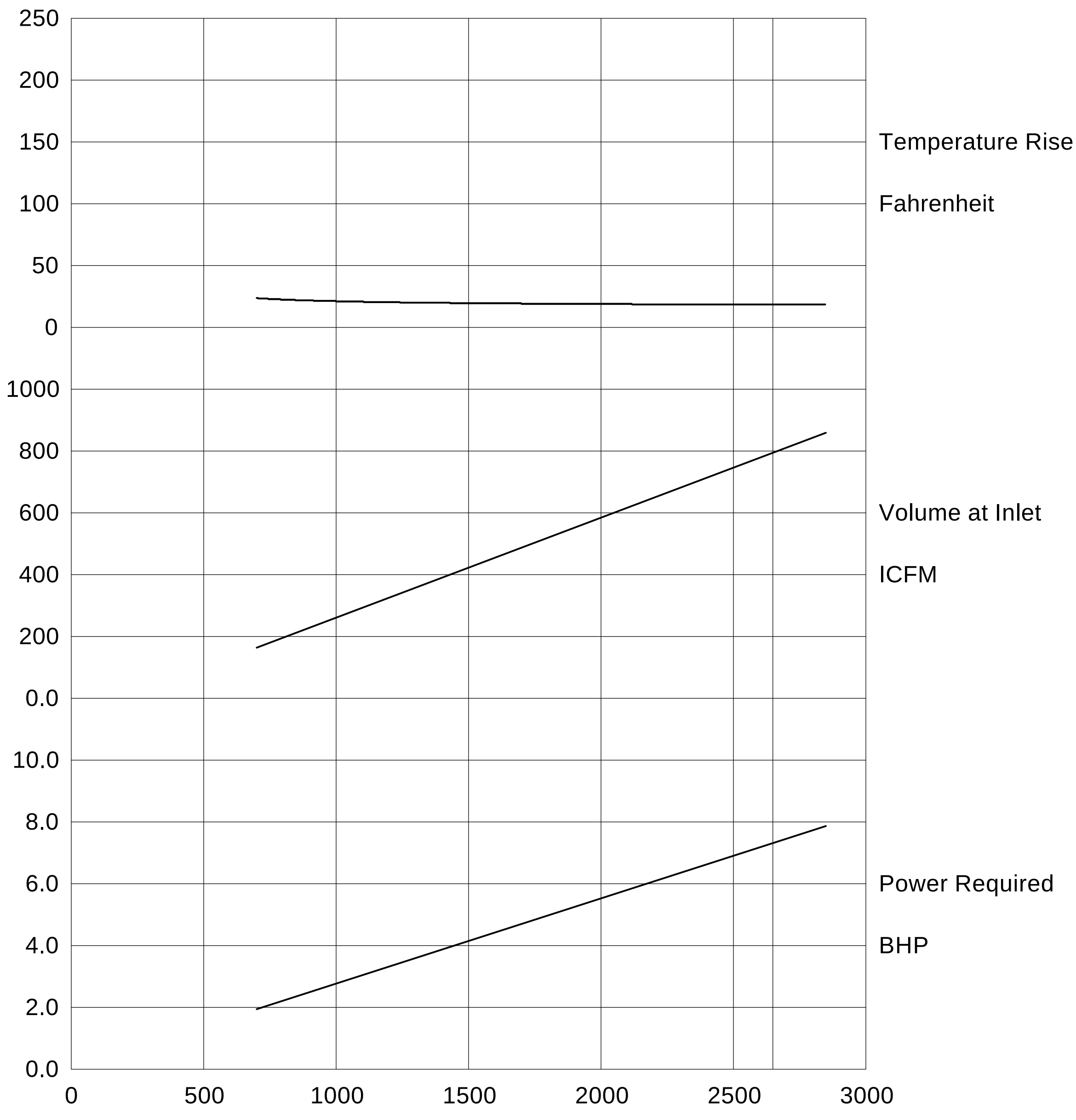
TUTHILL
Vacuum & Blower Systems

Date: 3/1/2004

Factory Offices
Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel: (417) 865-8715 Toll Free: (800) 825-6937
Fax: (417) 865-2950
blowerxpert@tuthill.com

Normal Condition Performance Curve for 5009-21L2

Reference/Quote:

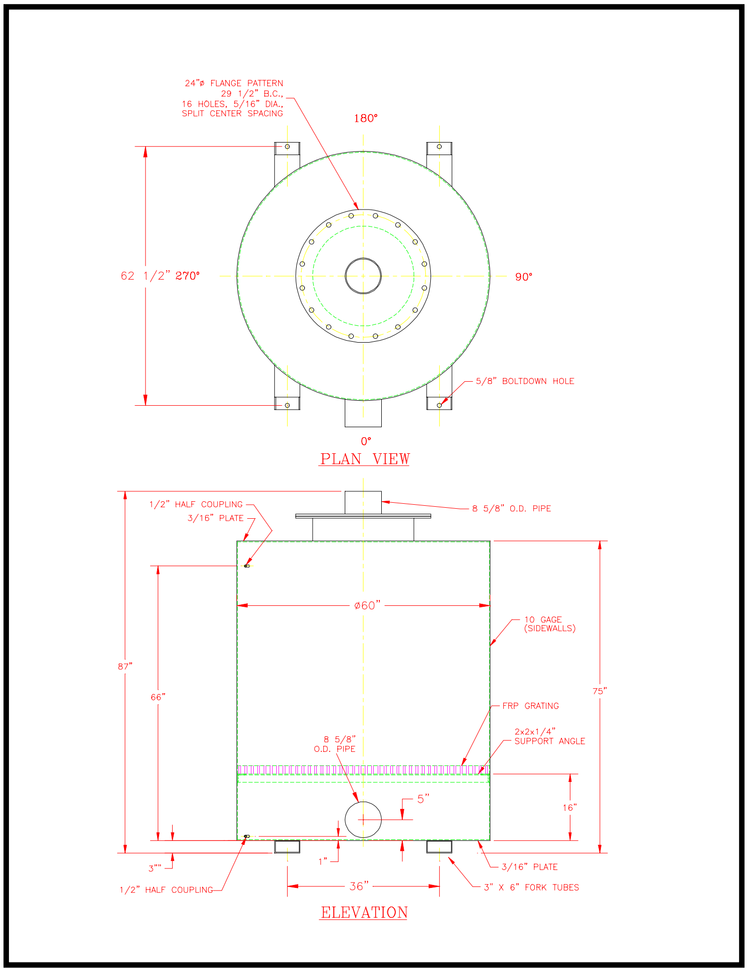


Performance Curve Based Upon The Conditions Of:

Displacement	0.323 CFR
Atmospheric Pressure:	14.7 PSIA
Elevation:	0 Feet
Gas:	AIR
Inlet Temperature	70 Fahrenheit
Molecular Weight	28.966
K Value	1.398
Inlet Pressure	47.65 in. H20 vac
Discharge Pressure	0.5522 PSIG (includes 0.252 PSI silencer loss)

GAS PHASE CARBON ADSORBERS

GPC 20R



Specifications

Dimensions: 5'ODx7'2"H
Bed Area:: 19.63 sq. ft.
Flow Range: 200-1800 cfm
Carbon Capacity: 2,000 lbs
Fittings: 8 5/8" nozzle,
(2) 1/2" half couplings,
24" access port

Empty Weight: 1,200 lbs
Operating Weight: 3,200 lbs

Inlet Ports:
Discharge Stacks
(Optional)

Options: Carbon
Hose Kits

CARBONAIR®
ENVIRONMENTAL SYSTEMS

MINNESOTA: (corp hdqrtrs)
Carbonair
2731 Nevada Ave. N.
New Hope, MN 55427
PH:800-526-4999
763-544-2154
FAX:763-544-2151
Homepage: www.carbonair.com

FLORIDA:
Carbonair
2603 NW 74th Place
Gainesville, FL 32653
PH:800-241-7833
352-376-9528
FAX:352-373-4971

VIRGINIA:
Carbonair
761 Union Street
Salem, VA 24153
PH:800-204-0324
540-387-0540
FAX:540-389-6860

TEXAS:
Carbonair
4105 Hunter Rd. #10
San Marcos, TX 78666
PH:800-893-5937
512-392-0085
FAX:512-392-0066

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE *(Read Instructions on the reverse side prior to initiating this form)*	DATE March 15, 2004	TRANSMITTAL NO.: 005

Section I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This Section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE:
Doug Stanley U.S. Army Corps of Engineers 1325 "J" Street Sacramento, CA 95814-2922	Peter Kelsall Shaw Environmental, Inc. P.O. Box 1698 Marina, CA 93933-1698	DACW05-96-D-0011 T.O. # 011 WAD # 12	X THIS IS A NEW TRANSMITTAL THIS IS A RESUBMITTAL OF TRANSMITTAL

SPECIFICATION NO. (Cover only one section with each transmittal)	PROJECT TITLE AND LOCATION: FORMER FORT ORD, CALIFORNIA

ITEM NO a.	DESCRIPTION OF ITEM SUBMITTED *(Type, size, model number, etc.)* b.	MFG. OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. *(See Instruction No. 8)* c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT SPEC. PARA. NO. e.	CONTRACT REFERENCE DOCUMENT DRAWING SHEET NO. f.	FOR CONTRACTOR USE CODE g.	VARIATION *(See Instruction No. 6)* h.	FOR C E USE CODE i.
003	Final Work Plan and Sampling and Analysis Plan, Pilot Soil Vapor Extraction and Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California, Revision 0 (For Your Information Only)	N/A	30	SOP17		A		
004	DRF for the Final Work Plan and Sampling and Analysis Plan, Pilot Soil Vapor Extraction and Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California, Revision 0 (For Your Information Only)	N/A	30	SOP17		F		

REMARKS
cc:
See
Distribution List

CONTRACTOR QUALITY CONTROL SYSTEMS MANAGER
Shaw Environmental, Inc.
✓ Approved
________ Approved with corrections as noted on submittal data and/or attached sheet(s).

SIGNATURE: Signature on File
TITLE: CONTRACTOR QUALITY CONTROL SYSTEM MANAGER

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

Shaw Environmental, Inc.

Signature on File /PETER KELSALL
NAME AND SIGNATURE OF CONTRACTOR

Section II - APPROVAL ACTION

ENCLOSURES RETURNED (List by Item No.)	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

Shaw Environmental, Inc.

DOCUMENT REVIEW AND RELEASE FORM

Client: USACE	Authors: Shaw Environmental, Inc.	Submittal Register Item No.: 004	Date: March 15, 2004

Document Title:	Final Work Plan and Sampling and Analysis Plan, Pilot Soil Vapor Extraction and Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California	Revision: 0	T.O. # 011	WAD# 12

Reviewer (*print*)	Reviewer Initial & Date	Technical	Project Manager	CQC	Health and Safety Manager	Task Manager	Chemistry	UXO	Construction	Reviewer Comments Resolved (*Signature & Date)*
Peter Kelsall			X							Signature on File
Tom Ghigliotto				X						Signature on File
Eric Schmidt							X			
Same as Technical Reviewer above		X	Topic outline with objectives for each section submitted prior to Rev. A							

Program Reviewer's Acceptance for Document Submittal	Signature	Yes	No
1) A 4025 (as applicable) prepared and submitted with document?	Signature on File	X	
2) Technical Conclusions adequately supported by text and data?	Signature on File	X	
3) Tables and Figures are in the proper format and checked and approved?	Signature on File	X	
4) The Table of Contents consistent with text information?	Signature on File	X	
5) Technical Reviewers are qualified and accepted by Project Manager?	Signature on File	X	
6) A document Distribution List been prepared and submitted with document?	Signature on File	X	

Recommended
4025 Code A

Signature on File
Project Manager

Signature on File
Contractor Quality Control Systems Manager

FORT ORD

DISTRIBUTION LIST FOR: **Final Work Plan and Sampling and Analysis Plan, Pilot Soil Vapor Extraction and Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California, Revision 0**

No. of CDs	No. of Paper	Name	Company	Address	City and State	Zip Code	Controlled Yes or No
1		Doug Stanley	Department of the Army, USACE	1325 "J" Street	Sacramento, CA	95814-2922	Yes
1		Derek Lieberman	Department of the Army, USACE	BRAC, Bldg. #4463 Gigling Road	Monterey, CA	93944-5004	Yes
1		Dave Eisen	Department of the Army, USACE	BRAC, Bldg. #4463 Gigling Road	Monterey, CA	93944-5004	Yes
1		Fred Hart	Department of the Army, USACE	1325 "J" Street	Sacramento, CA	95814-2922	Yes
1		Glen Mitchell	Department of the Army, USACE	1325 "J" Street	Sacramento, CA	95814-2922	Yes
	1	Marc Edwards	Department of the Army, USACE	Project Office	Presidio of Monterey, CA	95814-2922	Yes
	1	Mellissa Hlebasko	Department of the Army	BRAC, Bldg. #4463 Gigling Road	Monterey, CA	93944-5004	Yes
	1	Gail Youngblood	DENR	BRAC, Bldg. #4463 Gigling Road	Monterey, CA	93944-5004	Yes
1		Eric Schmidt	Shaw Environmental, Inc.	3001 Concord Court	Marina, CA	93933	No
	1	Jen Moser/ Tom Ghigliotto	Shaw Environmental, Inc.	PO Box 1698	Marina, CA	93933	Yes
1	1	Ed Ticken	Mactec	5341 Old Redwood Hwy; Suite 300	Petaluma, CA	94954	No
	1	John Christopher	California Department of Toxic Substances Control	8800 California Center Drive	Sacramento, CA	95826	Yes
	1	Roman Racca	California Department of Toxic Substances Control	8800 California Center Drive	Sacramento, CA	95826	Yes
	1	Grant Himebaugh	California Regional Water Quality Control Board	81 Higuera Street, Suite 200	San Luis Obispo, CA	93401-5414	No
	1	Jeff Raines	Tech Law, Inc.	90 New Montgomery Street; Suite 1010	San Francisco, CA	94105	No
	1	John Chesnutt	U.S. Environmental Protection Agency	75 Hawthorne Street, Mail SFD-8-3	San Francisco, CA	94105	Yes
1		Tom Kellogg	Department of the Army, USACE	1325 "J" Street	Sacramento, CA	95814-2922	Yes

FORT ORD

DISTRIBUTION LIST FOR: **Final Work Plan and Sampling and Analysis Plan, Pilot Soil Vapor Extraction and Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California, Revision 0**

No. of CDs	No. of Paper	Name	Company	Address	City and State	Zip Code	Controlled Yes or No
	3	Mary Bakan	Administrative Records	BRAC, Bldg #4463 Gigling Road	Monterey, CA	93944-5004	No
1		Sandy Reese	Administrative Records	BRAC, Bldg #4463 Gigling Road	Monterey, CA	93944-5004	No
	1	LeVonne Stone	Environmental Justice Network	P.O. Box 361	Marina, CA	93933	No
	1	Christine Bettencourt	Temple Health/Life 2000	PO Box 1852	Greenfield, CA	93921	No
1		Curt Gandy	Fort Ord Toxic Project	PO Box 1904	Monterey, CA	93942	No
	1	Mike Weaver		52 Corral De Tierra Road	Salinas, CA	93908	No
	1	Nat Rojanasathira		802 Sunset Drive; Apt G	Pacific Grove, CA	93950	No
1	1	Project File	Shaw Environmental, Inc.	PO Box 1698	Marina, CA	93933	Yes
1		Program File (Kathy Grider)	Shaw Environmental, Inc.	4005 Port Chicago Highway	Concord, CA	94520-1120	Yes
12	18						

Approved: Signature on File
Glen Mitchell, USACE
Project Manager

Shaw Environmental, Inc.

Field Work Variance No.	TII-077
Page 1	of 2

FIELD WORK VARIANCE

Project Name/Number	Fort Ord / 783751	CTO/WAD	12
Applicable Document	Final Work Plan And Sampling And Analysis Plan, Pilot Soil Vapor Extraction And Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California, March 2004, Revision 0	Date	May 18, 2004

Problem Description:

The sampling and analytical schedule provided in Table 6-2 requires revision. The soil vapor extraction system has currently been in operation for 6 weeks. Based on the preliminary results received to date, the CT concentrations in the interior of the original soil gas plume have been reduced significantly (see attached figure). At this stage, additional probe data from the interior of the plume are not needed. Additional information from perimeter probes is needed to show that CT concentrations in the outer parts of the plume have also been reduced significantly. Subject to confirmation from these perimeter probes, it appears that it will be appropriate to shut down the system after approx. 2 months of operation when the carbon tetrachloride (CT) concentration in the influent will approach 1 ppbv.

Recommended solution:

Table 6-2 has been revised (attached) to combine the original “months 1 and 2” sampling periods as “week 6”, and bring forward the original “month 3” to “month 2”.

“Week 6” sampling will include the deep and shallow probes at the following perimeter probe locations (CTP SGP 51 through 60; excluding 55). The intermediate probes are not needed because data can be extrapolated from the deep and shallow probes. The shallow and interior probes specified for months 1 and 2 in the original schedule (CTP SGP 35, 37, 48, 49, 50, 61, and 62) will not be sampled during this revised round of sampling.

The week 6 sampling will occur approximately May 18, 2004. The system will be operated until the data are received and evaluated, approximately June 3. The system will then be shut down and the month 2 sampling will be conduced the week of June 7. The probes to be included in the month 2 sampling will be determined based on the data and may be revised by an additional FWV.

The original months 1 and 2 sampling of the extraction wells will be combined for one sampling round in week 6. Also, since there has been no evidence of breakthrough at the granulated activated carbon units, and CT concentrations have been reduced significantly, the effluent sample will be cancelled in the week 6 sampling.

Impact on present and completed work:

Due to the successful SVE performance the data required for the RI/FS can be provided with approx. 13 fewer samples, with resulting cost savings.

Requested by:

Eric Schmidt

Recommended solution/disposition:

Clarification ☐ Minor Change ☒ Major Change ☐

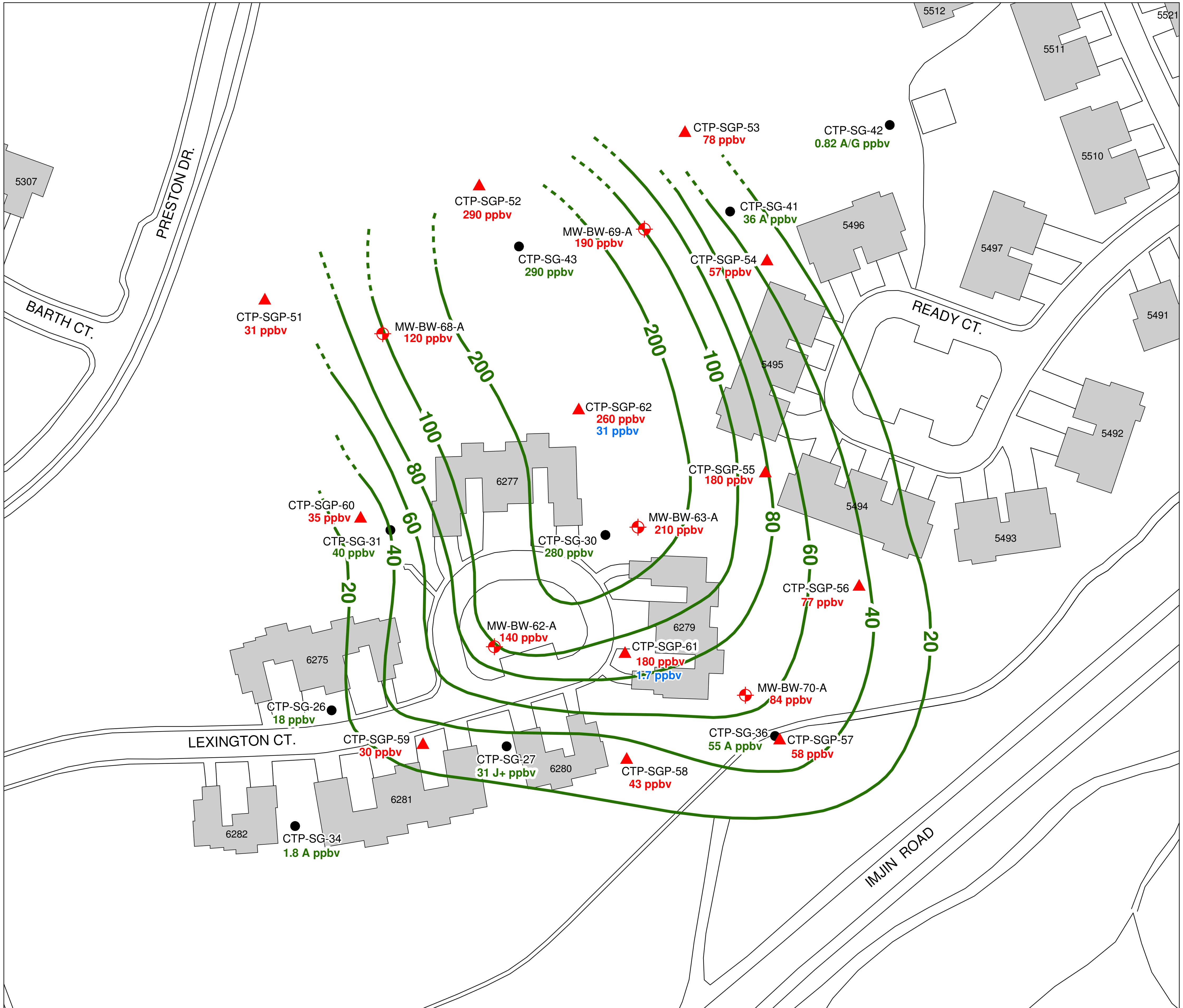
Signature ____________________ Date __________

Technical Reviewer

Shaw® Shaw Environmental, Inc.

Shaw Approvals:				*If Major Change:*			
Signature	*Project/Task Manager*	Date		Signature	*Sr. Project Manager*	Date	
Signature	*Project QC System Manager*	Date					

USACE Approval:				*If Major Change:*			
Approved	☐	Rejected	☐	Signature	*USACE COR or TM*	Date	



LEGEND

- SVE WELL
- DEEP (85 FT.) MONITORING PROBE
- SOIL GAS SAMPLE LOCATION
- 31 ppbv — CARBON TETRACHLORIDE CONCENTRATION APRIL 2004
- 35 ppbv — CARBON TETRACHLORIDE CONCENTRATION MARCH 2004
- 18 ppbv — CARBON TETRACHLORIDE CONCENTRATION MARCH-JUNE 2003
- CARBON TETRACHLORIDE CONCENTRATION CONTOURS BELOW 66 FT. DEPTH (ppbv); DASHED WHERE INFERRED
- BUILDING

NOTES:

1. April Carbon Tetrachloride concentrations measured 4/28/04.
2. March Carbon Tetrachloride concentrations measured between 3/29/04 and 3/31/04.
3. A, A/G, and J+ are laboratory qualifiers.
4. Carbon Tetrachloride concentration contours provided by Mactec and based on data collected March to July 2003.

N

0 100 200 FEET

REVISION	DATE	DESCRIPTION	CHKD	APPR

Shaw® Shaw Environmental, Inc.

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

DESIGNED: E. SCHMIDT
DRAWN: K. BLACK
CHECKED: P. KELSALL

Figure __
CARBON TETRACHLORIDE CONCENTRATIONS
DEEP MONITORING PROBES
OPERABLE UNIT CARBON TETRACHLORIDE
Former Fort Ord, California

SUBMITTED: DATE
SCALE: SPEC. No.
SHEET
FILE No. CTdeep_1Q04+2003.mxd

Table 6-2
Performance Monitoring Volatile Organic Compound Sampling Schedule
Revised for FWV 077

Sampling Location		Phase 1 Operation									Optional 6 Month System Operation			
		Baseline	Week 1					Week 2	Week 6	Month 2	Months 4-5	Month 6	Months 7-8	Month 9
Extraction Wells	MW-BW-62-A	1						1	1	1		1		1
	MW-BW-63-A	1						1	1	1		1		1
	MW-BW-68-A	1						1	1	1		1		1
	MW-BW-69-A	1						1	1	1		1		1
	MW-BW-70-A	1						1	1	1		1		1
Monitoring Probes	Interior													
	CTP-SGP-61	3						3		3		3		3
	CTP-SGP-62	3						3		3		3		3
	Perimeter													
	CTP-SGP-51	3							2	3				3
	CTP-SGP-52	3							2	3		3		3
	CTP-SGP-53	3							2	3				3
	CTP-SGP-54	3							2	3				3
	CTP-SGP-55	3								3		3		3
	CTP-SGP-56	3							2	3				3
	CTP-SGP-57	3							2	3				3
	CTP-SGP-58	3							2	3		3		3
	CTP-SGP-59	3							2	3				3
	CTP-SGP-60	3							2	3		3		3
	Shallow													
	CTP-SGP-35	1								1				1
	CTP-SGP-37	1						1		1		1		1
	CTP-SGP-48	1						1		1		1		1
	6277 Lexington Court													
	CTP-SGP-49 (Sub-Slab)							1		1		1		1
	CTP-SGP-50 (Exterior)							1		1		1		1
	Sub-total	44	0	0	0	0	0	15	23	46	0	27	0	46

Sampling Location		Phase 1 Operation									Optional 6 Month System Operation			
			Week 1					Week 2	Week 6	Month 2	Months 4-5	Month 6	Months 7-8	Month 9
		Baseline	**Day 1 (24-hour)**	Day 2	**Day 3 (24-hour)**	Day 4	Day 5							
Soil Vapor Treatment System	Influent	na	**1**	1	**1**	1	1	na	1	1	2	1	2	1
	Lead Carbon Vessel	na	**1**					na	1	1	2	1	2	1
	Effluent	na	**1**	1	**1**	1	1	na		1	2	1	2	1
	Sub-total	0	3	2	2	2	2	0	2	3	6	3	6	3

Total Samples	44	3	2	2	2	2	15	25	49	6	30	6	49

3 MONTH OPERATION	
TOTAL GAS SAMPLES =	144
FIELD DUPLICATES =	9
CUMULATIVE TOTAL =	153
OPTIONAL 6 MONTH OPERATION	
TOTAL GAS SAMPLES =	91
FIELD DUPLICATES =	5
CUMULATIVE TOTAL =	96

Shaw® Shaw Environmental, Inc.

Field Work Variance No.	TII-082
Page 1 of	2

FIELD WORK VARIANCE

Project Name/Number	Fort Ord / 783751	CTO/WAD	12
Applicable Document	Final Work Plan And Sampling And Analysis Plan, Pilot Soil Vapor Extraction And Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California, March 2004	Date	August 5, 2004

Problem Description:

1. A data gap exists at the northern end of the soil gas carbon tetrachloride plume (CTP). Additional probes are required to be able to determine if the SVE is complete in this area.
2. There is no data to evaluate if elevated soil gas concentrations may exist at depth immediately above the A-aquifer in areas where the CT concentration in groundwater is higher than observed in the SVE area.

Recommended solution:

1. Install three additional nested probes along the projected northern extent of the soil gas CTP. These probes will be drilled near Lexington Court approximately 200 feet north of the existing soil gas probes to further define the northern extent of the soil vapor plume. 2. A fourth probe will be drilled approximately 1000 feet north of the soil gas CTP to evaluate the presence of elevated soil gas concentrations at depth immediately above the A-aquifer. This probe is located near Preston Road where the CT concentration in groundwater is approximately 10 ppbv.

Figure 1 shows the location of the four monitoring probes. The probes will consist of three nested probes installed at approximate depths of 85, 60, and 30 ft bgs. The probes will be constructed following specifications presented in the Work Plan with ¾-in. diameter Schedule 40 PVC casing and screen. The bottom 5 ft of each probe will be constructed with a 0.125 (1/8 in.)-slotted Schedule 40 PVC well screen. The annulus surrounding the well screens will be backfilled with 3/8-in. crushed or natural washed pea gravel The probes will be equipped with sampling port assemblies to allow for the collection of induced vacuum measurements and soil vapor samples during system operation. A 12-in diameter stovepipe will be installed on each nested monitoring probe.

Collect one round of soil gas samples from each probe at the three locations near Lexington Court (9 total) and one from the deep probe in Preston Road. Samples will analyzed by the laboratory on standard TAT for EPA Method TO15 (TCE, PCE, Chloroform, & CT only).

Impact on present and completed work:

The additional data will close the contours on the northeastern end of the soil gas CTP and provide data to determine the need for additional SVE. Costs are presented in WVN 207.

Requested by: Jen Moser

Recommended solution/disposition:

Implemented as recommended above.

Clarification ☐ Minor Change ☐ Major Change ☒

Signature ____________ Date ________

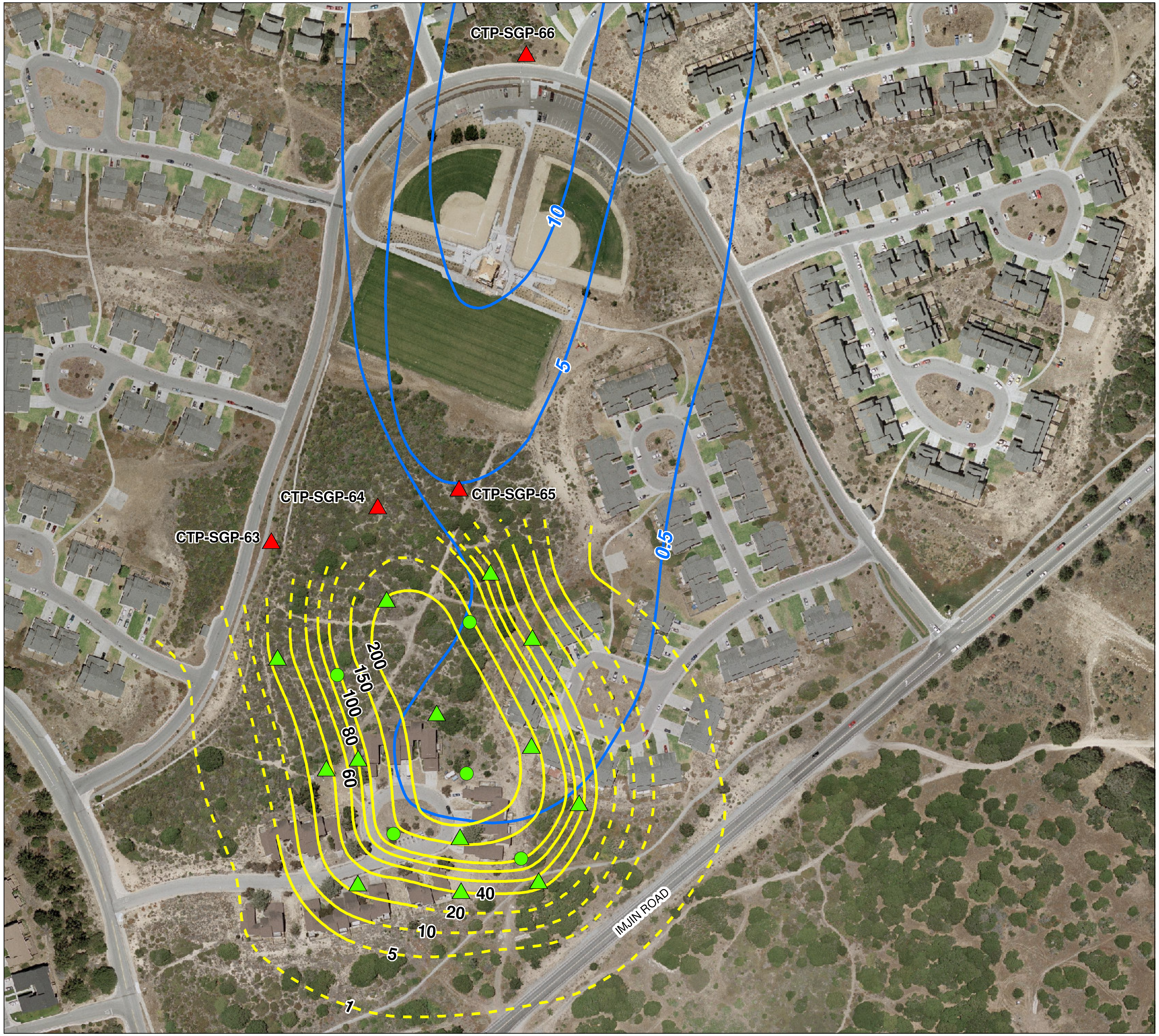
Technical Reviewer

Shaw Approvals: *If Major Change:*

Signature	______ *Project/Task Manager*	Date	______	Signature	______ *Sr. Project Manager*	Date	______
Signature	______ *Project QC System Manager*	Date	______				

USACE Approval: *If Major Change:*

Approved ☐ Rejected ☐ Signature ______ *USACE COR or TM* Date ______



LEGEND

- SOIL VAPOR EXTRACTION WELL
- EXISTING NESTED SOIL VAPOR MONITORING PROBE (30, 60, AND 85 FT. BGS)
- PROPOSED NESTED SOIL VAPOR MONITORING PROBE (30, 60, AND 85 FT. BGS)
- SOIL GAS CARBON TETRACHLORIDE CONCENTRATION CONTOURS AT 85 FT. DEPTH (ppbv); DASHED WHERE INFERRED
- A-AQUIFER CARBON TETRACHLORIDE CONCENTRATION CONTOURS (ppbv)

NOTES:

1. Soil gas concentrations existing prior to soil vapor extraction.
2. Groundwater Carbon Tetrachloride concentration contours provided by Mactec and based on data collected December 2003.

REVISION	DATE	DESCRIPTION	CHKD	APPR

Shaw Shaw Environmental, Inc.

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

DESIGNED: T. GHIGLIOTTO
DRAWN: K. BLACK
CHECKED: P. KELSALL

Figure 1
ADDITIONAL MONITORING PROBES OPERABLE UNIT CARBON TETRACHLORIDE PLUME
Former Fort Ord, California

SUBMITTED: DATE SCALE: SPEC. No. SHEET FILE No. Proposed_Probes.mxd

Shaw Environmental, Inc.

FIELD WORK VARIANCE

Project Name/Number	Fort Ord / 783751	CTO/WAD	12
Applicable Document	Final Work Plan and Sampling and Analysis Plan, Pilot Soil Vapor Extraction and Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California, March 2004	Date	Sept. 9, 2004

Problem Description:

Table 6-2 of the work plan proposed a set number of samples to be collected for Phase II operation of the Carbon Tetrachloride Soil Vapor Extraction system (CT SVE). At the time the original plan was prepared it was assumed that Phase II operation would be 6 months with probe sampling conducted after months 3 and 6. The CT SVE was operated from April to June 14, 2004 (Phase I). The system was then shut down because the CT concentrations had been reduced to low levels. Since shutdown, 3 rounds of sampling have occurred at two of the deep probes (SGP-55 and 62) to evaluate whether any rebound of VOCs is occurring. This FWV presents a revised plan for Phase II sampling based on evaluation of the Phase 1 data. It incorporates the rebound sampling already conducted, as well as additional sampling in 3 additional probes that were installed north of the original probes in accordance with FWV 82.

Recommended solution:

The CT SVE system will be operated (Phase II) for a period of approximately 1 month. At the end of this time, the performance of the pilot SVE system will be evaluated. This evaluation will determine whether the operation period may continue at the direction of the Army until either: a) cleanup levels have been attained, or b) the removal of volatile organic compounds from the soils is low and continued operation of the system is not cost effective.

The new sampling schedule presented in the attached revised Table 6-2 will be implemented for Phase II. Data will be collected before the SVE is restarted to provide additional evidence for rebound while the system was shut down, during Phase II, and at the completion of one month operation. The selection of certain probes is based on: 1) the concentrations of volatile organic compounds (VOCs) at the initial baseline; 2) physical location in the CTP; and 3) the concentration of VOCs after Phase 1 operations were completed.

Impact on present and completed work:

No impact on other work. The analytical cost is approximately the same as approved for Phase II operations.

Requested by: Eric Schmidt

Recommended solution/disposition: Implemented as recommended above.

Clarification ☐ Minor Change ☒ Major Change ☐

Signature ____________ Date ________

Technical Reviewer

Shaw Approvals: *If Major Change:*

Signature ____________ Date ________ Signature ____________ Date ________

Project/Task Manager *Sr. Project Manager*

Signature ____________ Date ________

Project QC System Manager

USACE Approval: *If Major Change:*

Approved ☐ Rejected ☐ Signature ____________ Date ________

USACE COR or TM

Table 6-2
Performance Monitoring Volatile Organic Compound Sampling Schedule

	Sampling Location	Phase 1 Operation											Phase 2 Operation				
		3/25 - 4/1/2004	**4/6/2004**	**4/7/2004**	**4/13/2004**	**4/16/2004**	**4/27/2004**	**4/28/2004**	**5/18 - 5/19/2004**	**6/14 - 6/18/2004**	**7/2/2004**	**7/20/2004**	**8/4/2004**	**New Baseline**	**Day 1**	**Day 15**	**Shutdown**
Extraction Wells	MW-BW-62-A	1						1	1	1							1
	MW-BW-63-A	**2**						1	1	1							1
	MW-BW-68-A	1						1	1	1							1
	MW-BW-69-A	1						1	1	1							1
	MW-BW-70-A	1						1	1	1							1
Monitoring Probes	Interior																
	CTP-SGP-61	3						3		3							2
	CTP-SGP-62	3						3		3	1	1	1	1		1	2
	Perimeter																
	CTP-SGP-51	3							2	3							2
	CTP-SGP-52	3							2	**4**				1		1	2
	CTP-SGP-53	**4**							2	3				1		1	2
	CTP-SGP-54	3							2	3							2
	CTP-SGP-55	3								**4**	1	1	1	1		1	2
	CTP-SGP-56	3							2	3				1		1	2
	CTP-SGP-57	3							2	3							2
	CTP-SGP-58	3							2	3							2
	CTP-SGP-59	3							2	3							2
	CTP-SGP-60	3							3	3							2
	Shallow																
	CTP-SGP-35	1								1							1
	CTP-SGP-37	1						1		**2**							1
	CTP-SGP-48	1						1		1							1
	6277 Lexington Court																
	CTP-SGP-49 (Sub-Slab)							1		1							1
	CTP-SGP-50 (Exterior)							1		1							1
	New Probes																
	CTP-SGP-63													3		1	2
	CTP-SGP-64													3		1	2
	CTP-SGP-65													3		1	2
	CTP-SGP-66													1			
	CTP-SGP-50 (Exterior)																
	Sub-total	46	0	0	0	0	0	15	24	49	2	2	2	15		8	40
	Influent	na	1	1	1	1	1		1	1					1	1	1
	Lead Carbon Vessel	na	1							1					1		
	Effluent	na	1	1	1	1	1			1					1	1	1
	Sub-total	0	3	2	2	2	2	0	1	3	0	0	0	0	3	2	2
	Total Samples	46	3	2	2	2	2	15	25	52	2	2	2	15	3	10	42

PHASE 1 OPERATION	
TOTAL GAS SAMPLES =	153
FIELD DUPLICATES =	4
CUMULATIVE TOTAL =	153
PHASE 2 OPERATION	
TOTAL GAS SAMPLES =	72
FIELD DUPLICATES =	4
CUMULATIVE TOTAL =	76

Shaw® Shaw Environmental, Inc.

Field Work Variance No. TII-089

Page 1 of 1

FIELD WORK VARIANCE

Project Name/Number	Fort Ord / 783751	CTO/WAD	12
Applicable Document	Final Work Plan and Sampling and Analysis Plan, Pilot Soil Vapor Extraction and Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California, March 2004	Date	Nov. 23, 2004

Problem Description:

As presented at the BCT on 11/8/04 the SVE was shut down on 11/8/04. The sampling schedule presented in Table 6-2 of the work plan requires modification based on analytical results obtained during the first part of Phase II operations to.

Recommended solution:

This FWV updates the sampling schedule in Table 6-2 and presents a revised plan for the final Phase II sampling based on a technical evaluation of the Phase I/II data that has been obtained to date. The new sampling schedule presented in the attached revised Table 6-2 will be implemented for Phase II (dates where sampling occurred have been provided). The selection of the probes for the final Phase II sampling is based on: 1) providing a clear picture of the final concentration of VOCs present (or absent) in the carbon tetrachloride plume (CTP); 2) physical location in the CTP; and 3) the concentration of VOCs in the plumes measured in Phases I and II.

Impact on present and completed work:

No impact on other work. The analytical cost is approximately the same as approved for Phase II operations.

Requested by: Eric Schmidt

Recommended solution/disposition: Implement as recommended above.

Clarification ☐ Minor Change ☒ Major Change ☐

Signature __________ Date ________
Technical Reviewer

Shaw Approvals:

Signature __________ Date ________
Project/Task Manager

Signature __________ Date ________
Project QC System Manager

If Major Change:

Signature __________ Date ________
Sr. Project Manager

USACE Approval:

Approved ☐ Rejected ☐

If Major Change:

Signature __________ Date ________
USACE COR or TM

Table 6-2
Performance Monitoring Volatile Organic Compound Sampling Schedule

		Phase 1 Operation										
	Sampling Location	3/25 - 4/1/2004	4/6/2004	4/7/2004	4/13/2004	4/16/2004	4/27/2004	4/28/2004	5/18 - 5/19/2004	6/14 - 6/18/2004	7/2/2004	7/20/2004
Extraction Wells	MW-BW-62-A	1						1	1	1		
	MW-BW-63-A	**2**						1	1	1		
	MW-BW-68-A	1						1	1	1		
	MW-BW-69-A	1						1	1	1		
	MW-BW-70-A	1						1	1	1		
Monitoring Probes	Interior											
	CTP-SGP-61	3						3		3		
	CTP-SGP-62	3						3		3	1	1
	Perimeter											
	CTP-SGP-51	3							2	3		
	CTP-SGP-52	3							2	**4**		
	CTP-SGP-53	**4**							2	3		
	CTP-SGP-54	3							2	3		
	CTP-SGP-55	3								**4**	1	1
	CTP-SGP-56	3							2	3		
	CTP-SGP-57	3							2	3		
	CTP-SGP-58	3							2	3		
	CTP-SGP-59	3							2	3		
	CTP-SGP-60	3							3	3		
	Shallow											
	CTP-SGP-35	1								1		
	CTP-SGP-37	1						1		**2**		
	CTP-SGP-48	1						1		1		
	6277 Lexington Court											
	CTP-SGP-49 (Sub-Slab)							1		1		
	CTP-SGP-50 (Exterior)							1		1		
	MacTec Probes (6 foot)											
	CTP-SGP-40											
	CTP-SGP-41											
	CTP-SGP-42											
	CTP-SGP-44											
	CTP-SGP-45											
	New Probes											
	CTP-SGP-63											
	CTP-SGP-64											
	CTP-SGP-65											
	CTP-SGP-66											
	Sub-total	46	0	0	0	0	0	15	24	49	2	2
	Influent		1	1	1	1	1		1	1		
	Lead Carbon Vessel		1							1		
	Effluent		1	1	1	1	1			1		
	Sub-total	0	3	2	2	2	2	0	1	3	0	0
	Total Samples	46	3	2	2	2	2	15	25	52	2	2

Table 6-2
Performance Monitoring Volatile Organic Compound Sampling Schedule

		Phase 2 Operation								
	Sampling Location	8/4/2004	9/02 - 9/02/2004	9/9/2004	9/23/2004	10/7/2004	10/14/2004	10/22/2004	11/8/2004	Proposed Final
Extraction Wells	MW-BW-62-A								1	
	MW-BW-63-A								1	
	MW-BW-68-A								1	
	MW-BW-69-A								1	
	MW-BW-70-A								1	
Monitoring Probes	Interior									
	CTP-SGP-61									
	CTP-SGP-62	1	1		1					
	Perimeter									
	CTP-SGP-51									2
	CTP-SGP-52		1		1					2
	CTP-SGP-53		1		1					2
	CTP-SGP-54				1					
	CTP-SGP-55	1	**2**		1	1	1			2
	CTP-SGP-56		1			**2**	1			2
	CTP-SGP-57									
	CTP-SGP-58									2
	CTP-SGP-59									2
	CTP-SGP-60									2
	Shallow									
	CTP-SGP-35									
	CTP-SGP-37									
	CTP-SGP-48									
	6277 Lexington Court									
	CTP-SGP-49 (Sub-Slab)									
	CTP-SGP-50 (Exterior)									
	MacTec Probes (6 foot)									
	CTP-SGP-40									1
	CTP-SGP-41									1
	CTP-SGP-42									1
	CTP-SGP-44									1
	CTP-SGP-45									1
	New Probes									
	CTP-SGP-63		3		1	1	1	1		2
	CTP-SGP-64		3		1					**3**
	CTP-SGP-65		3		1	1	1	1		2
	CTP-SGP-66		1							
	Sub-total	2	16		8	5	4	2	5	28
	Influent			1	**2**	1	1	1	1	
	Lead Carbon Vessel			1					1	
	Effluent			1	1				1	
	Sub-total	0	0	3	3	1	1	1	3	0
	Total Samples	2	16	3	11	6	5	3	8	28

PHASE 1 OPERATION	
TOTAL GAS SAMPLES =	153
FIELD DUPLICATES =	5
CUMULATIVE TOTAL =	158
PHASE 2 OPERATION	
TOTAL GAS SAMPLES =	82
FIELD DUPLICATES =	4
CUMULATIVE TOTAL =	86

FIELD WORK VARIANCE

Project Name/Number	Fort Ord / 783751	CTO/WAD	12
Applicable Document	Final Work Plan and Sampling and Analysis Plan, Pilot Soil Vapor Extraction and Treatment, Operable Unit Carbon Tetrachloride Plume, Former Fort Ord, California, March 2004	Date	May 9, 2005

Problem Description:

The Carbon Tetrachloride Soil Vapor Extraction System (CT SVE) was shut down on 11/8/04. As evidenced by the reduction in VOCs in the influent, monitoring probes, and extraction wells, the pilot SVE was very effective in removing VOCs, specifically CT from the soil gas.

Additional sampling of select probes is required in order to confirm that there has been no significant increase in concentrations since the system was shutdown.

The sampling schedule presented in Table 6-2 of the work plan requires modification in order to include the select probes that will be sampled during this additional round.

Recommended solution:

This FWV updates the sampling schedule in Table 6-2 and presents a revised plan for the additional sampling that will be conducted to confirm that there has been no significant change in concentrations since the CT SVE shutdown on 11/8/2004.

The selection of the probes for the additional sampling is based on:

1) Providing a representative picture of the current concentration of VOCs present (or absent) in the carbon tetrachloride plume (CTP); and

2) The probes physical location in the CTP.

Impact on present and completed work:

No impact on other work. The analytical cost is covered under WVN 226.

Requested by: Eric Schmidt

Recommended solution/disposition: Implement as recommended above.

Clarification ☐ Minor Change ☐ Major Change ☒

Signature ____________ Date ________

Technical Reviewer

Shaw Shaw Environmental, Inc.

Field Work Variance No. TII-093

Shaw Approvals:		*If Major Change:*	
Signature [signature] *Project/Task Manager*	Date 5/10/05	Signature for [signature] *Sr. Project Manager*	Date 5/9/05
Signature [signature] *Project QC System Manager*	Date 5/9/05		

USACE Approval:		*If Major Change:*	
Approved ☑	Rejected ☐	Signature [signature] *USACE COR or TM*	Date 5/17/05

Table 6-2

Performance Monitoring Volatile Organic Compound Sampling Schedule

	Sampling Location	Phase 1 Operation													
		3/25 - 4/1/2004	4/6/2004	4/7/2004	4/13/2004	4/16/2004	4/27/2004	4/28/2004	5/18 - 5/19/2004	6/14 - 6/18/2004	7/2/2004	7/20/2004	8/4/2004	9/02 - 9/02/2004	9/9/2004
Extraction Wells	MW-BW-62-A	1						1	1	1					
	MW-BW-63-A	2						1	1	1					
	MW-BW-68-A	1						1	1	1					
	MW-BW-69-A	1						1	1	1					
	MW-BW-70-A	1						1	1	1					
Monitoring Probes	Interior														
	CTP-SGP-61	3						3		3					
	CTP-SGP-62	3						3		3	1	1	1	1	
	Perimeter														
	CTP-SGP-51	3							2	3					
	CTP-SGP-52	3							2	4				1	
	CTP-SGP-53	4							2	3				1	
	CTP-SGP-54	3							2	3					
	CTP-SGP-55	3								4	1	1	1	2	
	CTP-SGP-56	3							2	3				1	
	CTP-SGP-57	3							2	3					
	CTP-SGP-58	3							2	3					
	CTP-SGP-59	3							2	3					
	CTP-SGP-60	3							3	3					
	Shallow														
	CTP-SGP-35	1								1					
	CTP-SGP-37	1						1		2					
	CTP-SGP-48	1						1		1					
	6277 Lexington Court														
	CTP-SGP-49 (Sub-Slab)							1		1					
	CTP-SGP-50 (Exterior)							1		1					
	MacTec Probes (6 foot)														
	CTP-SGP-40														
	CTP-SGP-41														
	CTP-SGP-42														
	CTP-SGP-44														
	CTP-SGP-45														
	New Probes														
	CTP-SGP-63													3	
	CTP-SGP-64													3	
	CTP-SGP-65													3	
	CTP-SGP-66													1	
	Sub-total	46	0	0	0	0	0	15	24	49	2	2	2	16	
	Influent		1	1	1	1	1		1	1					1
	Lead Carbon Vessel		1							1					1
	Effluent		1	1	1	1	1			1					1
	Sub-total	0	3	2	2	2	2	0	1	3	0	0	0	0	3
	Total Samples	46	3	2	2	2	2	15	25	52	2	2	2	16	3

Table 6-2

Performance Monitoring Volatile Organic Compound Sampling Schedule

		Phase 2 Operation						
	Sampling Location	9/23/2004	10/7/2004	10/14/2004	10/22/2004	11/8/2004	11/8 - 12/1/2004	Additional Sampling
Extraction Wells	MW-BW-62-A					1		
	MW-BW-63-A					1		
	MW-BW-68-A					1		
	MW-BW-69-A					1		
	MW-BW-70-A					1		
Monitoring Probes	Interior							
	CTP-SGP-61							
	CTP-SGP-62	1						2
	Perimeter							
	CTP-SGP-51						2	2
	CTP-SGP-52	1					2	2
	CTP-SGP-53	1					2	2
	CTP-SGP-54	1						
	CTP-SGP-55	1	1	1			2	2
	CTP-SGP-56		2	1			2	2
	CTP-SGP-57							
	CTP-SGP-58						2	2
	CTP-SGP-59						2	2
	CTP-SGP-60						2	2
	Shallow							
	CTP-SGP-35							
	CTP-SGP-37							
	CTP-SGP-48							
	6277 Lexington Court							
	CTP-SGP-49 (Sub-Slab)							
	CTP-SGP-50 (Exterior)							1
	MacTec Probes (6 foot)							
	CTP-SGP-40						1	
	CTP-SGP-41						1	
	CTP-SGP-42						1	
	CTP-SGP-44						1	
	CTP-SGP-45						1	
	New Probes							
	CTP-SGP-63	1	1	1	1		2	2
	CTP-SGP-64	1					3	3
	CTP-SGP-65	1	1	1	1		2	2
	CTP-SGP-66							
	Sub-total	8	5	4	2	5	28	26
	Influent	2	1	1	1	1		
	Lead Carbon Vessel					1		
	Effluent	1				1		
	Sub-total	3	1	1	1	3	0	0
	Total Samples	11	6	5	3	8	28	26

PHASE 1 OPERATION	
TOTAL GAS SAMPLES =	148
FIELD DUPLICATES =	5
CUMULATIVE TOTAL =	153
PHASE 2 OPERATION	
TOTAL GAS SAMPLES =	78
FIELD DUPLICATES =	4
CUMULATIVE TOTAL =	86
ADDITIONAL ROUND	
TOTAL GAS SAMPLES =	25
FIELD DUPLICATES =	1
CUMULATIVE TOTAL =	26

Appendix B
Well Logs

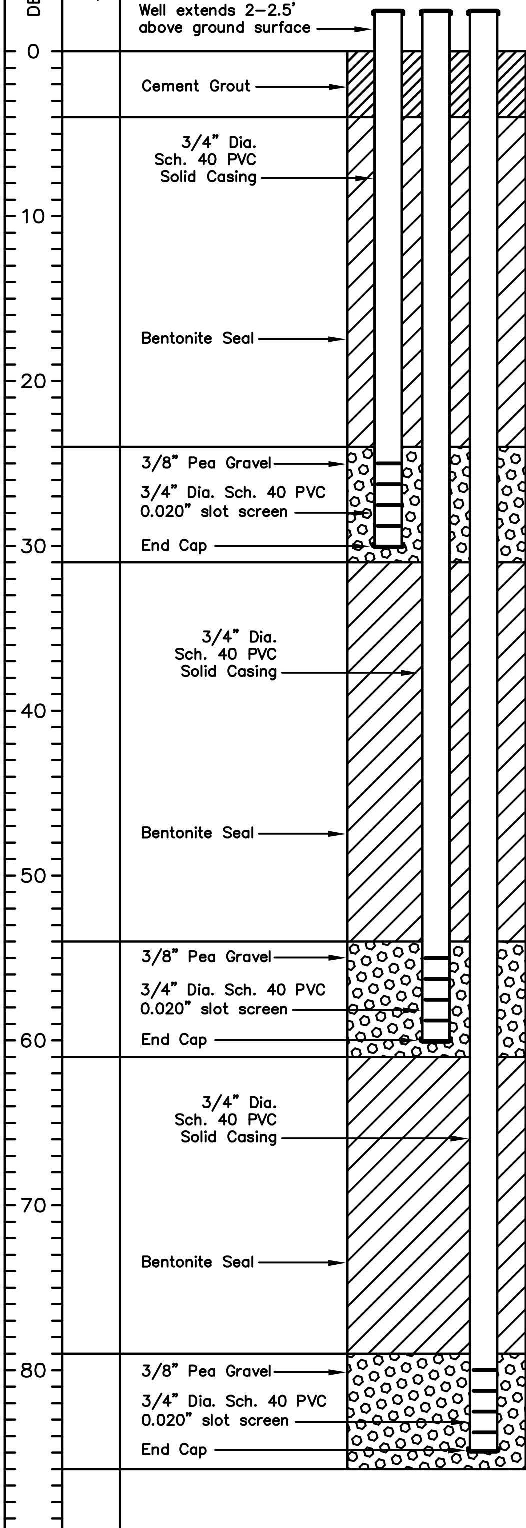
MONITORING WELL NO. CTP-SGP-51

COORDINATES: N 2138068
E 5747942

FIELD GEOLOGIST C. Luckie
CHECKED BY J. Moser
APPROVED BY J. Moser
TOTAL DEPTH 86 ft.

DATE BEGAN 3/1/04
DATE FINISHED 3/1/04
SURFACE ELEV. ~187.66
CORE SIZE N/A

DEPTH IN FEET | SAMPLE TYPE & NO. | WELL SUMMARY AND DRILLING REMARKS | USCS | PROFILE | DESCRIPTION



Well Summary and Drilling Remarks

Well extends 2–2.5' above ground surface

Cement Grout

3/4" Dia. Sch. 40 PVC Solid Casing

Bentonite Seal

3/8" Pea Gravel

3/4" Dia. Sch. 40 PVC 0.020" slot screen

End Cap

3/4" Dia. Sch. 40 PVC Solid Casing

Bentonite Seal

3/8" Pea Gravel

3/4" Dia. Sch. 40 PVC 0.020" slot screen

End Cap

3/4" Dia. Sch. 40 PVC Solid Casing

Bentonite Seal

3/8" Pea Gravel

3/4" Dia. Sch. 40 PVC 0.020" slot screen

End Cap

DESCRIPTION

0–6' Dark Brown Sandy Soil with organics, moist

6–11' Dark Brown Sand, moist

11–30' Medium Brown Sand, moist

30–37' Yellowish/Light Brown Sand, moist

37–45' Yellowish Brown Sand, moist

45–68' Medium Brown Sand, slightly moist

68–86' Yellowish Brown Sand, moist

Bottom of Boring = 86'
Logged by tailings

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

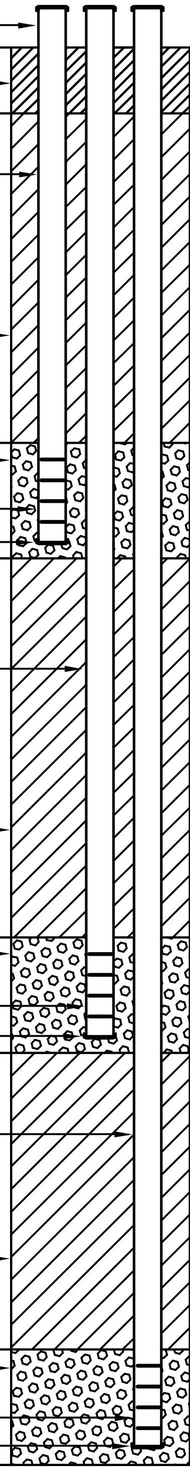
DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-51
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. CTP-SGP-52

FIELD GEOLOGIST	C. Luckie	COORDINATES:	N 2138181 / E 5748153
CHECKED BY	J. Moser	DATE BEGAN	3/3/04
APPROVED BY	J. Moser	DATE FINISHED	3/3/04
TOTAL DEPTH	86 ft.	SURFACE ELEV.	~197.49
		CORE SIZE	N/A

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
0		Well extends 2–2.5' above ground surface; Cement Grout			0–8' Dark Brown Sand, moist
10		3/4" Dia. Sch. 40 PVC Solid Casing			8–20' Yellowish Sand, moist
20		Bentonite Seal			20–34' Medium Dark Brown Sand, moist
30		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			
40		3/4" Dia. Sch. 40 PVC Solid Casing			34–75' Light Brown Sand, moist
50		Bentonite Seal			
60		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			
70		3/4" Dia. Sch. 40 PVC Solid Casing; Bentonite Seal			75–77' Medium Brown Sand, moist
80		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			77–86' Light Brown Sand, moist
90					Bottom of Boring = 86' Logged by tailings



DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-52
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

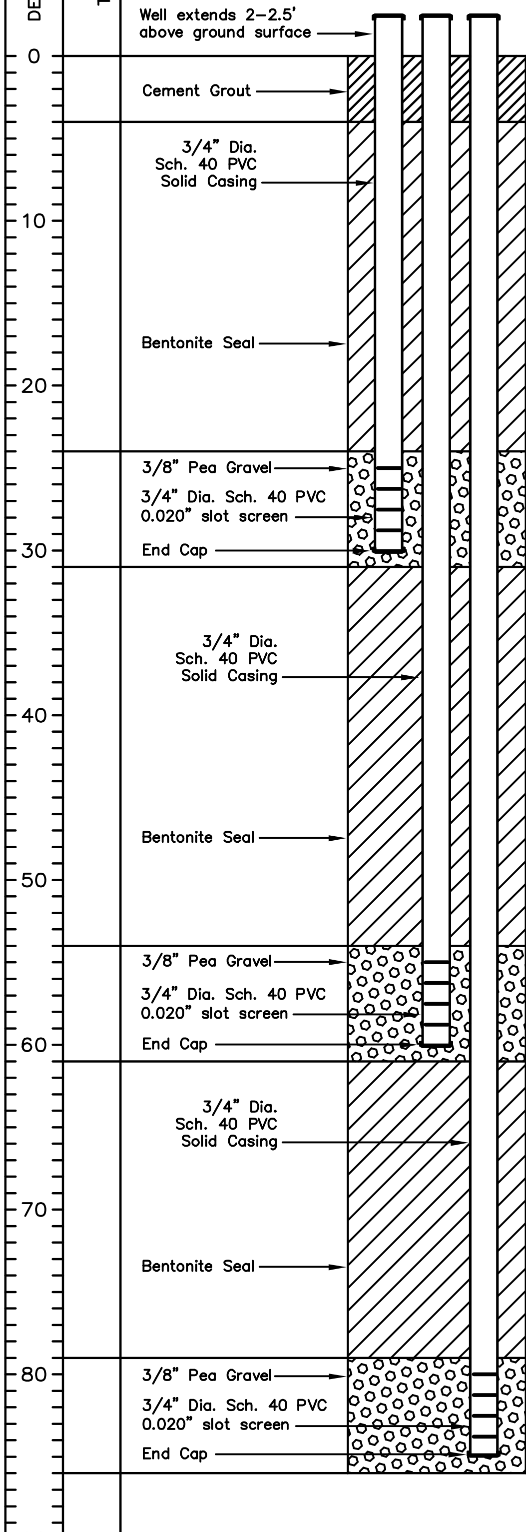
MONITORING WELL NO. CTP–SGP–53

COORDINATES: N 2138233
E 5748356

FIELD GEOLOGIST C. Luckie
CHECKED BY J. Moser
APPROVED BY J. Moser
TOTAL DEPTH 86 ft.

DATE BEGAN 3/4/04
DATE FINISHED 3/4/04
SURFACE ELEV. ~189.06
CORE SIZE N/A

DEPTH IN FEET | SAMPLE TYPE & NO. | WELL SUMMARY AND DRILLING REMARKS | USCS | PROFILE | DESCRIPTION



DESCRIPTION

0–8' Dark Brown Sand with organics, moist

8–11' Yellowish Sand, moist

11–14' Medium Brown Sand, moist

14–16' Light Brown Sand, moist

16–18' Medium Light Brown Sand, moist

18–30' Light Brown Sand, moist

30–34' Medium Dark Brown Sand, moist

34–45' Medium Brown Sand, moist

45–86' Light Brown Sand, moist

Bottom of Boring = 86'
Logged by tailings

PAGE 1 OF 1

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

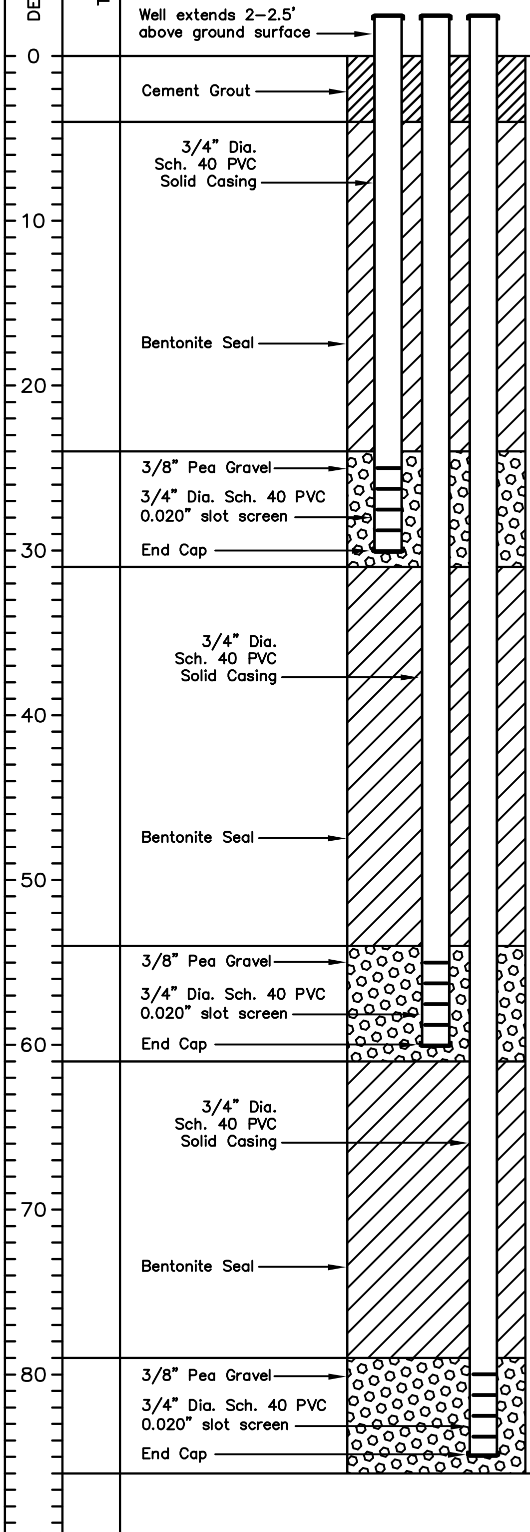
DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP–SGP–53
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. CTP-SGP-54

FIELD GEOLOGIST	T. Ghigliotto	COORDINATES:	N 2138107 / E 5748437
CHECKED BY	J. Moser	DATE BEGAN	3/4/04
APPROVED BY	J. Moser	DATE FINISHED	3/4/04
TOTAL DEPTH	86 ft.	SURFACE ELEV.	~180.99
		CORE SIZE	N/A

DEPTH IN FEET | SAMPLE TYPE & NO. | WELL SUMMARY AND DRILLING REMARKS | USCS | PROFILE | DESCRIPTION



DESCRIPTION

0-5' Dark Brown Sandy Soil with organics, moist

5-10' Dark Brown Sand, moist

10-15' Medium to Dark Brown Sand, slightly moist

15-25' Medium Brown Sand, slightly moist

25-35' Yellowish/Light Brown Sand, slightly moist

35-45' Light to Medium Brown Sand, slightly moist

45-65' Medium Brown Sand, slightly moist

65-73' Medium to Light Brown Sand, slightly moist

73-86' Medium Brown Sand, slightly moist

Bottom of Boring = 86'
Logged by tailings

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-54
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

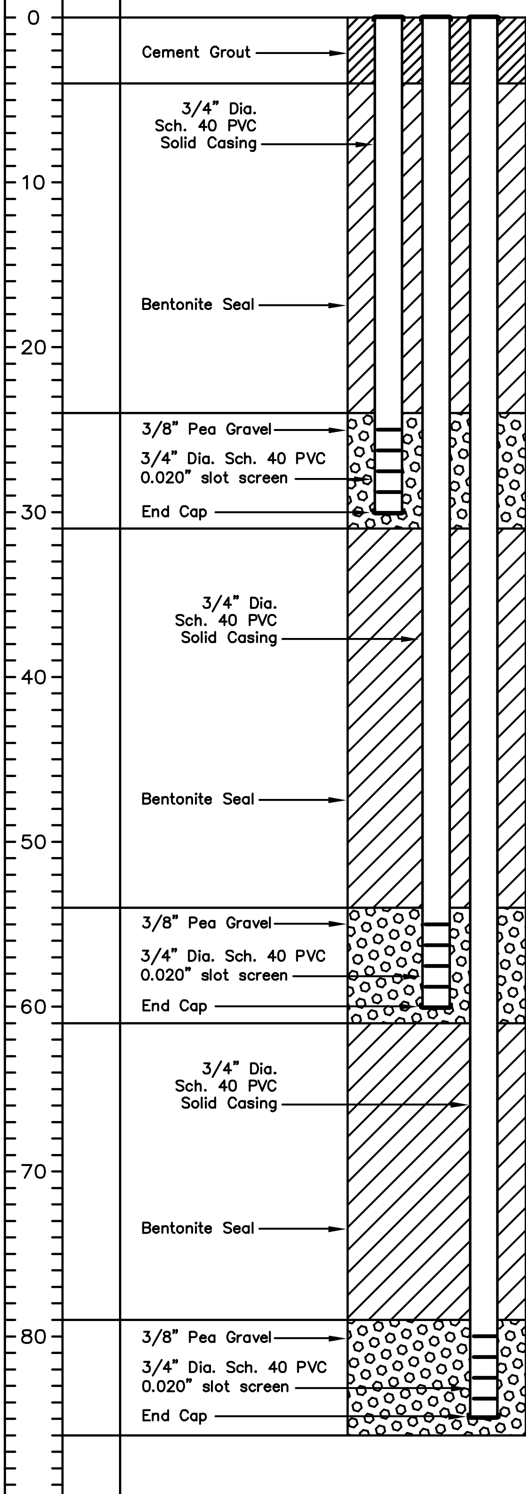
MONITORING WELL NO. CTP-SGP-55

COORDINATES: N 2137898
E 5748436

FIELD GEOLOGIST: T. Ghigliotto
CHECKED BY: J. Moser
APPROVED BY: J. Moser
TOTAL DEPTH: 86 ft.

DATE BEGAN: 3/4/04
DATE FINISHED: 3/4/04
SURFACE ELEV.: ~181.79
CORE SIZE: N/A

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
0					0–6" Sandy Soil with organics, moist 6"–7' Light Brown Sand, slightly moist
7					7–15' Yellowish/Light Brown Sand, slightly moist
15					15–20' Medium Brown Sand, slightly moist
20					20–22' Yellowish/Light Brown Sand, slightly moist
22					22–35' Medium Brown Sand, slightly moist
35					35–50' Medium to Medium/Light Brown Sand, slightly moist
50					50–60' Medium Brown Sand, slightly moist
60					60–65' Medium to Medium/Dark Brown Sand, slightly moist
65					65–86' Medium Brown Sand, slightly moist
86					Bottom of Boring = 86' Logged by tailings



PAGE 1 OF 1

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-55
DATE	6/1/04	APPROVED BY			

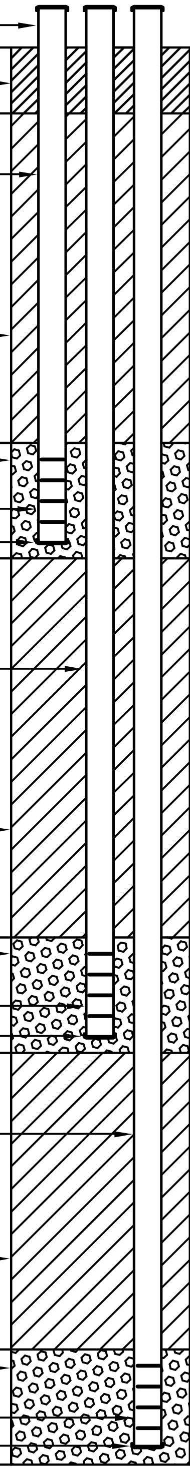
Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. CTP-SGP-56

COORDINATES: N 2137786
E 5748528

FIELD GEOLOGIST T. Ghigliotto — DATE BEGAN 3/3/04
CHECKED BY J. Moser — DATE FINISHED 3/3/04
APPROVED BY J. Moser — SURFACE ELEV. ~184.32
TOTAL DEPTH 86 ft. — CORE SIZE N/A

DEPTH IN FEET | SAMPLE TYPE & NO. | WELL SUMMARY AND DRILLING REMARKS | USCS | PROFILE | DESCRIPTION



Well summary and drilling remarks:

- Well extends 2–2.5' above ground surface
- Cement Grout
- 3/4" Dia. Sch. 40 PVC Solid Casing
- Bentonite Seal
- 3/8" Pea Gravel
- 3/4" Dia. Sch. 40 PVC 0.020" slot screen
- End Cap
- 3/4" Dia. Sch. 40 PVC Solid Casing
- Bentonite Seal
- 3/8" Pea Gravel
- 3/4" Dia. Sch. 40 PVC 0.020" slot screen
- End Cap
- 3/4" Dia. Sch. 40 PVC Solid Casing
- Bentonite Seal
- 3/8" Pea Gravel
- 3/4" Dia. Sch. 40 PVC 0.020" slot screen
- End Cap

Description:

0–4' Medium to Dark Brown Sandy Soil with organics, moist

4–10' Medium to Light Brown Sand, moist

10–25' Medium Brown Sand, slightly moist

25–30' Yellowish Brown Sand, slightly moist

30–50' Medium Brown Sand, slightly moist

50–60' Medium to Light Brown Sand, slightly moist

60–86' Medium Brown Sand, slightly moist

Bottom of Boring = 86'
Logged by tailings

Depth scale (feet): 0, 10, 20, 30, 40, 50, 60, 70, 80, 90

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-56
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

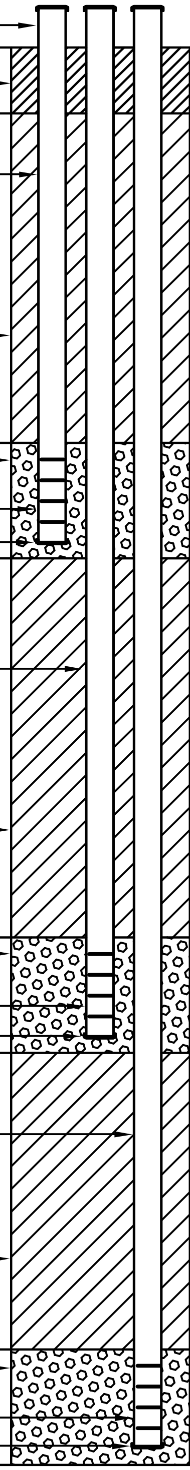
MONITORING WELL NO. CTP-SGP-57

COORDINATES: N 2137635
E 5748450

FIELD GEOLOGIST T. Ghigliotto
CHECKED BY J. Moser
APPROVED BY J. Moser
TOTAL DEPTH 86 ft.

DATE BEGAN 3/2/04
DATE FINISHED 3/2/04
SURFACE ELEV. ~182.50
CORE SIZE N/A

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
0		Well extends 2–2.5' above ground surface; Cement Grout			0–1' Organics 1–4' Dark Brown Sandy Soil, very moist
		3/4" Dia. Sch. 40 PVC Solid Casing			4–11' Medium to Light Brown Sand, moist
10					11–25' Medium Brown Sand, moist
20		Bentonite Seal			
		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			25–35' Light to Yellowish Brown Sand, slightly moist
30		3/4" Dia. Sch. 40 PVC Solid Casing			35–40' Medium to Light Brown Sand, slightly moist
40		Bentonite Seal			40–47' Light Brown Sand, slightly moist 47–50' Dark Brown Sand, slightly moist
50		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			50–55' Medium to Medium/Dark Brown Sand, slightly moist 55–65' Medium Brown Sand, slightly moist
60		3/4" Dia. Sch. 40 PVC Solid Casing			65–80' Medium to Light Brown Sand, slightly moist
70		Bentonite Seal			
80		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			80–86' Light Brown Sand, slightly moist
90					Bottom of Boring = 86' Logged by tailings



PAGE 1 OF 1

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-57
DATE	6/1/04	APPROVED BY			

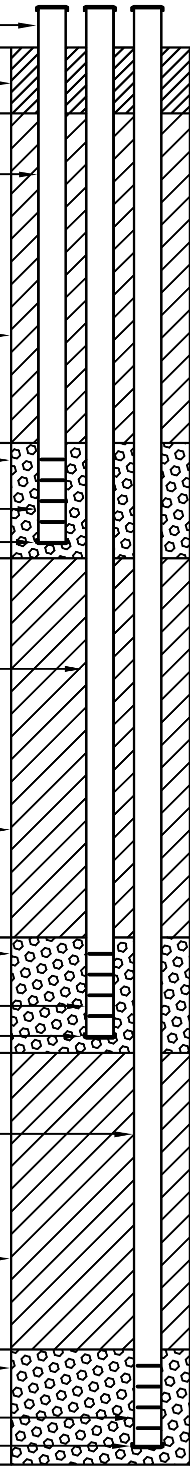
Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. CTP-SGP-58

COORDINATES: N 2137615
E 5748299

FIELD GEOLOGIST	T. Ghigliotto	DATE BEGAN	3/2/04
CHECKED BY	J. Moser	DATE FINISHED	3/2/04
APPROVED BY	J. Moser	SURFACE ELEV.	~185.72
TOTAL DEPTH	86 ft.	CORE SIZE	N/A

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
0		Well extends 2–2.5' above ground surface; Cement Grout			0–2' Light Brown Sand, slightly moist
		3/4" Dia. Sch. 40 PVC Solid Casing			2–25' Medium Brown Sand, slightly moist
10					
20		Bentonite Seal			
		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			25–35' Yellowish Brown Sand, slightly moist
30					
		3/4" Dia. Sch. 40 PVC Solid Casing			35–60' Medium to Light Brown Sand, slightly moist
40		Bentonite Seal			
50		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			
60		3/4" Dia. Sch. 40 PVC Solid Casing			60–86' Medium Brown Sand, slightly moist
70		Bentonite Seal			
80		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			
90					Bottom of Boring = 86' Logged by tailings



DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-58
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

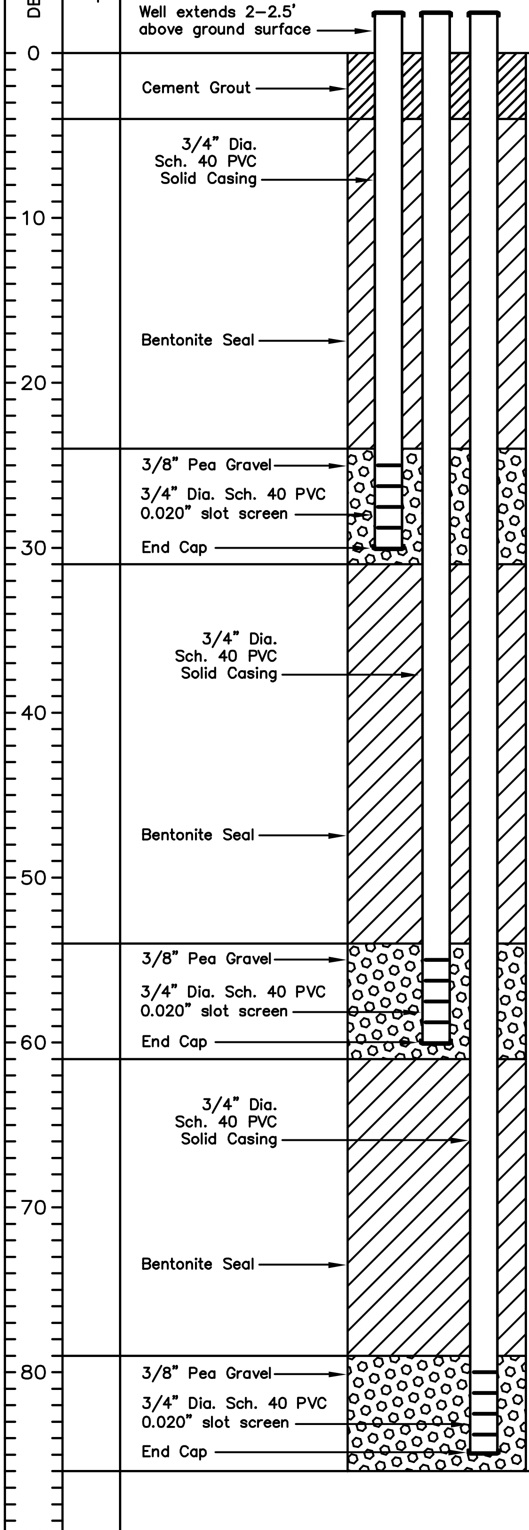
MONITORING WELL NO. CTP-SGP-59

COORDINATES: N 2137630
E 5748098

FIELD GEOLOGIST T. Ghigliotto
CHECKED BY J. Moser
APPROVED BY J. Moser
TOTAL DEPTH 86 ft.

DATE BEGAN 3/1/04
DATE FINISHED 3/1/04
SURFACE ELEV. ~184.20
CORE SIZE N/A

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION



DESCRIPTION

0–6" Organics
6"–4' Light Brown Sand, moist
4–6' Medium Brown Sand, moist
6–15' Yellowish Brown Sand, moist
15–35' Light Brown Sand, slightly moist
35–65' Medium Brown Sand, slightly moist
65–86' Medium to Light Brown Sand, slightly moist

Bottom of Boring = 86'
Logged by tailings

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

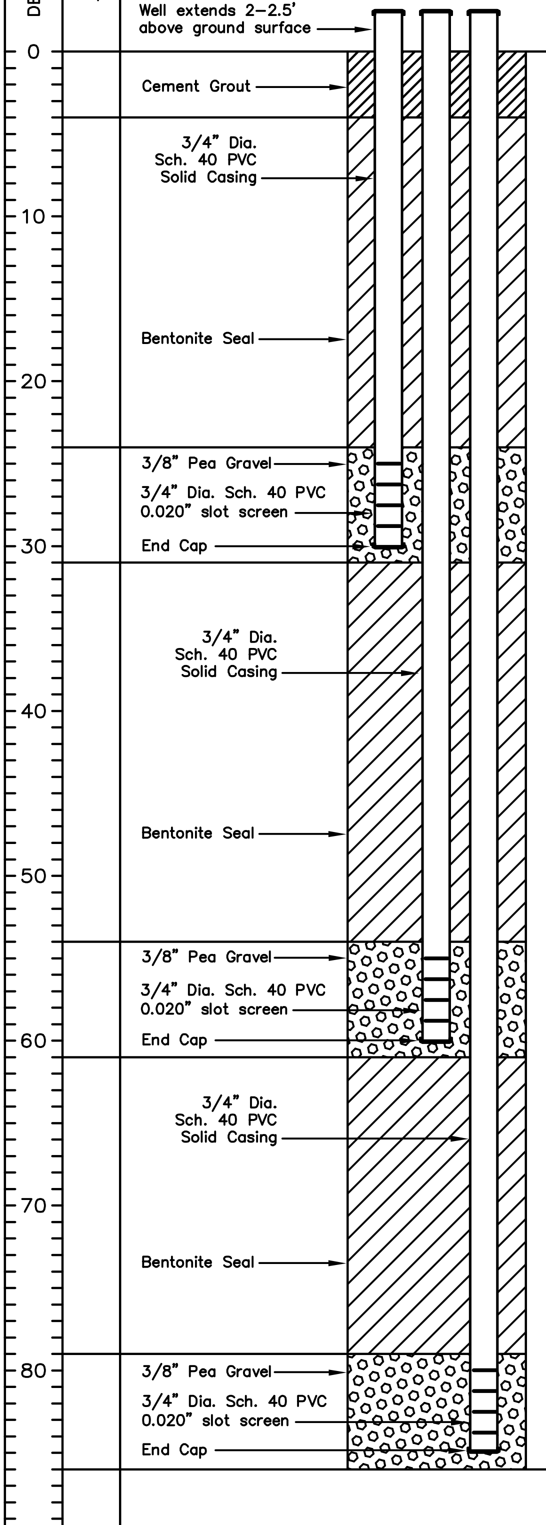
DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-59
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. CTP-SGP-60

FIELD GEOLOGIST: T. Ghigliotto	COORDINATES: N 2137853, E 5748036
CHECKED BY: J. Moser	DATE BEGAN: 3/5/04
APPROVED BY: J. Moser	DATE FINISHED: 3/5/04
TOTAL DEPTH: 86 ft.	SURFACE ELEV.: ~184.77
	CORE SIZE: N/A

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
0		Well extends 2–2.5' above ground surface			
0–3		Cement Grout			0–3' Dark Brown Sandy Soil with organics, moist
3–6					3–6' Dark Brown Sand, moist
6–10		3/4" Dia. Sch. 40 PVC Solid Casing			6–10' Medium Brown Sand, slightly moist
10–15					10–15' Medium to Light Brown Sand, slightly moist
15–22		Bentonite Seal			15–22' Yellowish Brown Sand, slightly moist
22–50		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap; 3/4" Dia. Sch. 40 PVC Solid Casing; Bentonite Seal			22–50' Medium to Light Brown Sand, slightly moist
50–75		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap; 3/4" Dia. Sch. 40 PVC Solid Casing; Bentonite Seal			50–75' Medium Brown Sand, slightly moist
75–86		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			75–86' Medium to Light Brown Sand, slightly moist
86–90					Bottom of Boring = 86' Logged by tailings



DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-60
DATE	6/1/04	APPROVED BY			

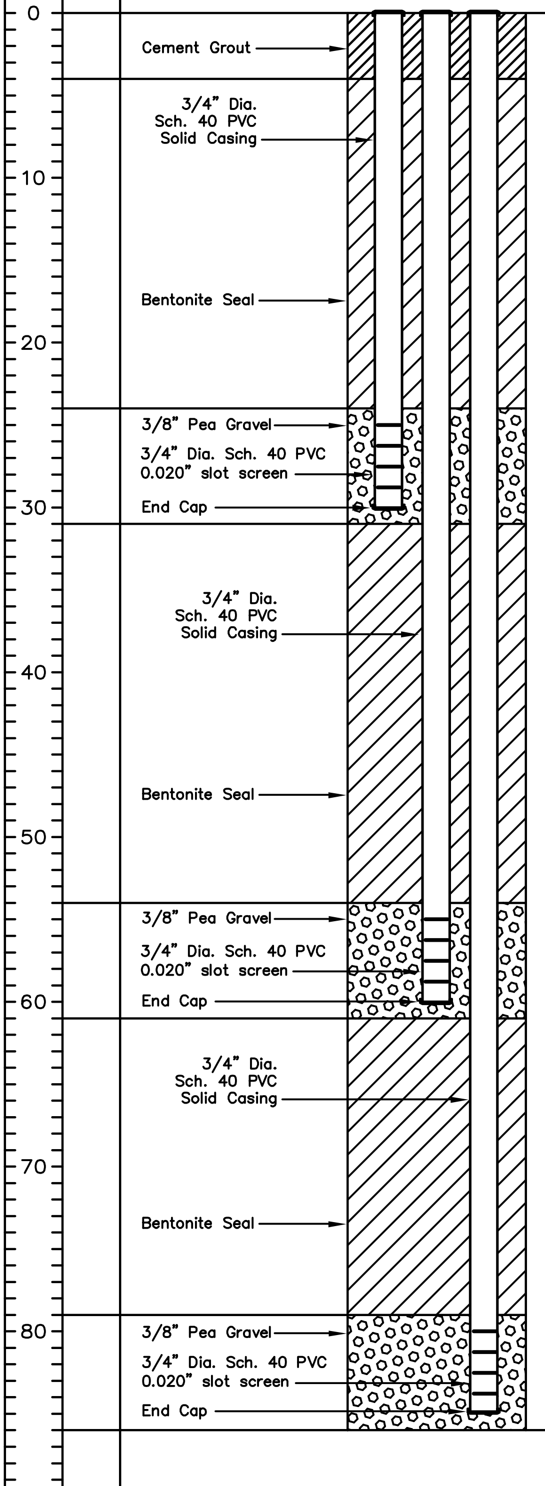
Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. CTP-SGP-61

COORDINATES: N 2137720
E 5748297

FIELD GEOLOGIST T. Ghigliotto
DATE BEGAN 3/3/04
CHECKED BY J. Moser
DATE FINISHED 3/3/04
APPROVED BY J. Moser
SURFACE ELEV. ~185.99
TOTAL DEPTH 86 ft.
CORE SIZE N/A

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION



0–6" Organics
6"–3' Dark Brown Sandy Soil, moist
3–10' Medium to Light Brown Sand, slightly moist
10–30' Medium Brown Sand, slightly moist
30–35' Yellowish Brown Sand, slightly moist
35–50' Medium Brown Sand, slightly moist
50–60' Medium to Medium/Dark Brown Sand, slightly moist
60–70' Medium Brown Sand, slightly moist
70–75' Medium to Medium/Light Brown Sand, slightly moist
75–86' Medium Brown Sand, slightly moist

Bottom of Boring = 86'
Logged by tailings

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-61
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

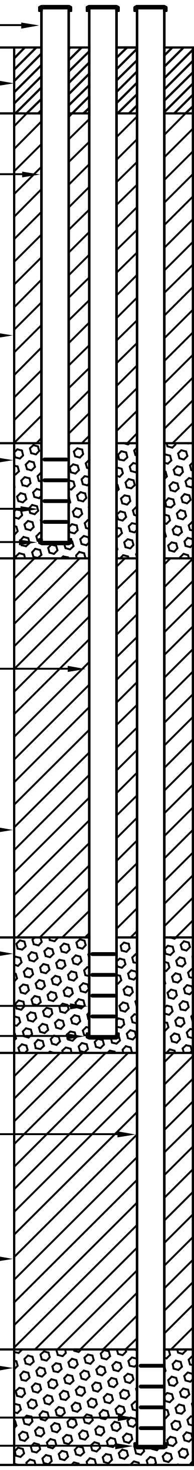
MONITORING WELL NO. CTP-SGP-62

COORDINATES: N 2137960
E 5748252

FIELD GEOLOGIST C. Luckie
CHECKED BY J. Moser
APPROVED BY J. Moser
TOTAL DEPTH 86 ft.

DATE BEGAN 3/4/04
DATE FINISHED 3/5/04
SURFACE ELEV. ~189.00
CORE SIZE N/A

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
0		Well extends 2–2.5' above ground surface; Cement Grout			0–3' Dark Brown Sandy Soil with organics, moist
		3/4" Dia. Sch. 40 PVC Solid Casing			3–6' Dark Brown Sand, moist
					6–10' Medium to Dark Brown Sand, moist
10					10–30' Medium Brown Sand, slightly moist
20		Bentonite Seal			
		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			
30					30–35' Medium Light Brown Sand, slightly moist
		3/4" Dia. Sch. 40 PVC Solid Casing			35–38' Medium Brown Sand, moist
					38–47' Yellowish Brown Sand, slightly moist
40		Bentonite Seal			47–51' Medium Brown Sand, slightly moist
50					51–55' Light Brown Sand, slightly moist
		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen			55–58' Medium to Dark Brown Sand, slightly moist
60		End Cap			58–86' Yellowish Brown Sand, slightly moist
		3/4" Dia. Sch. 40 PVC Solid Casing			
70		Bentonite Seal			
80		3/8" Pea Gravel; 3/4" Dia. Sch. 40 PVC 0.020" slot screen; End Cap			
90					Bottom of Boring = 86' Logged by tailings



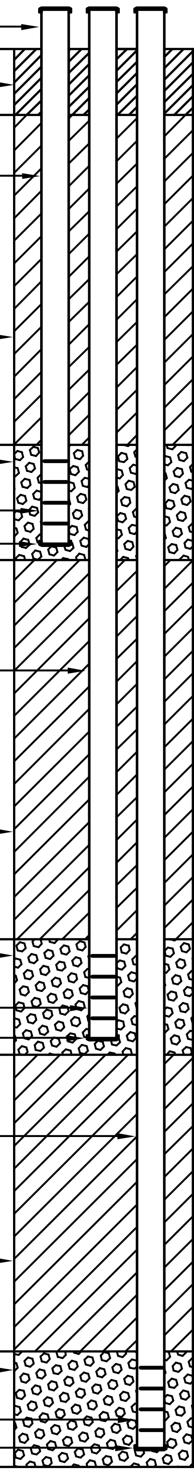
DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-62
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. CTP-SGP-63

FIELD GEOLOGIST C. Luckie	COORDINATES:
CHECKED BY J. Moser	DATE BEGAN 8/26/04
APPROVED BY J. Moser	DATE FINISHED 8/26/04
TOTAL DEPTH 86 ft.	SURFACE ELEV.
	CORE SIZE



DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
		Well extends 2–2.5' above ground surface			
0		Cement Grout			0–5' Sand, silty, dry, fine grained
		3/4" Dia. Sch. 40 PVC Solid Casing			5–15' Medium Brown to Tan Sand, dry
10					
		Bentonite Seal			15–25' Medium Brown Sand, slightly moist to damp
20					
		3/8" Pea Gravel 3/4" Dia. Sch. 40 PVC 0.020" slot screen End Cap			25–30' Yellowish Brown Sand, slightly moist
30					30–55' Brown Sand, slightly moist, coarse grained
		3/4" Dia. Sch. 40 PVC Solid Casing			
40					
		Bentonite Seal			
50					
		3/8" Pea Gravel 3/4" Dia. Sch. 40 PVC 0.020" slot screen End Cap			55–75' Medium Brown Sand, slightly moist
60					
		3/4" Dia. Sch. 40 PVC Solid Casing			
70		Bentonite Seal			75–86' Yellowish Brown Sand, damp
80		3/8" Pea Gravel 3/4" Dia. Sch. 40 PVC 0.020" slot screen End Cap			
					Bottom of Boring = 86' Logged by tailings
90					

PAGE 1 OF 1

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-63
DATE	9/15/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

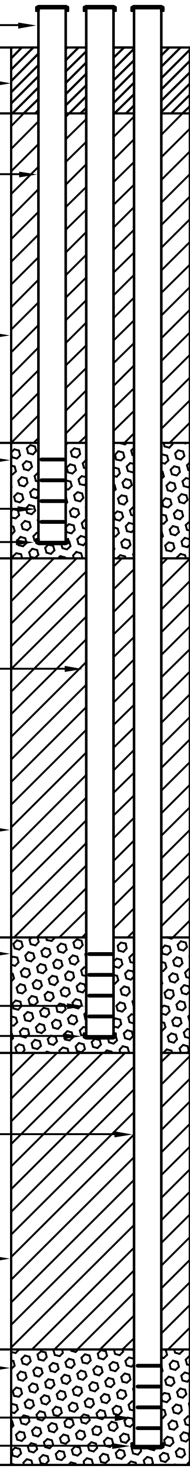
MONITORING WELL NO. CTP–SGP–64

COORDINATES: ____________

FIELD GEOLOGIST T. Ghigiotto
CHECKED BY J. Moser
APPROVED BY J. Moser
TOTAL DEPTH 86 ft.

DATE BEGAN 8/12/04
DATE FINISHED 8/12/04
SURFACE ELEV. ____________
CORE SIZE ____________

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
above 0		Well extends 2–2.5' above ground surface			
0		Cement Grout			0–3' Dark Brown Sandy Soil with organics, dry, loose, fine grained
					3–7' Medium Brown Sand, dry, loose, medium–fine grained
		3/4" Dia. Sch. 40 PVC Solid Casing			7–15' Medium to Light Brown Sand, slightly moist, medium grained
10					
		Bentonite Seal			15–35' Light Brown Sand, moist, medium grained
20					
		3/8" Pea Gravel			
		3/4" Dia. Sch. 40 PVC 0.020" slot screen			
30		End Cap			
		3/4" Dia. Sch. 40 PVC Solid Casing			35–45' Medium to Light Brown Sand, moist, medium grained
40					
		Bentonite Seal			45–60' Medium Brown Sand, moist, medium grained
50					
		3/8" Pea Gravel			
		3/4" Dia. Sch. 40 PVC 0.020" slot screen			
60		End Cap			60–80' Yellowish Brown Sand, moist, medium grained
		3/4" Dia. Sch. 40 PVC Solid Casing			
70		Bentonite Seal			
80		3/8" Pea Gravel			80–86' Medium to Light Brown Sand, moist, medium grained
		3/4" Dia. Sch. 40 PVC 0.020" slot screen			
		End Cap			
					Bottom of Boring = 86' Logged by tailings
90					



PAGE 1 OF 1

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP–SGP–64
DATE	9/15/04	APPROVED BY			

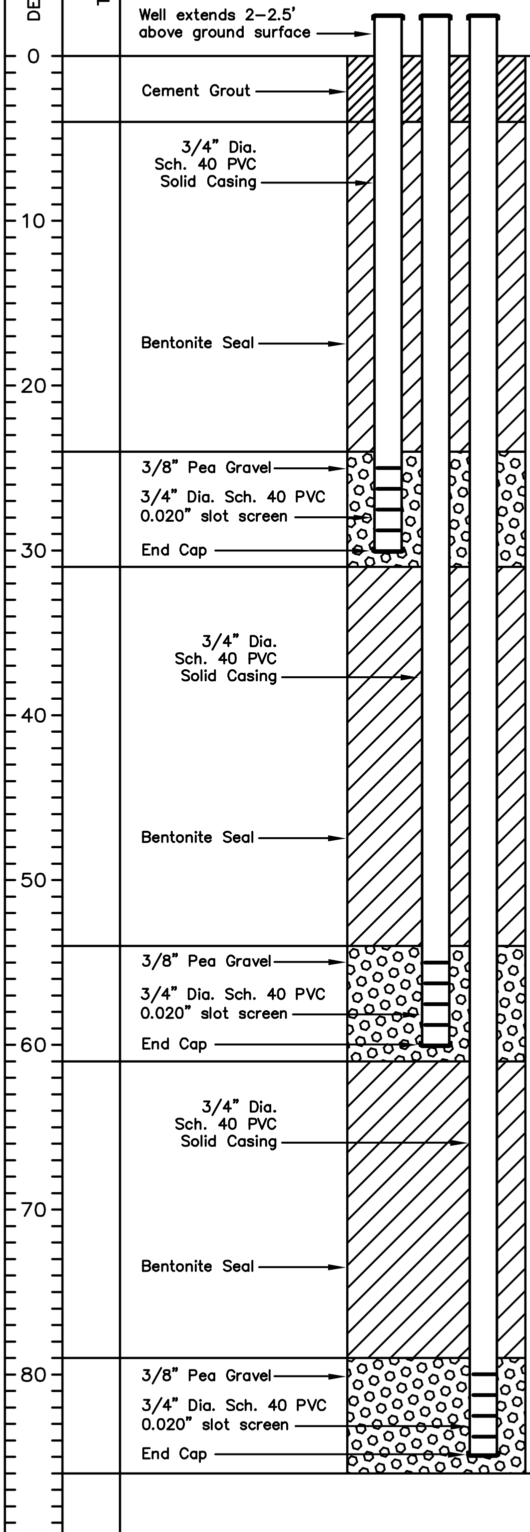
Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. CTP-SGP-65

FIELD GEOLOGIST	T. Ghigiotto	DATE BEGAN	8/26/04
CHECKED BY	J. Moser	DATE FINISHED	8/26/04
APPROVED BY	J. Moser	SURFACE ELEV.	
TOTAL DEPTH	86 ft.	CORE SIZE	

COORDINATES:

DEPTH IN FEET | SAMPLE TYPE & NO. | WELL SUMMARY AND DRILLING REMARKS | USCS | PROFILE | DESCRIPTION



DESCRIPTION

0–3' Dark Brown Sandy Soil with organics, dry, loose, fine grained

3–15' Brown Sand, dry, loose, medium–fine grained

15–33' Brown Sand, slightly moist, medium grained

33–45' Medium to Light Brown Sand, slightly moist, medium grained

45–50' Medium Brown Sand, slightly moist, medium grained

50–55' Medium to Medium Dark Brown Sand, slightly moist, medium grained

55–86' Medium Brown Sand, slightly moist, medium grained

Bottom of Boring = 86'
Logged by tailings

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP-SGP-65
DATE	9/15/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

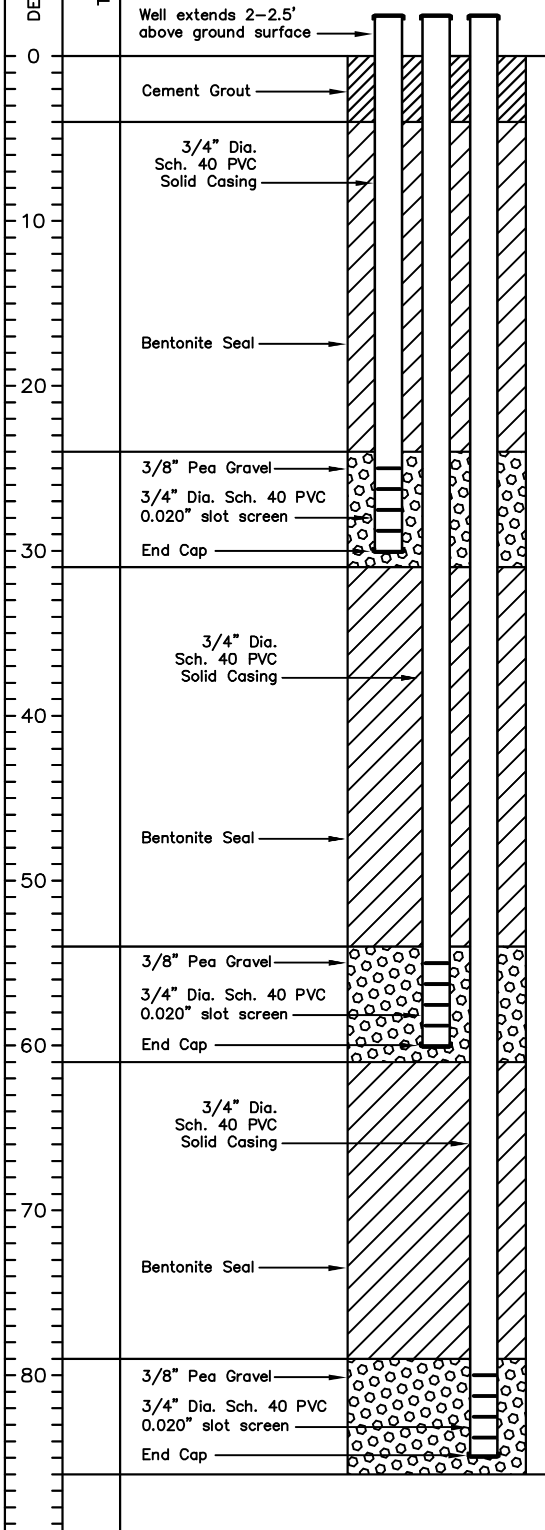
MONITORING WELL NO. CTP–SGP–66

COORDINATES: ______

FIELD GEOLOGIST C. Luckie
CHECKED BY J. Moser
APPROVED BY J. Moser
TOTAL DEPTH 86 ft.

DATE BEGAN 8/26/04
DATE FINISHED 8/26/04
SURFACE ELEV. ______
CORE SIZE ______

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
0					0–6" Medium Grayish Sand, very silty, very dry
					6"–5' Medium Dark Brown Sand, silty, dry, very fine grained
5					5–10' Medium Brown Sand, dry, medium coarse grained
10					10–40' Medium Brown Sand, slightly damp, coarse grained
40					40–65' Light Yellowish Sand, moist
65					65–75' Medium Brown Sand, moist
75					75–86' Brown Sand, moist, coarse grained
86					Bottom of Boring = 86' Logged by tailings



PAGE 1 OF 1

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	CTP–SGP–66
DATE	9/15/04	APPROVED BY			

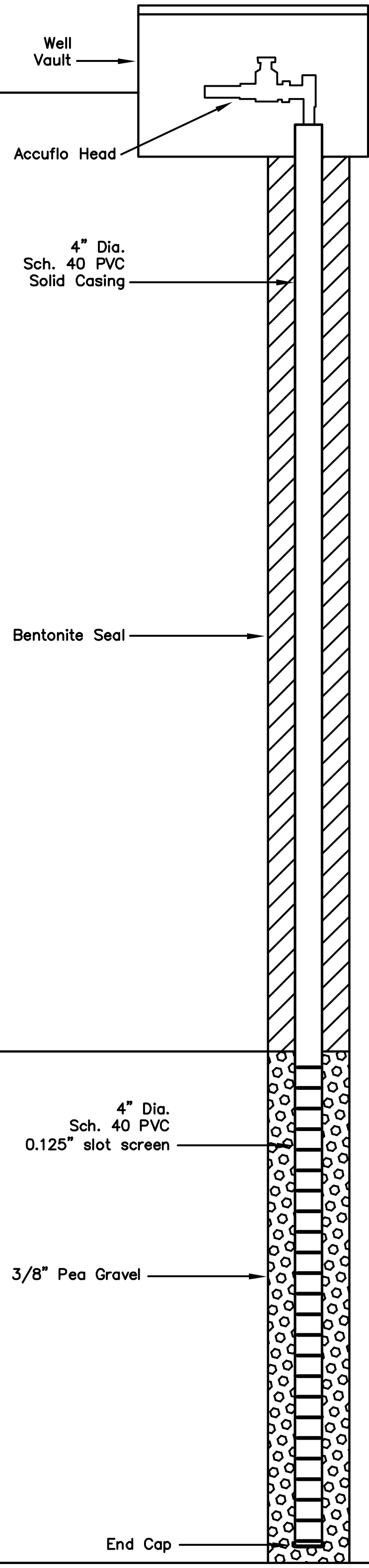
Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. MW–BW–68–A

FIELD GEOLOGIST C. Luckie
CHECKED BY J. Moser
APPROVED BY J. Moser
TOTAL DEPTH 92 ft.

COORDINATES: N
E
DATE BEGAN 3/1/04
DATE FINISHED 3/2/04
SURFACE ELEV.
CORE SIZE N/A

DEPTH IN FEET	SAMPLE TYPE & NO.	WELL SUMMARY AND DRILLING REMARKS	USCS	PROFILE	DESCRIPTION
0					0–6" Dark Brown Soil / Organics 6"–3' Dark Brown Sand, moist 3–7' Yellowish Brown Sand, moist 7–16' Medium Brown Sand, moist
10					16–75' Light Brown Sand, moist
20					
30					
40					
50					
60					
70					75–92' Medium, Light Brown Sand mix, moist
80					
90					



Bottom of Boring = 92'
Hand augered to 5'
Logged by tailings

PAGE 1 OF 1

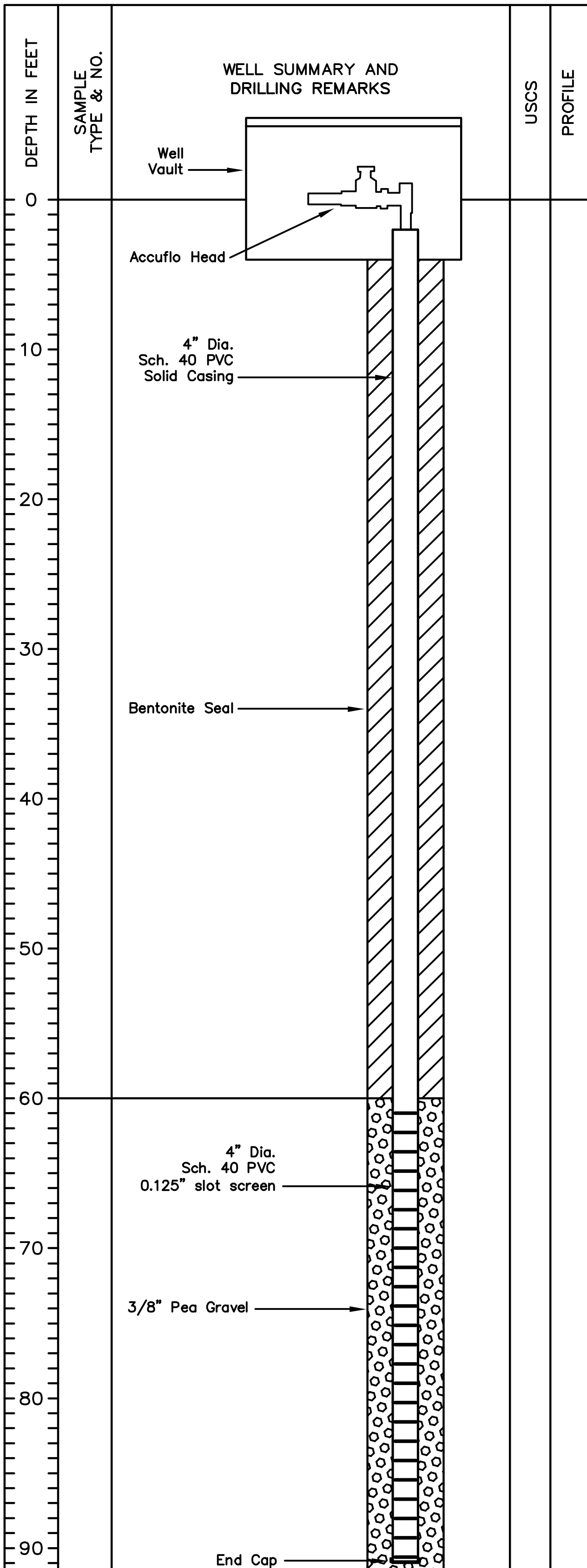
DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	MW–BW–68–A
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. MW-BW-69-A

FIELD GEOLOGIST C. Luckie	COORDINATES: N
	E
CHECKED BY J. Moser	DATE BEGAN 3/2/04
APPROVED BY J. Moser	DATE FINISHED 3/2/04
TOTAL DEPTH 92 ft.	SURFACE ELEV.
	CORE SIZE N/A



DESCRIPTION

0–8' Dark Brown Sand, no vegetation, moist

8–23' Light Brown Sand, moist

23–28' Yellowish Sand, moist

28–30' Dark Brown Sand, moist

30–92' Light Brown Sand, moist

Bottom of Boring = 92'
Logged by tailings

PAGE 1 OF 1

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

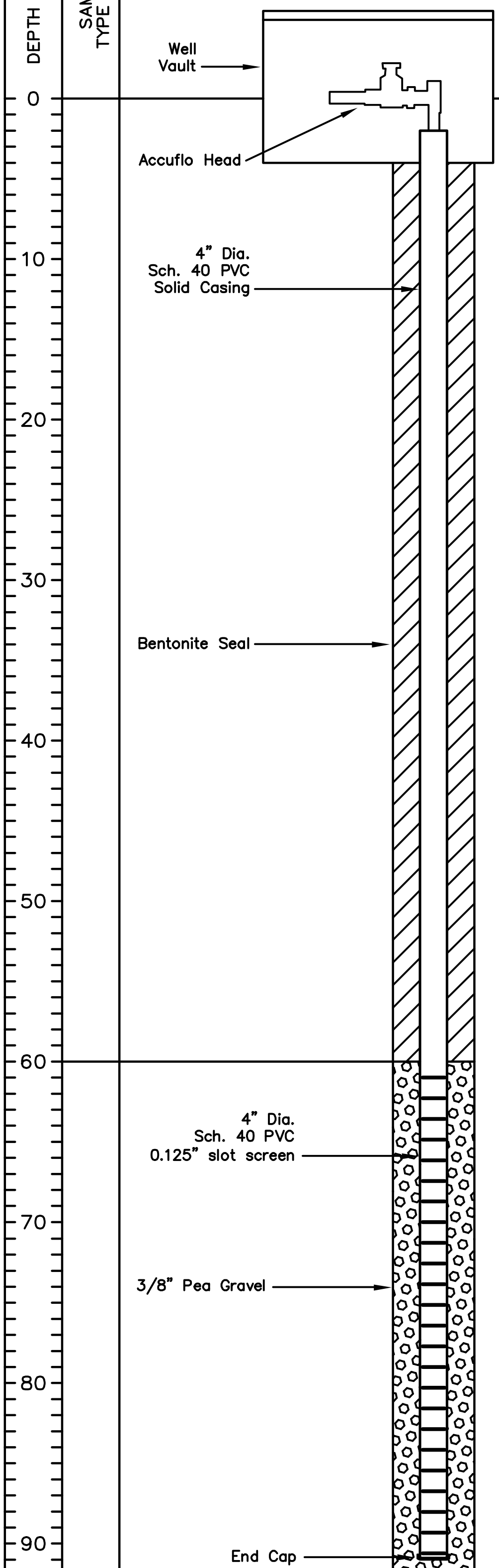
DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	MW-BW-69-A
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

MONITORING WELL NO. MW-BW-70-A

		COORDINATES:	N
			E
FIELD GEOLOGIST	C. Luckie	DATE BEGAN	3/1/04
CHECKED BY	J. Moser	DATE FINISHED	3/1/04
APPROVED BY	J. Moser	SURFACE ELEV.	
TOTAL DEPTH	92 ft.	CORE SIZE	N/A

DEPTH IN FEET | SAMPLE TYPE & NO. | WELL SUMMARY AND DRILLING REMARKS | USCS | PROFILE | DESCRIPTION



DESCRIPTION

0–6" Light Yellowish Sand with organics
6"–2' Dark Brown Sand, moist
2–25' Light Colored Sand, moist

25–51' Light, Dark Brown Sand mix, moist

51–92' Light Brown Sand, moist

Bottom of Boring = 92'
Hand augered to 6' (hit root @ 5')
Logged by tailings

PAGE 1 OF 1

DRILLING CO. : Woodward Drilling
DRILLING METHOD : 8" Hollow Stem Auger
LOCATION : CTP Site, Former Fort Ord, California
PROJECT NO. : 783751

DRAWN BY	K. Black	CHECKED BY		FILE NAME & DISK NUMBER	MW-BW-70-A
DATE	6/1/04	APPROVED BY			

Shaw® Shaw Environmental, Inc.

Appendix C
Completed Field Data Forms

Form 7-3

Sample Collection Log - Field Measurements

Soil Vapor Extraction System

Operable Unit Carbon Tetrachloride, Former Fort Ord

Date: 4/06/04

System Start Time: 1355

System Stop Time: 1700

pipe Area = .349 ft²

Location	Type	Time	Barometric Pressure (inches w.c.)	Absolute Pressure (inches w.c.)	Flow Rate ~~(scfm)~~ (fpm) acfm	Temperature (°F)
Pilot SVE System						
Pre-blower influent		1355	-5.5 IHg		.29 = 2300 fpm ≈ 720 acfm	110
Extraction Wells						
MW-BW-62-A		1436	407.52	395.96	NM / 11.56 IWC	
MW-BW-63-A		1600	407.41	398.85	NM / 8.56 IWC	
MW-BW-68-A		1515	407.43	398.95	NM / 4.48 IWC	
MW-BW-69-A		1535	407.45	401.08	NM / 6.37 IWC	
MW-BW-70-A		1450	407.53	399.13	NM / 8.40 IWC	
Monitoring Probes						
CTP-SGP-61	Interior	NM				
CTP-SGP-62 30 60 85	Interior	1525	407.42	407.25 ~~408~~ 406.90 406.83		
CTP-SGP-51 30 60 85	Perimeter	1518	407.41	~~406~~ 407.34 407.23 ~~407.17~~ 407.17		
CTP-SGP-52 30 60 85	Perimeter	1531	407.30	407.25 406.97 406.83		
CTP-SGP-53 30 60 85	Perimeter	~~14~~ 1540	407.36	407.29 407.10 407.16		
CTP-SGP-54 30 40 85	Perimeter	1554	407.46	407.39 407.25	407.22 (85)	
CTP-SGP-55	Perimeter	NM				
CTP-SGP-56 30 60 85	Perimeter	1547	407.45	407.39 407.27 407.24		
CTP-SGP-57 30 60 85	Perimeter	1455	407.50	407.39 406.63 406.51		
CTP-SGP-58 30 60 85	Perimeter	1502 ~~1455~~	407.49 ~~407.50~~	407.31 407.07 407.07		
CTP-SGP-59 30 60 85	Perimeter	1506	407.44	407.32 407.00 406.96		
CTP-SGP-60 30 60 85	Perimeter	1421 ~~[illegible]~~	407.61	407.52 407.43 407.39		
CTP-SGP-35	Shallow	NM				
CTP-SGP-37	Shallow	NM				
CTP-SGP-48	Shallow	NM				
CTP-SGP-49	Lexington Ct. sub-slab	NM				
CTP-SGP-50	Lexington Ct. exterior	NM				

Comments: Blower 1425 : T=118°F Flow = { .28 = DP IWC ∃ 2200 fpm or 691 cfm

1605 : T=118°F Flow = { ~691 cfm)

1642 : T= 118 Vac = 5 IHg

Prepared By: JM [signature]

Form 7-3
Sample Collection Log - Field Measurements
Soil Vapor Extraction System
Operable Unit Carbon Tetrachloride, Former Fort Ord

Date: 4/07/04

System Start Time: 0830

System Stop Time: 0800 4/8/04

Blower effluent	Time: 1031	Pitot Tube Delta P (IWC): SIHG .29		Temperature: 119	Feet per minute: 2300	cubic feet per minute:
Location	**Depth or Location**	**Time**	**Barometric Pressure (IWC)**	**Absolute Pressure (IWC)**	**Flow Rate** ~~(acfm)~~ **scfm**	**Temperature (°F)**
Extraction Wells						
MW-BW-62-A		1109		11.7	183	63
MW-BW-63-A		1131		9.5	155	62
MW-BW-68-A		1419		8.1	175	~~66~~ 62
MW-BW-69-A		1433		6.3	168	61
MW-BW-70-A		1122		8.2	127	64
Monitoring Probes						
CTP-SGP-61	30	1114	407.42	407.34		
	60			406.29		
	85			407.37		
CTP-SGP-62	30	14.17 ~~1350~~	406.7 ~~406.7~~	406.57		
	60			406.49		
	85			406.48		
CTP-SGP-51	30	1424	406.62	406.58		
	60			406.51		
	85			406.49		
CTP-SGP-52	30	1428	406.46	406.45		
	60			406.22		
	85			406.30		
CTP-SGP-53	30	1430	406.58	406.53		
	60			406.42		
	85			406.37		
CTP-SGP-54	30	1437	406.71	406.65		
	60			406.52		
	85			406.51		
CTP-SGP-55	30	1448	406.73	406.57		
	60			406.44		
	85			406.41		
CTP-SGP-56	30	1137	407.33	407.24		
	60			407.17		
	85			407.14		
CTP-SGP-57	30	1125	407.38	407.27		
	60			406.52		
	85			406.39		
CTP-SGP-58	30	1120	407.34	407.20		
	60			406.97		
	85			406.91		
CTP-SGP-59	30	1111	407.40	407.28		
	60			406.95		
	85			406.91		
CTP-SGP-60	30	1100	407.45	407.33		
	60			407.17		
	85			407.12		
CTP-SGP-35 1500	Shallow	~~1457~~ ~~1329~~	63 406.79	~~406.81~~ 406.61		
CTP-SGP-37	Shallow	1457 ~~1345~~	406.864	~~406.81~~ 406.58		
CTP-SGP-48	Shallow	1442	406.65	406.63		
CTP-SGP-49	Lexington Ct. sub-slab	1512	406.62	406.60		
CTP-SGP-50	Lexington Ct. exterior	1508	406.59	406.57		

Comments: 69a has a union air leak

Prepared By: [signature]

Form 7-3
Sample Collection Log - Field Measurements
Soil Vapor Extraction System
Operable Unit Carbon Tetrachloride, Former Fort Ord

Date: 4/12/04

System Start Time: 0830   24 hours

System Stop Time:

Blower	Time: 1345	Vacuum (IHg): 5	Filter Backpressure (PSI): 0	Pitot Tube Delta P (IWC): 0.28	Temperature: 122°	Feet per minute:
Extraction Wells	**Time**	**Static Pressure (gauge) (IWC)**	**Temperature (°F)**	**Flow Rate (scfm)**		
MW-BW-62-A	1400	-11.5 ~~[illegible]~~	64°	190		
MW-BW-63-A	1410	-08.7	63°	145		
MW-BW-68-A	1430	-08.5	61°	161		
MW-BW-69-A	1420	-00.5	61°	168		
MW-BW-70-A	1440	-08.3	62°	130		

Monitoring Probes	Depth	Time	Barometric Pressure (IWC)	Absolute Pressure (IWC)	
CTP-SGP-61	30	1450	406.86	406.77	
	60			405.72	
	85			405.79	
CTP-SGP-62	30	1413	406.82	406.47	
	60			406.32	
	85			406.24	
CTP-SGP-51	30	1424	406.81	406.74	
	60			406.64	
	85			406.66	
CTP-SGP-52	30	1428	406.64	406.62	
	60			406.23	
	85			406.34	
CTP-SGP-53	30	1431	406.77	406.70	
	60			~~406.4~~	406.55
	85			406.49	
CTP-SGP-54	30	1435	406.98	406.83	
	60			406.67	
	85			406.65	
CTP-SGP-55	30	1446	406.91	406.75	
	60			406.61	
	85			406.57	
CTP-SGP-56	30	1411	406.89	406.85	
	60			406.71	
	85			406.68	
CTP-SGP-57	30	1408	406.94	406.82	
	60			406.03	
	85			405.90	
CTP-SGP-58	30	1404	406.88	406.74	
	60			406.48	
	85			406.41	
CTP-SGP-59	30	1448	406.81	406.69	
	60			406.36	
	85			406.32	
CTP-SGP-60	30	1355	406.90	406.79	
	60			406.64	
	85			406.59	
CTP-SGP-35	Shallow	1440	406.84	406.81	
CTP-SGP-37	Shallow	1443	406.82	406.76	
CTP-SGP-48	Shallow	1418	406.89	406.86	
CTP-SGP-49	Lexington Ct. sub-slab				
CTP-SGP-50	Lexington Ct. exterior				

Comments:

Prepared By: [signature]

Sample Collection Log - Soil Vapor Extraction System

Date: 4/13/04

System Start Time: 24 Hour

Prepared By: [signature]

System Stop Time:

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
st Blower	5	1529	407.81	+ 0.29	124	0

Extraction Wells	Static Pressure Gauge (IWC)	Time	Barometric Pressure (IWC)	Flow Rate (scfm)	Temperature (°F)
MW-BW-62-A	-11.2	1608	407.75	190	63°
MW-BW-63-A	-08.4	1614	407.70	149	62°
MW-BW-68-A	-08.6	1618	407.68	163	61°
MW-BW-69-A	-06.7	1625	407.73	164	61°
MW-BW-70-A	-08.6	1630	407.71	131	62°

Monitoring Probes	Depth	Time	Barometric Pressure (IWC)	Absolute Pressure (IWC)	
CTP-SGP-61	30	1415	406.87	406.79	
	60			405.75	
	85			405.81	
CTP-SGP-62	30	1430	406.91	406.72	
	60			406.35	
	85			406.28	
CTP-SGP-51	30	1421	407.01	406.74	
	60			406.64	
	85			406.65	
CTP-SGP-52	30	1438	406.48	406.62	
	60			406.23	
	85			406.38	
P-SGP-53	30	1435	406.79	406.71	
	60			406.57	
	85			406.53	
CTP-SGP-54	30	1450	406.93	406.61	
	60			406.68	
	85			406.69	
CTP-SGP-55	30	1701	406.94	406.76	
	60			406.63	
	85			406.58	
CTP-SGP-56	30	1424	406.90	406.66	
	60			406.74	
	85			406.69	
CTP-SGP-57	30	1452	406.84	406.84	
	60			406.07	
	85			405.93	
CTP-SGP-58	30	1603	407.77	407.64	
	60			407.44	
	85			407.39	
CTP-SGP-59	30	1400	407.77 ~~1014.19~~	~~1013.84~~	407.67
	60			~~1014.18~~ ~~1012.99~~	407.41
	85			~~1012.90~~	407.38
CTP-SGP-60	30	1539	407.84	407.14	
	60			407.58	
	85			407.53	
CTP-SGP-35	Shallow		406.92	406.85	
CTP-SGP-37	Shallow		406.85	406.78	
-SGP-48	Shallow		406.92	408.90	
TP-SGP-49	Lexington Ct. sub-slab	1536	407.85	407.81	
CTP-SGP-50	Lexington Ct. exterior		406.94	407.62	

Comments:

Sample Collection Log - Soil Vapor Extraction System

Date: 4/14/04

System Start Time: 24 Hour

Prepared By: Charles Luckie

System Stop Time:

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower	5	1538	407.69	+ 0.27	122°	0

Extraction Wells	Static Pressure Gauge (IWC)	Time	Barometric Pressure (IWC)	Flow Rate (scfm)	Temperature (°F)
MW-BW-62-A	408.84	1511	-11.0	195	63°
MW-BW-63-A	407.79	1514	-8.2	153	62°
MW-BW-68-A	407.71	1523	-8.3	161	61°
MW-BW-69-A	407.72	1527	-6.3	166	61°
MW-BW-70-A	407.83	1519	-8.0	128	62°

Monitoring Probes	Depth	Time	Barometric Pressure (IWC)	Absolute Pressure (IWC)
CTP-SGP-61	30	1628	407.69	407.61
	60			406.41
	85			406.67
CTP-SGP-62	30	1625	407.59	407.45
	60			407.14
	85			407.08
CTP-SGP-51	30	1623	407.62	407.54
	60			407.45
	85			407.41
CTP-SGP-52	30	1618	407.46	407.44
	60			407.10
	85			407.21
CTP-SGP-53	30	1612	407.58	407.52
	60			407.39
	85			407.34
CTP-SGP-54	30	1608	407.72	407.64
	60			407.53
	85			407.51
CTP-SGP-55	30	1602	407.77	407.64
	60			407.51
	85			407.48
CTP-SGP-56	30	1557	407.68	407.65
	60			407.55
	85			407.52
CTP-SGP-57	30	1553	407.72	407.63
	60			40~~6~~.90
	85			406.77
CTP-SGP-58	30	1549	407.69	407.57
	60			407.36
	85			407.30
CTP-SGP-59	30	1545	407.69	401.60
	60			407.31
	85			407.28
CTP-SGP-60	30	1504	407.72	407. ~~86~~ 64
	60			407.52
	85			407.49
CTP-SGP-35	Shallow	1614	406.88	406.52
CTP-SGP-37	Shallow	1651	406.91	406.84
CTP-SGP-48	Shallow	1500	406.87	406.74
CTP-SGP-49	Lexington Ct. sub-slab	1450	407.84	407.63
CTP-SGP-50	Lexington Ct. exterior	1454	406.84	407.67

Comments:

Sample Collection Log - Soil Vapor Extraction System

Date: 4/15/04

System Start Time: 24 hour

Prepared By: BOO

System Stop Time:

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower	~5.0	1620	406.81	+0.26	123	0 ~~+0.26~~

Extraction Wells	Static Pressure Gauge (IWC)	Time	Barometric Pressure (IWC)	Flow Rate (scfm)	Temperature (°F)
MW-BW-62-A	-11.2	1640	406.84	175	63
MW-BW-63-A	-8.6	1450	406.89	151	62
MW-BW-68-A	-8.4	1650	406.69	160	61
MW-BW-69-A	-6.6	1700	406.73	168	62
MW-BW-70-A	-8.2	1520	406.88	126	62

Monitoring Probes	Depth	Time	Barometric Pressure (IWC)	Absolute Pressure (IWC)
CTP-SGP-61	30	1550	406.95	406.85
	60			406.82
	85			405.88
CTP-SGP-62	30	1340	406.85	406.72
	60			406.41
	85			406.35
CTP-SGP-51	30	1320	406.91	406.83
	60			406.73
	85			406.69
CTP-SGP-52	30	1315	406.75	406.72
	60			406.38
	85			406.49
CTP-SGP-53	30	1310	406.86	406.80
	60			406.68 67
	85			406.62
CTP-SGP-54	30	1300	407.00	406.94
	60			406.82
	85			406.80
CTP-SGP-55	30	1400	407.02	406.87
	60			406.73
	85			406.69
CTP-SGP-56	30	1410	406.93	406.88
	60			406.75
	85			406.72
CTP-SGP-57	30	1530	406.92	406.81
	60			406.06
	85			405.93
CTP-SGP-58	30	1540	406.86	406.73
	60			406.49
	85			406.43
CTP-SGP-59	30	1600	406.88	~~406.88~~ 406.75
	60			406.43
	85			406.39
CTP-SGP-60	30	1610	406.~~88~~ 87	406.77
	60			406.63
	85			406.59
CTP-SGP-35	Shallow	1620	406.87	406.84
CTP-SGP-37	Shallow	1440	406.89	406.84
CTP-SGP-48	Shallow	1350	406.93	406.91
CTP-SGP-49	Lexington Ct. sub-slab	1630	406.81	406.79
CTP-SGP-50	Lexington Ct. exterior	1330	406.94	406.84

Comments:

Sample Collection Log - Soil Vapor Extraction System

Date: 4/16/04

System Start Time: 24 hour

Prepared By: 1300

System Stop Time:

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower	-5.05	1720	406.17	+0.26	123	0

Extraction Wells	Static Pressure Gauge (IWC)	Time	Barometric Pressure (IWC)	Flow Rate (scfm)	Temperature (°F)
MW-BW-62-A	-11.4	1710	406.24	194	62
MW-BW-63-A	-8.4	1430	406.28	153	62
MW-BW-68-A	-8.3	1350	406.28	132	61
MW-BW-69-A	-6.5	1320	406.34	156	60
MW-BW-70-A	-8.2	1600	406.28	122	62

Monitoring Probes	Depth	Time	Barometric Pressure (IWC)	Absolute Pressure (IWC)
CTP-SGP-61	30	1630	406.26	406.18
	60			405.17
	85			405.23
CTP-SGP-62	30	1410	406.26	406.12
	60			405.81
	85			~~405.80~~ 405.75
CTP-SGP-51	30	1340	406.34	406.26
	60			406.16
	85			406.12
CTP-SGP-52	30	1330	406.17	406.16
	60			405.92
	85			405.80
CTP-SGP-53	30	1310	406.31	406.25
	60			406.12
	85			406.07
CTP-SGP-54	30	1300	406.46	406.39
	60			406.25
	85			406.22
CTP-SGP-55	30	1440	406.37	406.22
	60			406.11
	85			406.07
CTP-SGP-56	30	1450	406.25	406.22
	60			406.12
	85			406.09
CTP-SGP-57	30	1610	406.24	406.15
	60			405.40
	85			405.27
CTP-SGP-58	30	1620	406.20	406.07
	60			405.83
	85			405.77
CTP-SGP-59	30	1640	406.22	406.09
	60			405.77
	85			405.74
CTP-SGP-60	30	1700	406.23	406.12
	60			405.98
	85			405.94
CTP-SGP-35	Shallow			
CTP-SGP-37	Shallow	1430	406.30	406.24
CTP-SGP-48	Shallow	1420	406.32	406.29
CTP-SGP-49	Lexington Ct. sub-slab	1650	406.22	406.19
CTP-SGP-50	Lexington Ct. exterior	1400	406.37	406.~~25~~ 32

Comments: N Side Garage temp = 76 °F

Sample Collection Log - Soil Vapor Extraction System

Date: 4/22/04

Prepared By: Tom Ghigliotto

System Start Time: 24 hour

System Stop Time:

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower	3	1530	406.43	+.26	125.	0

Extraction Wells	Static Pressure Gauge (IWC)	Time	Barometric Pressure (IWC)	Flow Rate (scfm)	Temperature (°F)
MW-BW-62-A	-11.2	15:45	406.50	189	63
MW-BW-63-A	-8.4	1410	406.54	151	63
MW-BW-68-A	-8.3	1355	406.55	155	61
MW-BW-69-A	~~406.~~ -6.4	1325	406.55	169	61
MW-BW-70-A	-8.1	1440	406.43	114	66

79.2 Indoor Tem

Monitoring Probes	Depth	Time	Barometric Pressure (IWC)	Absolute Pressure (IWC)
CTP-SGP-61	30	1500	406.48	406.71
	60			405.37
	85			405.44
CTP-SGP-62	30	1450	406.38	406.22
	60			405.89
	85			405.83
CTP-SGP-51	30	1345	406.59	406.50
	60			406.38
	85			406.33
CTP-SGP-52	30	1335	406.43	406.39
	60			406.12
	85			406.00
CTP-SGP-53	30	1320 ~~1315~~	406.51 ~~406.64~~	~~406.57~~ 406.44
	60			~~406~~.31
	85			406.25
CTP-SGP-54	30	1315	406.64	406.57
	60			406.42
	85			406.40
CTP-SGP-55	30	1415	406.59	~~406.31~~ ~~406.~~ 406.29 *
	60			~~406.25~~ 406.25
	85			406.30
CTP-SGP-56	30	1425	406.47	406.45
	60			406.34
	85			406.31
CTP-SGP-57	30	1435	406.48	406.40
	60			405.68
	85			405.55
CTP-SGP-58	30	1455	406.44	406.29
	60			406.04
	85			405.97
CTP-SGP-59	30	1510	406.42	406.31
	60			405.98
	85			405.95
CTP-SGP-60	30	1515	406.43	406.33
	60			406.19
	85			406.15
CTP-SGP-35	Shallow			← Not measured
CTP-SGP-37	Shallow	1415	406.54	406.~~50~~ ~~22~~ 48
CTP-SGP-48	Shallow	1405	406.54	406.53 ~~.652~~
CTP-SGP-49	Lexington Ct. sub-slab	* 1535	406.44	406.44
CTP-SGP-50	Lexington Ct. exterior	1520	406.44	406.~~24~~ 40

Comments: * #55 @ 30' & 60 would not stabalize

Sample Coll. . Vapor Extraction System

Date: 4/29/04

Prepared By: Tom Ghislworth

System Start Time: 24 hour

System Stop Time:

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower 74.2° indoor	5.25	1300	404.42	+0.26	128°	0
Extraction Wells	**Static Pressure Gauge (IWC)**	**Time**	**Barometric Pressure (IWC)**	**Flow Rate (scfm)**	**Temperature (°F)**	
MW-BW-62-A	-11.2	1458	404.41	183	64	
MW-BW-63-A	-8.5	1440	404.52	144	62	
MW-BW-68-A	-8.4	1435	404.44	152	~~62~~ 61	
MW-BW-69-A	-6.4	1430	404.47	160	61	
MW-BW-70-A	-8.0	1450	404.49	118	63	
Monitoring Probes	**Depth**	**Time**	**Barometric Pressure (IWC)**	**Absolute Pressure (IWC)**		
CTP-SGP-61	30	1320	404.53	404.45		
	60			403.34		
	85			403.42		
CTP-SGP-62	30	1345	404.44	404.28		
	60			403.91		
	85			403.84		
CTP-SGP-51	30	1355	404.50	404.40		
	60			404.27		
	85			404.22		
CTP-SGP-52	30	1405	404.32	404.30		
	60			404.01		
	85			403.87		
CTP-SGP-53	30	1420	404.45	404.36		
	60			404.20		
	85			404.14		
CTP-SGP-54	30	1415	404.56	404.48		
	60			404.32		
	85			404.29		
CTP-SGP-55	30	1340	404.59	404.43		
	60			404.30		
	85			404.59		
CTP-SGP-56	30	1335	404.~~49~~ 50	404.45		
	60			404.30		
	85			404.26		
CTP-SGP-57	30	1330	404.52	404.41		
	60			403.62		
	85			403.49		
CTP-SGP-58	30	1325	404.48	404.32		
	60			404.05		
	85			403.98		
CTP-SGP-59	30	1320	404.50	404.35		
	60			403.97		
	85			403.94		
CTP-SGP-60	30	1315	404.49	404.36		
	60			404.19		
	85			404.14		
CTP-SGP-35	Shallow	1458	404.48	404.44		
CTP-SGP-37	Shallow	1445	404.52	404.46		
CTP-SGP-48	Shallow	1350	404.54	404.51		
CTP-SGP-49	Lexington Ct. sub-slab					
CTP-SGP-50	Lexington Ct. exterior					

Comments:

Sample Collection Log - Soil Vapor Extraction System

Date: 3 June, 04

System Start Time:

Prepared By: Charles Luenzie

System Stop Time:

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower	5.25	1010	406.78 ~~0.21~~	0.21	130	0

Extraction Wells	Static Pressure Gauge (IWC)	Time	Barometric Pressure (IWC)	Flow Rate (scfm)	Temperature (°F)
MW-BW-62-A	-11.4	1210	407.03	177	63°
MW-BW-63-A	-8.5	1155	406.99	134	63°
MW-BW-68-A	-8.4	1140	406.85	152	61°
MW-BW-69-A	-6.4	1135	406.85	162	60°
MW-BW-70-A	-8.2	1205	406.99	110	65°

Monitoring Probes	Depth	Time	Barometric Pressure (IWC)	Absolute Pressure (IWC)
CTP-SGP-61	30	1030	406.90	406.80
	60			405.66
	85			405.73
CTP-SGP-62	30	1100	406.85	406.67
	60			406.28
	85			406.21
CTP-SGP-51	30	1105	406.89	406.77
	60			406.63
	85			406.57
CTP-SGP-52	30	1110	406.72	406.68
	60			406.35
	85			406.21
CTP-SGP-53	30	1120	406.84	406.75
	60			406.58
	85			406.51
CTP-SGP-54	30	1125	406.99	406.89
	60			406.70
	85			406.65
CTP-SGP-55	30	1055	407.01	406.79
	60			406.61
	85			406.53
CTP-SGP-56	30	1045	406.91	406.83
	60			406.65
	85			406.61
CTP-SGP-57	30	1040	406.91	406.79
	60			405.96
	85			405.82
CTP-SGP-58	30	1035	406.87	406.69
	60			406.40
	85			406.30
CTP-SGP-59	30	1030	406.83	406.68
	60			406.29
	85			406.25
CTP-SGP-60	30	1025	406.81	406.88
	60			406.51
	85			406.45
CTP-SGP-35	Shallow	1215	407.06	407.02
CTP-SGP-37	Shallow	1200	406.98	406.91
CTP-SGP-48	Shallow	1150	406.95	406.95
CTP-SGP-49	Lexington Ct. sub-slab	1015	406.80	406.77
CTP-SGP-50	Lexington Ct. exterior	1145	407.01	406.93

Comments:

Sample Collection Log - Soil Vapor Extraction System (1 of 2)

Date: 9/14/04   Prepared By: Tom [signature]

System Start Time: See Tom   System Stop Time:

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower	-5.25	1330	404.15	0.26	131	0
Extraction Wells	**Static Pressure Gauge (IWC)**	**Time**	**Barometric Pressure (IWC)**	**Flow Rate (scfm)**	**Temperature (°F)**	
MW-BW-62-A	-11.2	1445	404.13	182	64	
MW-BW-63-A	-8.2	1455	404.07	133	63	
MW-BW-68-A	-8.2	1500	404.07	152	62	
MW-BW-69-A	-6.3	1505	403.96	155	61	
MW-BW-70-A	-8.0	1450	404.07	120	64	
Monitoring Probes	**Depth**	**Time**	**Barometric Pressure (IWC)**	**Absolute Pressure (IWC)**		
CTP-SGP-35	Shallow	1615	403.71	403.69		
CTP-SGP-37	Shallow	1605	403.73	403.67		
CTP-SGP-48	Shallow	1610	403.70	403.69		
CTP-SGP-49	Lexington Ct. sub-slab	15:50	403.78	403.77		
CTP-SGP-50	Lexington Ct. exterior	15:45	403.78	403.74		
CTP-SGP-51	30	1440	403.91	403.84		
	60			403.74		
	85			403.70		
CTP-SGP-52	30	1525	403.77	403.73		
	60			403.50		
	85			403.395		
CTP-SGP-53	30	1515	403.95	403.90		
	60			403.77		
	85			403.72		
CTP-SGP-54	30	1510	404.09	404.03		
	60			403.90		
	85			403.88		
CTP-SGP-55	30	14:50	403.99	403.87		
	60			403.75		
	85			403.71		
CTP-SGP-56	30	14:55	403.90	403.87		
	60			403.77		
	85			403.74		
CTP-SGP-57	30	15:20	403.83	403.75		
	60			403.03		
	85			402.91		

8590 9/15 @ 1540

Sample Collection Log - Soil Vapor Extraction System (1 of 2)

Date: 10/7/04 Prepared By: [signature]

System Start Time: ______ 24 hrs. System Stop Time: ______

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower	-5.5	0900	406.82	0.25	130	0
Extraction Wells	**Static Pressure Gauge (IWC)**	**Time**	**Barometric Pressure (IWC)**	**Flow Rate (scfm)**	**Temperature (°F)**	
MW-BW-62-A	-11.2	0915	406.84	177	63	
MW-BW-63-A	-8.3	0925	406.83	129	63	
MW-BW-68-A	-8.3	0930	406.78	149	61	
MW-BW-69-A	-6.5	0935	406.78	155	61	
MW-BW-70-A	-8.0	0920	406.85	110	62	
Monitoring Probes	**Depth**	**Time**	**Barometric Pressure (IWC)**	**Absolute Pressure (IWC)**		
CTP-SGP-35	Shallow	N/A →	→	→		
CTP-SGP-37	Shallow	↓				
CTP-SGP-48	Shallow	↓				
CTP-SGP-49	Lexington Ct. sub-slab	↓				
CTP-SGP-50	Lexington Ct. exterior	↓				
CTP-SGP-51	30	0950	406.87	406.76		
	60			406.64		
	85			406.59		
CTP-SGP-52	30	0955	406.70	406.67		
	60			406.38		
	85			~~406.24~~ 406.24		
CTP-SGP-53	30	0945	406.80	406.72		
	60			406.58		
	85			406.51		
CTP-SGP-54	30	0940	406.93	406.85		
	60			406.68		
	85			406.64		
CTP-SGP-55	30	1025	407.01	406.82		
	60			406.68		
	85			406.63		
CTP-SGP-56	30	1035	406.90	406.87		
	60			406.73		
	85			406.69		
CTP-SGP-57	30	1240	406.91	406.81		
	60			406.07		
	85			405.94		

Sample Collection Log

Date: 10/14/04

System Start Time:

Prepared By: [signature]

System Stop Time:

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower	-5.75	1015	405.62	0.27	132	0
Extraction Wells	**Static Pressure Gauge (IWC)**	**Time**	**Barometric Pressure (IWC)**	**Flow Rate (scfm)**	**Temperature (°F)**	
MW-BW-62-A	-10.8	1250	405.10	176	64	
MW-BW-63-A	-8.1	1225	405.55	166	63	
MW-BW-68-A	-8.0	1155	405.47	145	62	
MW-BW-69-A	-6.0	1115	405.50	157	63	
MW-BW-70-A	-7.9	1300	405.08	108	64	
Monitoring Probes	**Depth**	**Time**	**Barometric Pressure (IWC)**	**Absolute Pressure (IWC)**		
CTP-SGP-35	Shallow					
CTP-SGP-37	Shallow					
CTP-SGP-48	Shallow					
CTP-SGP-49	Lexington Ct. sub-slab					
CTP-SGP-50	Lexington Ct. exterior					
CTP-SGP-51	30	1205	405.55	405.~~50~~ 48		
	60			405.40		
	85			405.36		
CTP-SGP-52	30	1145	405.41	405.39		
	60			405.20		
	85			405.10		
CTP-SGP-53	30	1105	405.56	405.49		
	60			405.37		
	85			405.34		
CTP-SGP-54	30	1055	405.~~30~~ .69	405.62		
	60			405.46		
	85			405.43		
CTP-SGP-55	30	0915	405.51	405.32		
	60			405.16		
	85			405.11		
CTP-SGP-56	30	0925	405.41	405.36		
	60			405.21		
	85			405.18		
CTP-SGP-57	30	1310	405.15	405.05		
	60			404.34		
	85			404.21		

Sample Collection Log - Soil Vapor Extraction System (1 of 2)

Date: 11/2/04   24 hr.   Prepared By: Tom [illegible]

System Start Time: ______   System Stop Time: ______

Post Blower	Vacuum (IHg)	Time	Barometric Pressure (IWC)	Pitot Tube Velocity Pressure (IWC)	Temperature (°F)	Filter Backpressure (PSI)
Post Blower	-7.0	1115	409.41	0.24	136	0

Extraction Wells	Static Pressure Gauge (IWC)	Time	Barometric Pressure (IWC)	Flow Rate (scfm)	Temperature (°F)
MW-BW-62-A	-5.7	1055	409.80	100	64
MW-BW-63-A	-4.4	1020	409.80	57	63
MW-BW-68-A	-13.4	1010	409.72	236	61
MW-BW-69-A	~~[illegible]~~ -9.6	0945	409.80	228	60
MW-BW-70-A	-5.4	1035	409.78	96	63

Monitoring Probes	Depth	Time	Barometric Pressure (IWC)	Absolute Pressure (IWC)
CTP-SGP-35	Shallow			
CTP-SGP-37	Shallow			
CTP-SGP-48	Shallow			
CTP-SGP-49	Lexington Ct. sub-slab			
CTP-SGP-50	Lexington Ct. exterior			
CTP-SGP-51	30	1005	409.78	409.65
	60			409.49
	85			409.43
CTP-SGP-52	30	1000	409.65	409.59
	60			409.21
	85			409.05
CTP-SGP-53	30	0950	409.77	409.67
	60			409.47
	85			409.40
CTP-SGP-54	30	0955	409.89	409.80
	60			409.60
	85			409.56
CTP-SGP-55	30	1025	409.92	409.80
	60			409.70
	85			409.67
CTP-SGP-56	30	1030	409.80	409.77
	60			409.69
	85			409.67
CTP-SGP-57	30	1040	409.8[illegible]	409.75
	60			409.25
	85			409.16

[illegible] 12/6/04   11/22 wells off

Appendix D
Dwyer Pitot Tube Specifications

BULLETIN NO. H-11

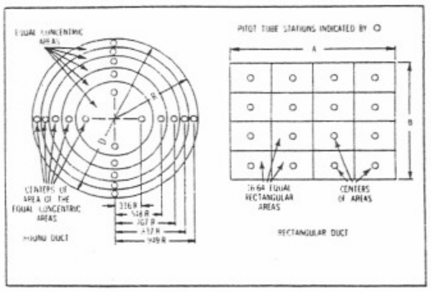
AIR VELOCITIES WITH THE DWYER PITOT TUBE

AIR VELOCITY

The total pressure of an air stream flowing in a duct is the sum of the static or bursting pressure exerted upon the sidewalls of the duct and the impact or velocity pressure of the moving air. Through the use of a pitot tube connected differentially to a manometer, the velocity pressure alone is indicated and the corresponding air velocity determined.

For accuracy of plus or minus 2%, as in laboratory applications, extreme care is required and the following precautions should be observed:

1. Duct diameter 4″ or greater.
2. Make an accurate traverse per sketch at right, calculate the velocities and average the readings.
3. Provide smooth, straight duct sections a minimum of 8½ diameters in length upstream and 1½ diameters downstream from the pitot tube.
4. Provide an egg crate type straightener upstream from the pitot tube.



In making an air velocity check select a location as suggested above, connect tubing leads from both pitot tube connections to the manometer and insert in the duct with the tip directed into the air stream. If the manometer shows a minus indication reverse the tubes. With a direct reading manometer, air velocities will now be shown in feet per minute. In other types, the manometer will read velocity pressure in inches of water and the corresponding velocity will be found from the curves in this bulletin. If circumstances do not permit an accurate traverse, center the pitot tube in the duct, determine the center velocity and multiply by a factor of .9 for the approximate average velocity. Field tests run in this manner should be accurate within plus or minus 5%.

The velocity indicated is for dry air at 70°F., 29.9" Barometric Pressure and a resulting density of .075#/cu. ft. For air at a temperature other than 70°F. refer to the curves in this bulletin. For other variations from these conditions, corrections may be based upon the following data:

$$\text{Air Velocity} = 1096.2\sqrt{\frac{P_V}{D}}$$

where P_V = velocity pressure in inches of water
D = Air density in #/cu. ft.

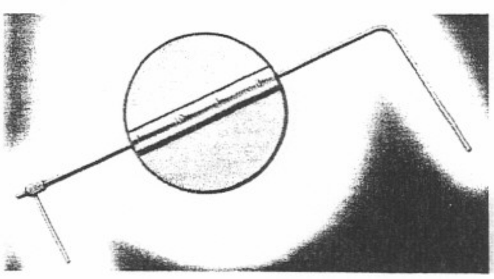
$$\text{Air Density} = 1.325 \times \frac{P_B}{T}$$

where P_B = Barometric Pressure in inches of mercury
T = Absolute Temperature (indicated temperature °F plus 460)

Flow in cu. ft. per min. = Duct area in square feet x air velocity in ft. per min.

AIR VELOCITY CALCULATOR

Computes velocity based on air density corrected for conditions of temperature and pressure. Eliminates tedious calculations. Ranges from .01 to 10" water corresponding to 400 to 20,000 FPM. Furnished with each pitot tube.

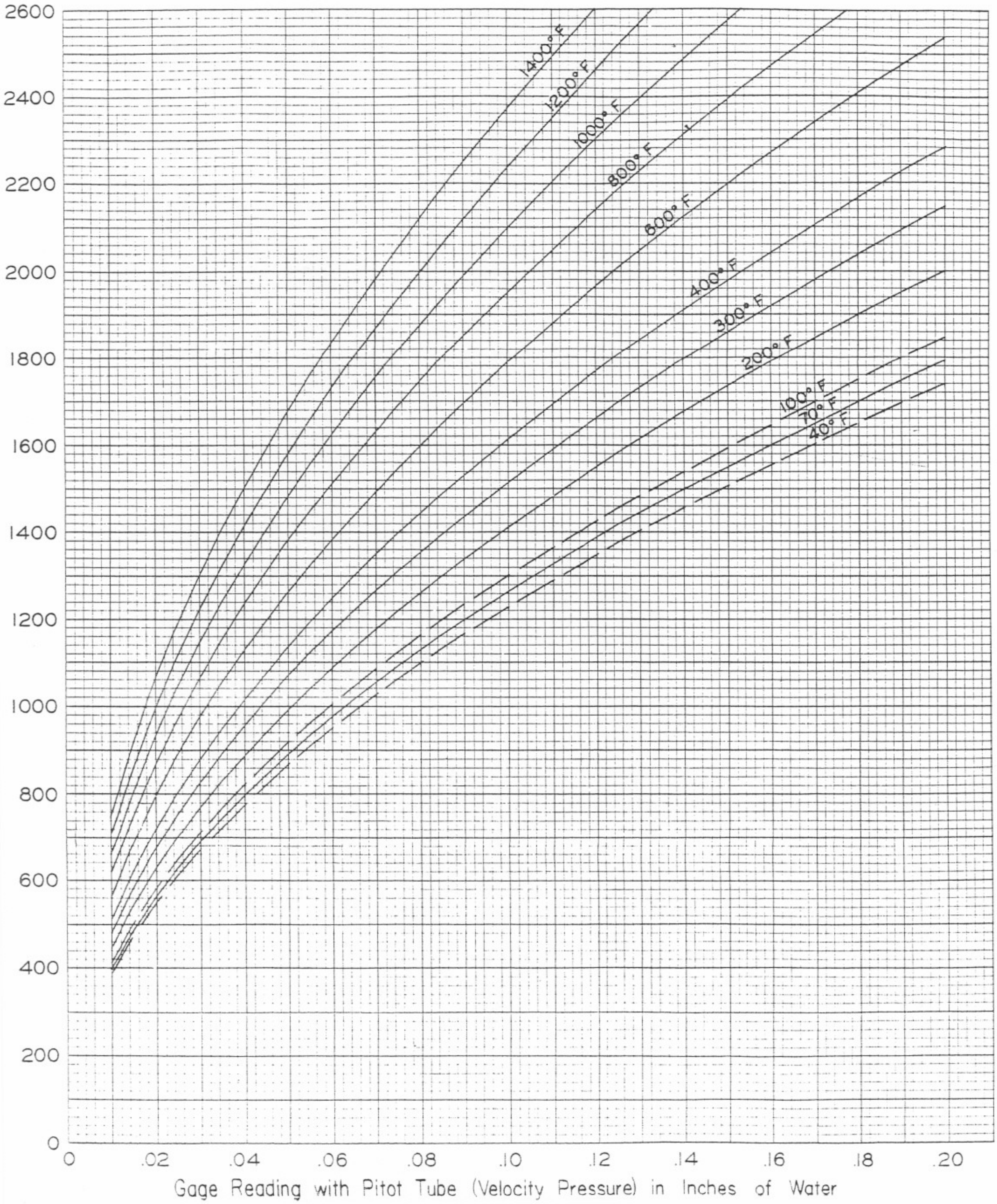


STAINLESS STEEL PITOT TUBES

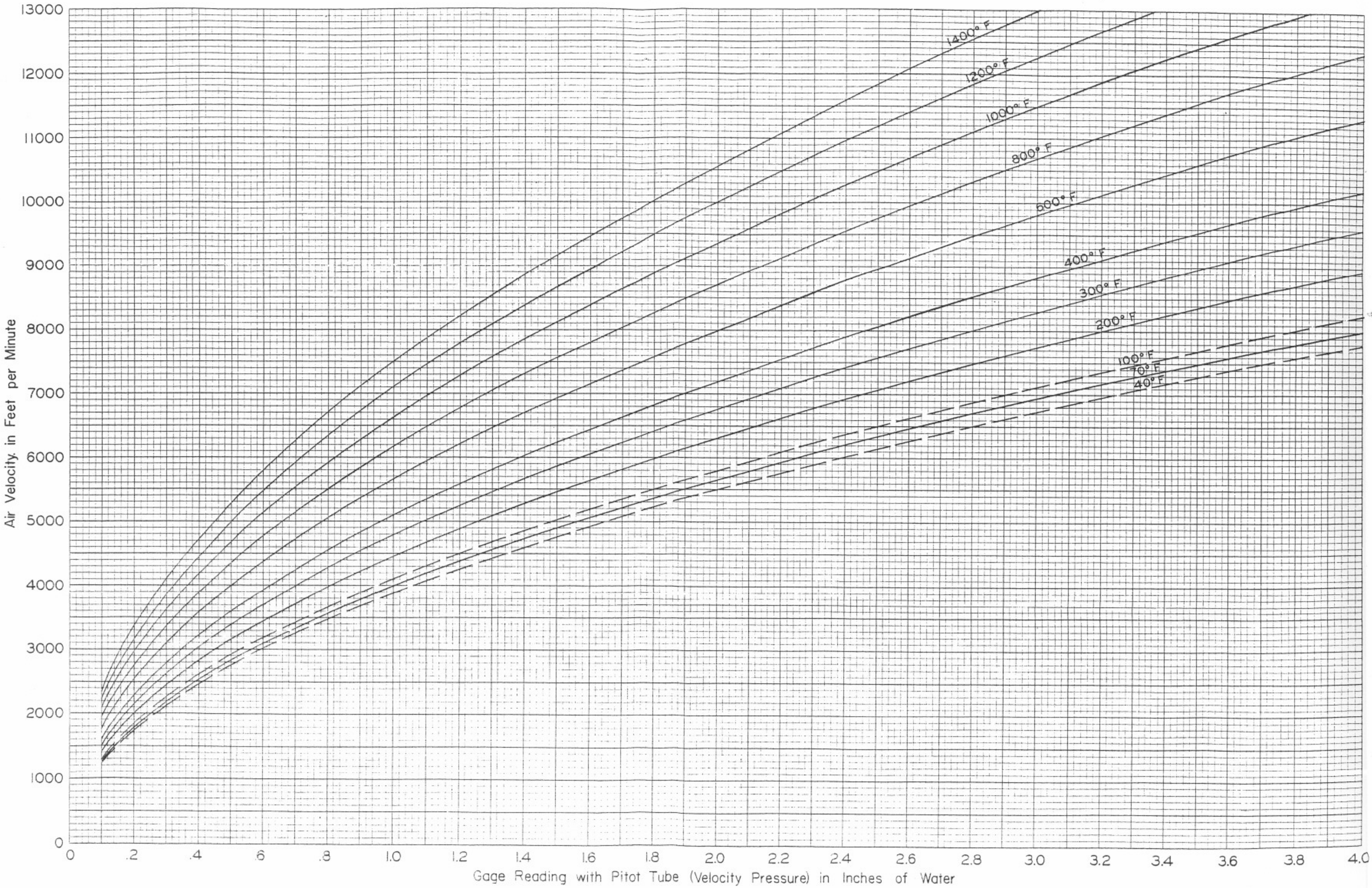
Test confirmed unity coefficient and lifetime construction of No. 304 stainless steel. Inch graduations show depth of insertion for traversing. Complies with AMCA and ASHRAE specifications. Sizes 12" to 60" long. Hand or fixed mounting types.

Printed in U.S.A. 8/92

DWYER INSTRUMENTS, INC.
P. O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Telephone 219/879-8000
Fax 219/872-9057



FR 72-440226-00



Air Velocity in Feet per Minute
Gage Reading with Pitot Tube (Velocity Pressure) in Inches of Water
1400° F
1200° F
1000° F
800° F
600° F
400° F
300° F
200° F
100° F
70° F
40° F
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
0
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE
(Read Instructions on the reverse side prior to initiating this form)

DATE: August 18, 2005

TRANSMITTAL NO.: 016

Section I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This Section will be initiated by the contractor)*

TO: Doug Stanley
U.S. Army Corps of Engineers
1325 "J" Street
Sacramento, CA 95814-2922

FROM: Peter Kelsall
Shaw Environmental, Inc.
P.O. Box 1698
Marina, CA 93933-1698

CONTRACT NO.
DACW05-96-D-0011

T.O. # 011 WAD # 12

CHECK ONE:
X THIS IS A NEW TRANSMITTAL
THIS IS A RESUBMITTAL OF TRANSMITTAL

SPECIFICATION NO. (Cover only one section with each transmittal)

PROJECT TITLE AND LOCATION: FORMER FORT ORD, CALIFORNIA

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED *(Type, size, model number, etc.)* b.	MFG. OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. *(See Instruction No. 8)* c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT: SPEC. PARA. NO. e.	CONTRACT REFERENCE DOCUMENT: DRAWING SHEET NO. f.	FOR CONTRACTOR USE CODE g.	VARIATION *(See Instruction No. 6)* h.	FOR C E USE CODE i.
013	Draft Evaluation Report, Pilot Soil Vapor Extraction and Treatment, Operable Unit, Carbon Tetrachloride Plume, Former Fort Ord, California. Revision C (For Government Review Only)	N/A	36	SOP17		A		
014	DRF for the Draft Evaluation Report, Pilot Soil Vapor Extraction and Treatment, Operable Unit, Carbon Tetrachloride Plume, Former Fort Ord, California. Revision C (For Your Information Only)	N/A	36	SOP17		F		

REMARKS
cc:
See
Distribution List

CONTRACTOR QUALITY CONTROL SYSTEMS MANAGER
Shaw Environmental, Inc.
✓ Approved
_________ Approved with corrections as noted on submittal data and/or attached sheet(s).

SIGNATURE: Signature on File
TITLE: CONTRACTOR QUALITY CONTROL SYSTEM MANAGER

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

Shaw Environmental, Inc.

Signature on File /PETER KELSALL
NAME AND SIGNATURE OF CONTRACTOR

Section II - APPROVAL ACTION

ENCLOSURES RETURNED (List by Item No.)	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

DOCUMENT REVIEW AND RELEASE FORM

Shaw Environmental, Inc.

Client: USACE	Authors: Shaw	Submittal Register Item No.: 016	Date: August 18, 2005

Document Title:	Draft Evaluation Report, Pilot Soil Vapor Extraction and Treatment, Operable Unit, Carbon Tetrachloride Plume, Former Fort Ord, California	Revision: 0	T.O. # 011	WAD# 12

Reviewer (*print*)	Reviewer Initial & Date	Technical	Project Manager	CQC	Health and Safety Manager	Task Manager	Chemistry	UXO	Construction	Reviewer Comments Resolved (*Signature & Date)*
Peter Kelsall			X							Signature on File
Tom Ghigliotto				X						Signature on File
Eric Schmidt							X			Signature on File
Same as Technical Reviewer above		X	Topic outline with objectives for each section submitted prior to Rev. A							

Program Reviewer's Acceptance for Document Submittal	Signature	Yes	No
1) A 4025 (as applicable) prepared and submitted with document?	Signature on File	X	
2) Technical Conclusions adequately supported by text and data?	Signature on File	X	
3) Tables and Figures are in the proper format and checked and approved?	Signature on File	X	
4) The Table of Contents consistent with text information?	Signature on File	X	
5) Technical Reviewers are qualified and accepted by Project Manager?	Signature on File	X	
6) A document Distribution List been prepared and submitted with document?	Signature on File	X	

Recommended
4025 Code A

Signature on File
Project Manager

Signature on File
Contractor Quality Control Systems Manager

FORT ORD

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1			Marc Edwards	Department of the Army, USACE	BRAC, Bldg. #4463 Gigling Road	Monterey, CA	93944-5004	Yes
		1	Gail Youngblood/ Derek Lieberman	Department of the Army, Fort Ord BRAC Office	BRAC, Bldg. #4463 Gigling Road	Monterey, CA	93944-5004	Yes
1			Peter Kelsall	Shaw Environmental, Inc.	9201 East Dry Creek Road	Centennial, CO	80112	Yes
		1	Jen Moser/ Tom Ghigliotto	Shaw Environmental, Inc.	PO Box 1698	Marina, CA	93933	Yes
1			Eric Schmidt	Shaw Environmental, Inc.	PO Box 1698	Marina, CA	93933	Yes
1		1	Ed Ticken	Mactec	5341 Old Redwood Hwy; Suite 300	Petaluma, CA	94954	Yes
1		1	Roman Racca	California Department of Toxic Substances Control	8800 California Center Drive	Sacramento, CA	95826	Yes
		1	Grant Himebaugh	California Regional Water Quality Control Board	895 Aerovista Place; Suite 101	San Luis Obispo, CA	93401-7906	Yes
		1	Bill Mabey	Tech Law, Inc.	90 New Montgomery Street; Suite 1010	San Francisco, CA	94105	Yes
		1	Martin Hausladen	U.S. Environmental Protection Agency	Home address			Yes
		1	Stewart Black	California Department of Toxic Substances Control	8800 California Center Drive	Sacramento, CA	95826	Yes
1		3	Sandy Reese	Administrative Records	BRAC, Bldg #4463 Gigling Road	Monterey, CA	93944-5004	Yes
		1	Peter deFur	TAG Consultant	1108 Westbriar Drive; Suite F	Richmond, VA	23238	Yes

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1			Curt Gandy	Fort Ord Toxics Project	PO Box 1904	Monterey, CA	93942	Yes
		1	Mike Weaver		52 Corral De Tierra Road	Salinas, CA	93908	Yes
1		1	Bruce Becker		PO Box 1904	Monterey, CA	93942	Yes
1			Michael Boyd		5439 Soquel Drive	Soquel, CA	95073	Yes
1			Commander Ed Lorenzana		1200 Aquajito Road; Suite 002	Monterey, CA	93940	Yes
1			Ed Oberwieser		2080 7th Avenue	Santa Cruz, CA	95062	Yes
1		1	Project File	Shaw Environmental, Inc.	PO Box 1698	Marina, CA	93933	Yes
1			Program File (Kathy Grider)	Shaw Environmental, Inc.	4005 Port Chicago Highway	Concord, CA	94520-1120	Yes

18 0 17

Approved: Signature on File

David Eisen,
USACE Project Manager