

Final Work Plan for Soil Vapor Extraction System Upgrades for Area of Concern 65 and Solid Waste Management Unit B-3



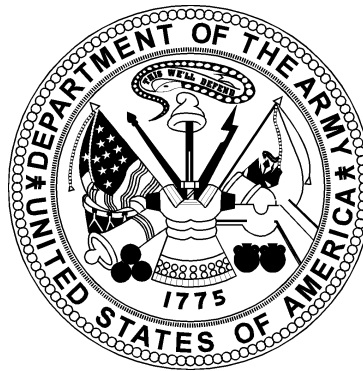
Prepared for:

**Camp Stanley Storage Activity
Boerne, Texas**

August 2006

**FINAL WORK PLAN FOR SOIL VAPOR EXTRACTION
SYSTEM UPGRADES FOR AREA OF CONCERN 65 AND
SOLID WASTE MANAGEMENT UNIT B-3**

CAMP STANLEY STORAGE ACTIVITY



BOERNE, TEXAS

PREPARED FOR

**CAMP STANLEY STORAGE ACTIVITY
BOERNE, TEXAS
AFCEE/ERD QAE
BROOKS AFB, TEXAS**

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
AFCEE	Air Force Center for Environmental Excellence
bgs	Below ground surface
cfm	cubic feet per minute
CSSA	Camp Stanley Storage Activity
CY	Cubic yard
DQO	Data quality objectives
ft	Foot or feet
HDPE	High density polyethylene
hp	Horsepower
Hz	Hertz
ID	Inside diameter
lbs/yr	Pound per year
LGR	Lower Glen Rose
NM	Not measured
O&M	operations and maintenance
PBR	Permit by rule
PCE	tetrachloroethene
Ppbv	Parts per billion by volume
PVC	Polyvinyl chloride
PVER	Pore volume exchange rate
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
ROI	Radius of Influence
scfm	Standard cubic feet per minute
SHPO	State Historic Preservation Office
SOW	Statement of work
SVE	soil vapor extraction
SWMU	Solid Waste Management Unit

TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TVH	Total volatile hydrocarbons
UGR	Upper Glen Rose
USGS	U.S. Geological Survey
V	volts
VEW	vapor extraction well
VMP	Vapor monitoring points
VOC	volatile organic compound
WP	Work plan

SECTION 1 INTRODUCTION

1.1 PROJECT OBJECTIVES

The objective of this project is to perform additional system expansion activities for the soil vapor extraction (SVE) systems currently in place at Area of Concern (AOC)-65 and Solid Waste Management Unit (SWMU) B-3 at Camp Stanley Storage Activity (CSSA), Boerne, Texas. The purpose of the expansion is to improve contaminant removal rates for the SVE systems. Improvement of the contaminant removal rates will be accomplished by installing new vapor extraction wells (VEWs) in new locations or complete VEWs in depth intervals that are not addressed with the current systems. Removal rates will also be improved by reconfiguring piping for the AOC-65 and Building 90 SVE systems in order to increase airflow within the piping. Additionally, removal rates for the AOC-65 system will be improved by installing a new vacuum blower sized to provide higher airflow while maintaining adequate vacuum levels.

Parsons intends to achieve these objectives by expanding the existing SVE systems to improve performance. Expansion activities will include:

Installing a new vacuum blower and new VEWs at AOC-65; and replacing the inoperable blower at SWMU B-3;

- Testing the existing VEWs at AOC-65 to identify ones that should be removed from future extraction operations;
- Reconfiguring the extraction piping for the AOC-65 and Building 90 systems: and
- Evaluating the need for continued SVE operations at SWMU B-3 and re-installing the blower and installing new wells if determined beneficial.

1.2 SCOPE OF WORK

The scope of work as described in the technical approach for the task order authorizing this task includes:

- Installing one deep nested VEW cluster near the Building 90 west loading dock, installing up to four shallow VEWs, and installing up to three intermediate-depth VEWs west of the ditch at Building 90. The nested VEW cluster will consist of two VEWs installed to depths of 125 and 180 feet (ft) below ground surface (bgs).
- Installing four new shallow VEWs and three intermediate depth VEWs west of the Building 90 asphalt parking lot and adjacent drainage ditch. The shallow and intermediate-depth VEWs will be approximately 20 and 50 ft bgs, respectively.
- Procuring and installing a new vacuum blower for the AOC-65 SVE system. The new blower will be installed north of the weather station west of Building 90 and will require a new electrical service connection which will be sized based on expected blower requirements. The blower will be sized for airflow capacity based on anticipated flow rates from existing and planned VEWs and housed within a building to contain the system.

- Reconfiguring the SVE piping for the AOC-65 SVE system to eliminate condensate blockage that has affected system performance. The current SVE system will be reconfigured into two separate SVE systems. One system will consist of the VEWs adjacent to the loading dock, including the proposed new VEW cluster wells. The second system will consist of the existing and proposed shallow and intermediate VEWs west of the ditch at Building 90. The VEWs adjacent to the loading dock will be connected to the existing AOC-65 SVE blower, and the VEWs west of the ditch at Building 90 will be connected to the new blower to be installed north of the weather station. Additionally, reconfiguration of the SVE piping will utilize a larger diameter pipe for the extraction piping.
- Evaluating the need for continuing SVE operations at SWMU B-3 once the bioreactor is operational. If SVE operations are to be continued, the blower, associated equipment, and building will need to be re-located. Additionally, if SVE operations are to be continued, new VEWs must be installed. The original plan included installing 400 ft of new VEWs for the SWMU B-3 SVE system, but the installation of the new VEWs will be delayed pending evaluation of appropriateness after the bioreactor is operational. The location the new VEWs will be determined once the influence of the bioreactor has been evaluated. The expected location for any new VEWs is east of the main landfill area and will be constructed to remove vapor emanating from the shallow bedrock material. The anticipated depth for the new VEWs is between 20 and 40 ft bgs, but will be determined upon review of soil gas packer data collected during the installation of the VEWs.

1.3 DATA QUALITY OBJECTIVES

The overall data quality goal for this project is to gather sufficient information to guide the selection of remedial alternatives and interim corrective measures and to measure the effectiveness of SVE systems at removing contaminant mass. Data quality is defined by its representativeness, precision, comparability, and completeness. Representativeness of the data is dependent on site selection and number of samples taken, which are easily addressed in the sampling plan design. The requirements for precision, comparability, and completeness of the data vary between data types but all are enhanced by the use of standardized sampling and analysis protocols and standardized reporting procedures. Data quality objectives (DQOs) are dynamic documents that are continually being updated as the project progresses and data are generated. The most current DQOs are presented in the “*Draft TO 006 Work Plan Addendum*,” Parsons, July 2005, and the “*Draft TO-006 Work Plan Addendum*,” Parsons, July 2005.

The types of data to be collected for this project are listed below, along with a discussion of their uses and requirements.

- **Soil Gas** – Soil gas samples will be collected during SVE treatability study testing and extraction packer testing. Samples will be collected to provide “point in time” data to establish baseline conditions, evaluate zones with the highest levels of contamination, and determine zones where the greatest removal rates are anticipated. The DQO requirements for the soil gas samples are presented in the “*Draft TO 006 Work Plan Addendum*,” Parsons, July 2005.

- **Air Emissions** – Air emission samples will be collected from the blowers attached to the subslab ventilation and SVE systems to validate the calculations made in support of the standard exemptions and to assess volatile organic compound (VOC) removal rates. Requirements for the air emission sampling are included in the “*Draft TO 006 Work Plan Addendum*,” Parsons, July 2005.
- **Investigation Derived Waste Characterization** – Soil cuttings and decontamination liquids generated during drilling for VEW installation and liquids from the blower moisture separators need to be characterized to determine applicable disposal requirements and appropriate waste handling procedures. Requirements for liquid and soil cuttings generated during the SVE system expansion will be characterized as described in the “*Final CSSA SVE O&M Update*” (January 2006)..
- **Field Measurements** – Data will be collected in the field to include, but not limited to, oxygen, carbon dioxide, and total volatile hydrocarbon (TVH) in soil gas; SVE flow rates; pressure response of vapor monitoring points (VMPs); groundwater elevations; and soil temperature. As most of these data are for screening purposes only, the use of standardized techniques and properly calibrated and maintained equipment will ensure that the data are of sufficient quality to be used for the intended purpose of screening. Requirements for these field measurements are included in the “*Draft TO 006 Work Plan Addendum*,” Parsons, July 2005.

1.4 WORK PLAN ORGANIZATION

This Work Plan (WP) consists of five sections, including this project description. Section 2 provides an overview of CSSA and SWMU B-3 and a summary of current SVE operations at the sites. Section 3 describes the planned expansions of the existing SVE systems at AOC-65 and SWMU B-3. Section 4 discusses the anticipated schedule for completing WP activities, and Section 5 describes the reporting deliverables for the project.

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SECTION 2 BACKGROUND

2.1 SITE DESCRIPTION AND HISTORY

2.1.1 AOC-65

AOC-65 consists of potential VOC source areas associated with activities performed at or around Building 90. Possible source areas include an inactive, subslab, concrete-lined pit on the west side of the interior of Building 90, and an area extending outside Building 90 along abandoned drain lines and storm water ditches. These areas are identified by the presence of contaminant plumes detected during a previous soil gas survey “*Draft Soil Gas Survey Technical Report*,” Parsons, August 2001, and the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) completed in 2001 (*AOC 65 RFI Report*).

Currently, a citrus-based cleaner is used at CSSA to clean ordnance; however, prior to 1995, chlorinated solvents such as tetrachloroethane (PCE) and trichloroethylene (TCE) were used to degrease ordnance, and were stored in a metal vat inside Building 90. The metal vat containing the chlorinated solvents was placed in a subslab pit located in the southern portion of Building 90. This former vat location is a suspected source of contamination in AOC 65 although visual inspections of the vat were unable to identify any evidence of releases such as cracks or visible staining.

In addition to the former solvent pit, floor drains within Building 90 may have contributed to the spread of contaminants beneath and outside Building 90. The floor drains originally collected drippings and wash fluids from within Building 90 and discharged them to ditches adjacent to the building. The floor drains are currently plugged with concrete and the drain lines are disconnected.

Further background information regarding the location, size, and known historical use of the site is included in the “*CSSA Environmental Encyclopedia (Volume 1-3, AOC 65)*.”

2.1.2 SWMU B-3

SWMU B-3 is a former landfill disposal site thought to have been used primarily for garbage disposal and burning. The SWMU B-3 landfill area consisted of several shallow unlined trenches in which solid waste was disposed and burned, and which may have contained drums of spent VOCs. Over time the drums buried in the trenches probably corroded or were damaged by landfill activities and their contents leaked to the surrounding soil, with some migration of waste constituents to the water-bearing unit.

Several investigations were performed to identify the extent of the trenches and characterize the waste. A summary of those investigation results can be found in the “*Soil Vapor Extraction Test Report for SWMU B-3*,” Volume 4-1.1, Environmental Encyclopedia, and the *Draft Pilot Study for SWMU B-3 Soil Vapor Extraction* (Parsons, February 2004).

SVE was first tested during a treatability study at SWMU B-3 in 1996 to evaluate removal of VOC contamination from soil in the trench areas. As a result of that test, SVE proved to be an effective method of source removal in surface formations and initial system was expanded in

1997 to 18 extraction wells. This SVE system was removed in 2002 to allow limited removal actions to be performed at the unit. This work included excavation and off-site disposal of approximately 2000 cubic yards (CYs) of soil primarily from the eastern-most trench at the site. A second SVE pilot study was initiated in 2003 to address residual contamination present in the bedrock material underlying the western trenches at SWMU B-3 and in the general vicinity of drums removed from the eastern trench. That system was dismantled in July 2006 to allow more room for staging of excavated materials and for removal of the remaining wastes from the B-3 landfill. Results of the pilot studies are discussed in the “*Soil Vapor Extraction Test Report for SWMU B-3*,” Volume 4-1.1, Environmental Encyclopedia and the *Draft Pilot Study for SWMU B-3 Soil Vapor Extraction* (Parsons, February 2004).

The current plans for SWMU B-3 are to construct a bioreactor in the former landfill once the remaining debris and contaminated soil have been removed from the landfill trenches. The bioreactor will be constructed by backfilling the excavation with a bark-mulch and vegetable oil mixture that will provide a source of organic carbon to enhance the natural biodegradation of residual contaminants in the bedrock material and along migration and recharge pathways underlying the site. Operation of the bioreactor will include pumping contaminated groundwater from nearby wells, CS-MW16-LGR and CS-MW16-CC, into the bioreactor. Contaminants in the groundwater will be degraded within the bioreactor through anaerobic biodegradation processes. The organic-rich groundwater will percolate out of the bioreactor and infiltrate into the underlying bedrock stimulating anaerobic degradation of residual contaminants within the bedrock material.

Once the bioreactor has been operational for approximately 6 months, the need for additional soil venting in the former landfill area should be re-evaluated. Infiltration of water from the bioreactor will raise the water table in the immediate area that may render additional SVE operations ineffective. Additionally, operation of an SVE system near the bioreactor could increase the oxygen levels within the material which would be counterproductive for the bioreactor which is designed to create strongly anaerobic conditions conducive to biodegradation of the chlorinated compounds. The SVE equipment at SWMU B-3 can be re-installed with new VEWs once the removal actions are completed and the bioreactor is constructed if it is determined that concurrent SVE and bioreactor operations would be successful at optimizing contaminant mass removal at SWMU B-3.

2.2 GEOLOGY AND HYDROGEOLOGY

2.2.3 AOC-65

The Crawford and Bexar stony soils predominate AOC-65, although there is significant evidence that soil in the area was dramatically reworked during construction of Building 90 and the associated paved roadway. The Crawford and Bexar stony soil is thin (typically less than 1-ft thick), stony, very dark gray to dark reddish brown, non-calcareous clay that typically occurs in broad, nearly level to gently undulating areas. Detailed descriptions of all CSSA soil types are given in the “*Background Information Report, Soils and Geology*,” Volume 1-1, Environmental Encyclopedia.

The bedrock material at AOC-65 is the Upper Glen Rose (UGR) limestone. The UGR consists of beds of blue shale, limestone, and marly limestone with occasional gypsum beds.

The UGR deposits are approximately 38 ft thick in the vicinity of AOC-65, and overlie deposits of the Lower Glen Rose (LGR) limestone. The boundary between the upper and lower members of the Glen Rose Limestone is defined by a geologic marker bed containing fossils of the pelecypod *Corbula martinae*. The *Corbula* bed is 0.5-5 ft thick and contains small pelecypod clamshells, 3 to 5 millimeters in diameter. A marl layer containing gypsum deposits is generally present approximately 5 ft above the *Corbula* bed and is hydrogeologically significant due to the presence of karstic features (voids) within the layer resulting from dissolution and removal of the gypsum material. The karstic marl layer at AOC-65 was generally encountered at depths of 28 to 32 ft bgs, and several voids of a few inches to a foot in diameter were observed in borehole video logs performed during well installation activities.

The LGR formation is a massive, fossiliferous, vuggy limestone that grades upward into thin beds of limestone, marl, and shale; it is estimated to be 300 ft thick beneath CSSA. The LGR is underlain by the Bexar Shale facies of the Hensell Sand, estimated to be from 60 to 150 ft thick under the CSSA area. The Bexar Shale consists of silty dolomite, marl, calcareous shale, and shaley limestone. The geologic strata dip approximately 10 to 12 degrees to the south-southeast at CSSA.

According to previous geophysical studies conducted by Parsons for CSSA, there are two major fault (shatter) zones believed to be present at CSSA: the North Fault Zone and the South Fault Zone. The South Fault Zone lies approximately 2,200 ft south of AOC-65. Additional information on structural geology at CSSA can be found in the “**Background Information Report, Soils and Geology**,” Volume 1-1, Environmental Encyclopedia. More recent mapping conducted by the U.S. Geological Survey (USGS) identified a fault under and/or near the Building 90 area.

Surface topography in the vicinity of AOC-65 slopes gently (less than 2 percent grade) to the southeast, so run-off is generally toward the southeast. However, runoff on the paved area comprising AOC-65 and gutters from Building 90 discharge to a drainage ditch that parallels the west side of the building. This ditch begins near the north side of the building and empties into an open field east and southeast of Building 90. This ditch was lined with an impervious cover during interim response actions conducted in 2002 (**Area of Concern 65 Interim Removal Action** [Parsons, August 2003]). The ditch also diverts some drainage immediately to the south into open fields on the southwest side of AOC-65. There are no streams in the vicinity of AOC-65 so drainage from the surrounding land is primarily through man-made ditches or by overland flow.

Groundwater at AOC-65 is encountered in the LGR formation where it is generally considered to be under unconfined conditions. The depth to groundwater in the area is strongly controlled by infiltration of precipitation due to the fractured, faulted, and karstic nature of the formation. Depth to groundwater can vary during periods of high precipitation. An intermittent shallow perched aquifer can be found at depths of approximately 15 ft bgs after periods of heavy precipitation. The depth to stable water in the middle Trinity aquifer can range from 80 to over 200 ft bgs during periods of drought. Based on historical data, groundwater in the LGR at CSSA generally flows in a southerly direction. However, local flow gradient may vary depending on rainfall, recharge, and possibly well pumping.

2.2.4 SWMU B-3

The geology at SWMU B-3 is expected to be very similar to that encountered at AOC-65. Based on geophysical well logs from nearby well CS-MW16, approximately 18 ft of UGR limestone is present at the site and overlies LGR deposits. At SWMU B-3, the top of the UGR bedrock formation outcrops on the eastern edge of the site and dips to the west where it is encountered at depths to 20 ft bgs.

Results of test boring logs indicate that soil in the main SWMU B-3 landfill area consists of fill clay and silty clay with white caliche fragments near the surface, progressing with depth to competent limestone. The landfill debris was buried in a series of narrow north-south trending trenches. Outside the landfill trench limits, the soils consisted of dark brown, silty clay and clay from the surface to the top of limestone. The limestone appears highly weathered, pale yellow to gray, with occasional interbeds of hard massive limestone. The weakly structured limestone also exhibits evidence of fractures, which were more prevalent in the upper, more weathered horizons of the limestone. Intervals of vugs, some with calcite growths, bedding, bioturbation, and fracturing, were observed. Some interbedding of clay and weathered shale was also observed in the evaluated core samples.

2.3 SUMMARY OF CURRENT SVE SYSTEMS

Three SVE pilot systems are currently in operation at CSSA. Two separate SVE systems were installed at AOC-65 in the southwest section of the Post in 2002. One system at AOC-65 was installed to remove vapor from beneath the Building 90 floor slab and is referred to as the “Building 90” or “Subslab” SVE system. The other system at AOC-65 was installed outside Building 90 to remove contaminants from suspected source area material in the shallow bedrock west of the building and is referred to as the “AOC-65” SVE system. Additionally, one SVE pilot system designed to remove contaminants from the bedrock material underlying SWMU B-3 is in the central portion of CSSA.

2.3.1 AOC-65 System

The AOC-65 SVE system was installed west of Building 90 to reduce the migration of contaminants encountered beneath the building slab area and from possible releases along the drainage ditch west of the building where solvents may have been present in discharges from the floor drains. The AOC-65 system is composed of seven VEWs with two of the wells installed adjacent to the loading dock and the remaining five VEWs installed west of the drainage ditch. The locations, depths, screened interval placements, and design of these VEWs were selected based on geophysical data, lithologic observations, soil gas packer testing, and other site conditions noted during field activities. The well completion information for the AOC-65 VEWs is detailed in **Table 2.1**, and the system is depicted on **Figure 2.1**. Details of the typical well cross-section designed for this project is presented in the “*AOC-65 Treatability Test Plan*,” Parsons, April 2002.

Table 2.1 AOC-65 SVE System Borehole Completion Summary for VEWs

Well ID	Date Completed	Depth Cored (ft bgs)	Depth Reamed (ft bgs)	Screened Intervals (ft bgs)
AOC65-VEW 13-LGR	6/25/2002	43.8	41	15-40
AOC65-VEW 14-LGR	7/9/2002	59.2	61	40-60
AOC65-VEW 15-UGR	8/6/2002	NC	13	5-12
AOC65-VEW 16-UGR	8/6/2002	NC	41	15-40
AOC65-VEW 17-LGR	8/25/2002	53.5	52.5	22-52
AOC65-VEW 18-LGR	8/22/2002	79	81	15.5-55.5
AOC65-VEW 19-UGR	8/9/2002	NC	26	5-25

NC – Borehole not cored

Each VEW is connected to the SVE System with 1-inch, high density polyethylene (HDPE) vacuum piping direct-buried underground from the wellhead to a 2-inch diameter galvanized steel pipe manifold just upstream of the moisture separator. The 1-inch HDPE pipes transition to the common 2-inch diameter manifold by using 1-inch threaded connectors and 1-inch by 2-inch steel bushings. The vacuum lines for the four VEW wells located west of the driveway are direct-buried except beneath the driveway, where they were installed inside a ductile iron casing to prevent damage from heavy vehicles.

The blower used for the AOC-65 SVE system is a Gast[®] R6 regenerative blower with a 3 horsepower (hp) motor rated at 215 cfm at a vacuum of 55 inches of water. The system includes a 40-gallon moisture separator upstream of the blower with a pressure relief valve and a high-level float switch interlocked to automatically shut down the blower if there is a high liquid level in the moisture separator. The blower discharge piping connects into the exhaust piping from the Building 90 SVE blower. Check valves are present in the exhaust line from the blower to prevent backflow from the Building 90 system when the AOC-65 blower shuts down. A schematic of the AOC-65 SVE systems showing the VEWs and the associated equipment is provided in **Figure 2.2**. More detailed specification for this SVE system can be found in the “*AOC-65 Interim SVE Treatability Report*,” (Parsons 2004).

2.3.2 Building 90 SVE

The Building 90 SVE system includes 12 VEWs installed to remove contaminants detected in the subgrade material beneath the building. The 12 subslab VEWs were constructed with screened interval lengths ranging from 2.5 to 8 ft set at depths to 10.5 ft below the building floor slab. The 12 VEWs are connected to an SVE blower located on the west loading dock of Building 90. Locations of the Building 90 VEWs and SVE blower are depicted on **Figure 2.3**.

The Building 90 SVE system ran nearly continuously from initial startup of the system in December 2002 until July 8, 2005 when it was shut off to enable testing of static soil gas conditions in the subslab to aid in selection of VEWs for continued operation to optimize mass removal from beneath Building 90. Monitoring results from the initial startup and testing period and the operations and maintenance (O&M) period indicate the Building 90 system has been

successful in removing contaminant mass from the shallow material immediately beneath the building. At startup of the system on December 4, 2002, the initial PCE concentration detected in the influent into the SVE blower was 234,990 parts per billion by volume (ppbv), whereas the PCE concentration detected in the blower influent at the end of the O&M period in June 2004 was 1,210 ppbv. Based on the effectiveness of this SVE system to reduce the concentration of low-level chlorinated solvent vapor beneath the floor slab, continued operation of this system is planned to further reduce VOC mass and also reduce the potential for exposure by CSSA employees working inside the building.

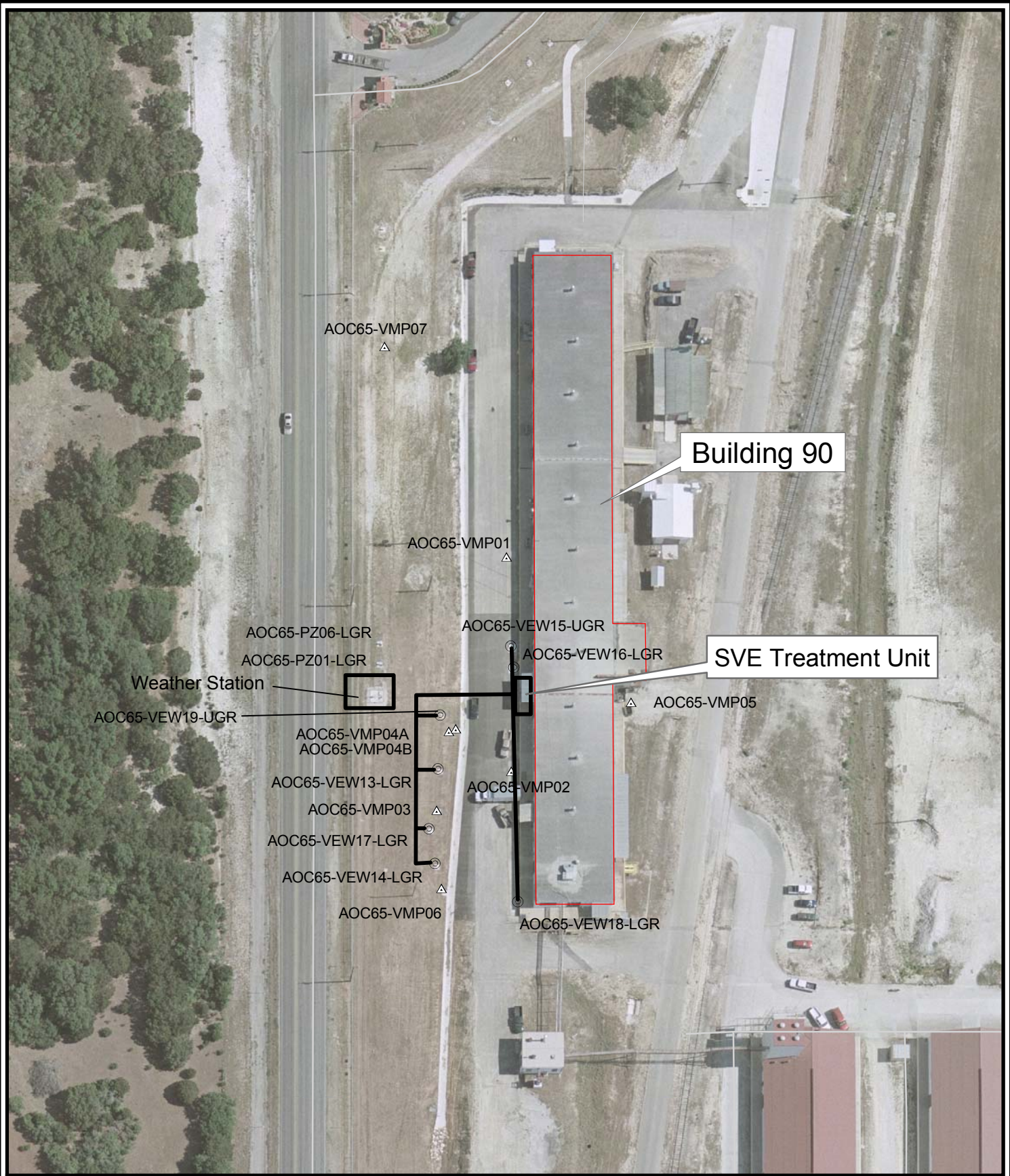
Given the effectiveness of the Building 90 system, expansion of the system is not warranted at this time. Installation of the nested deep VEWs along the west loading dock as part of the AOC-65 SVE system expansion will likely provide further reduction of vapor build-up beneath the slab by removing vapor from deeper intervals. Assessment of contaminant mass removal from this deep nested VEW system will provide information regarding the need to expand the Building 90 SVE system to incorporate removal from deeper intervals than currently addressed.

Continued O&M activities for this system are planned, and the O&M data will continue to be evaluated to assess system effectiveness. Additional information regarding the Building 90 subslab system is included in the “*AOC-65 Soil Vapor Extraction Interim Treatability Test Report*,” Parsons, April 2005 and the “*AOC-65 Soil Vapor Extraction Operations and Maintenance Assessment Report*,” Parsons, March 2005.

2.3.3 SWMU B-3

Initial SVE activities at the SWMU B-3 site were initiated in 1996 when a pilot study was performed to evaluate the effectiveness of SVE for removing contaminants from the landfill area. After full development, the initial SVE system included 18-VEWs installed within the landfill material and upper portions of the underlying bedrock. In 2000, TCE and PCE removal rates estimated for the SVE system were 161 and 51 pounds per year (lbs/yr), respectively. The pilot system was removed in 2002 during partial removal actions performed at the site. Additional information regarding the initial SWMU B-3 SVE pilot system can be found in the “*Soil Vapor Extraction Test Report for SWMU B-3*,” Volume 4-1.1, of the Environmental Encyclopedia and the “*Final SWMU B-3 Soil Vapor Extraction Operations and Maintenance Report*,” Volume 3-1.1 of the Environmental Encyclopedia.

In October and November 2003, Parsons installed a new SVE pilot system to continue evaluating the technology at the SWMU B-3 site. Since CSSA plans to remove the remaining 15,200 CYs of landfill debris in 2006, the pilot SVE system installed in 2003 was limited to a regenerative blower connected to two VEWs. One of the VEWs installed in 2003, CS-B3-VEW20, was installed in an area of high contaminant concentrations within the landfill with screened intervals placed below the bottom of the landfill. This VEW was removed in preparation of removal actions at SWMU B-3.



- ⊙ VEW Locations
- △ VMP Locations

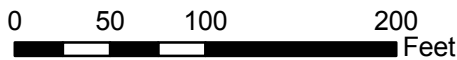
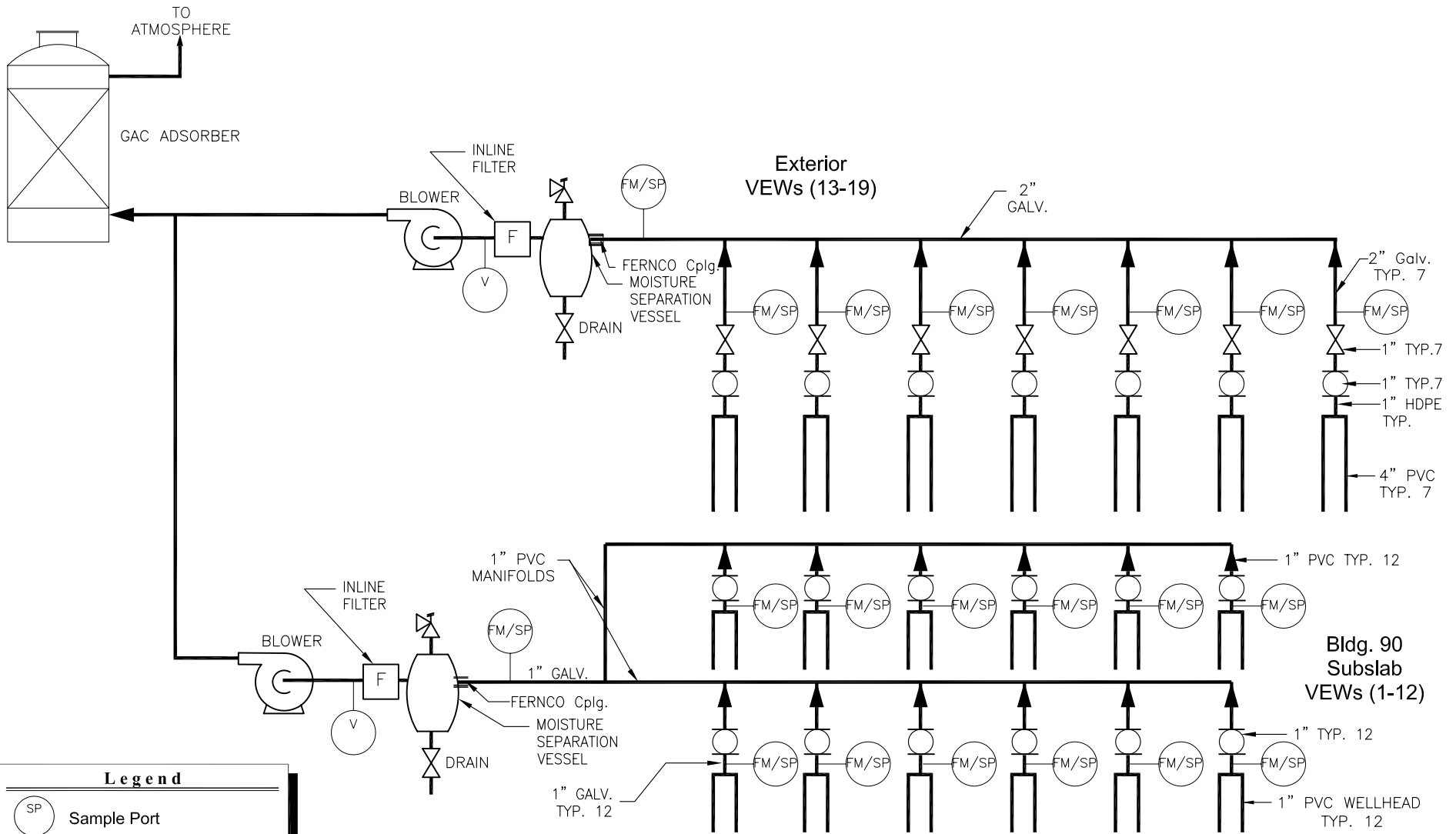


Figure 2.1
 AOC-65 SVE System
 Layout
 Camp Stanley Storage Activity
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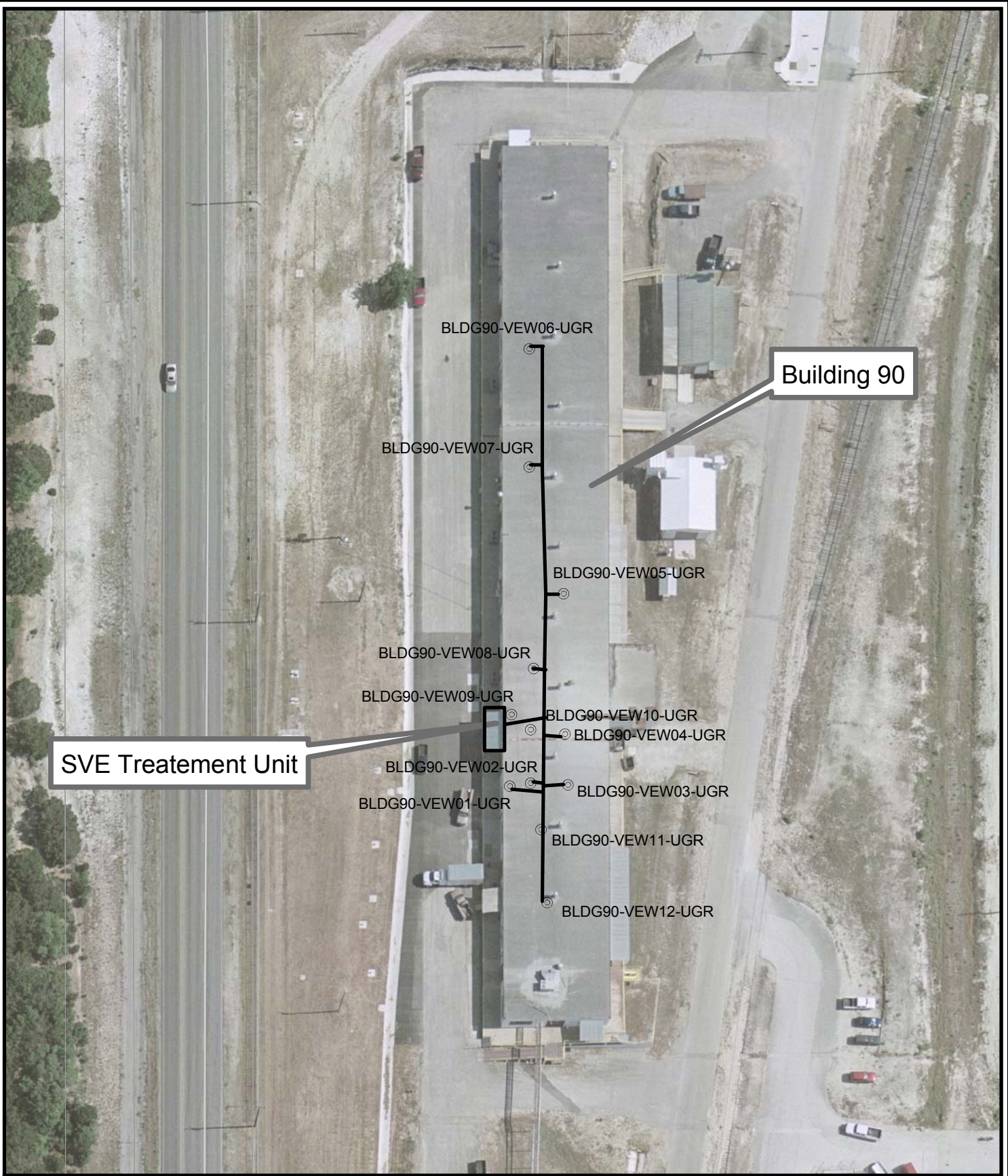
Legend	
	Sample Port
	Flow Measuring Port
	Pressure/Vacuum Indicator
	Gate Valve
	Ball Valve
	Vacuum Relief/Bleed Valve

SEPTEMBER 2005

Not To Scale

Figure 2.2
AOC-65 SVE System Schematic
Camp Stanley Storage Activity

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SVE Treatment Unit

Building 90

BLDG90-VEW06-UGR

BLDG90-VEW07-UGR

BLDG90-VEW05-UGR

BLDG90-VEW08-UGR

BLDG90-VEW09-UGR

BLDG90-VEW10-UGR

BLDG90-VEW04-UGR

BLDG90-VEW02-UGR

BLDG90-VEW03-UGR

BLDG90-VEW01-UGR

BLDG90-VEW11-UGR

BLDG90-VEW12-UGR



⊙ VEW Locations

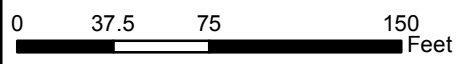


Figure 2.3

Building 90 Subslab SVE System
Layout
Camp Stanley Storage Activity

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Selection of screened intervals for the two VEWs installed in 2003, CS-B3-VEW19 and CS-B3-VEW20, were based on data from soil gas packer testing which exhibited higher permeability and contaminant concentrations in three intervals (14-24 ft, 32-42 ft, and 70-80 ft bgs). The highest contaminant levels were measured in these three intervals, so construction was implemented to address those intervals in the upper 80 ft. VEW CS-B3-VEW19 was screened from 34-84 ft bgs to assess two of the more permeable zones. The focus of CS-B3-VEW20 was primarily to assess removal of contaminants from wells installed directly underlying the landfill, so it was screened from 25-50 ft bgs. Both VEWs were completed with 2-inch diameter schedule 40 polyvinyl chloride (PVC) pipe and equipped with 0.050-inch PVC slotted well screens.

The SWMU B-3 SVE system was equipped with a Gast[®] R7 Series regenerative blower powered by a 10 hp motor. The blower is rated for a maximum vacuum of 110 inches of water at about 120 cubic feet per minute (cfm), but for this installation its performance was reduced from the published curve by about 10 percent because the motor is powered by 208 Volts (V) instead of 240 V, 60 Hertz (Hz), 3-phase power (GAST Manufacturing Regenair Regenerative Blower Catalog). Pilot duty thermal overload protection is standard on all 1 HP and larger motors. Two-inch-diameter schedule 40 PVC piping connects the VEWs to the blower system. The SVE system is equipped with a Gast[®] AG 258 pressure relief valve to prevent the blower from overheating in the event of reduce airflow. Also the system includes a 40-gallon moisture separating knockout tank installed between the VEWs and the blower inlet to remove water from the influent stream before it enters the blower. **Figure 2.4** shows the SWMU B-3 SVE system layout and **Figure 2.5** is a piping and instrumentation schematic of the system. Additional information regarding installation and construction of the SWMU B-3 SVE pilot system installed in 2003 can be found in “**Vapor Extraction Test Report for SWMU B-3,**” Volume 4-1.1 of the Environmental Encyclopedia.

During final removal actions at SWMU B-3 2006, the SVE blower, VEWs and associated equipment were dismantled to make room for surface space available for excavation of the remaining waste and construction of the bioreactor. The SVE blower system are stored at the site may be reinstalled pending evaluation of the need for additional venting operations. If CSSA determines that SVE should be continued at the site, the blower and associated equipment will be re-installed at the site and new VEWs will be installed. Final determination regarding the need and location of additional SVE activities should be made once the bioreactor has been operational for at least six months.

2.4 SVE EFFECTIVENESS

2.4.1 AOC-65 SVE

In the **AOC-65 Soil Vapor Extraction Interim Treatability Test Report**, system configuration and operational issues limiting the effectiveness of the AOC-65 SVE system were identified. As discussed in the report, the estimated PCE removal rate for the first 12 months after system startup was estimated to range from 20 to 40 lbs/yr. When compared to performance of the Building 90 system which achieved an estimated PCE removal rate of 15 to 100 lbs/yr, the AOC-65 system performance appears inefficient.

A main concern with the system configuration is the presence of a depression in the extraction piping connecting the VEWs to the piping manifold located near the blower. The depression in the line was necessary so the extraction pipes could pass beneath the shallow ditch and fire suppression water lines along the western edge of the Building 90 driveway. Condensation within the extraction pipes collects in the depression restricting the flow of air from the VEWs; as a result, the airflow and vacuum measured at the VEW wellheads were extremely low. To alleviate the problem, an air compressor was used to periodically blow the condensate from the line. While the air compressor appears to be an effective means to temporarily remove condensation from the lines, removal of the depression area in the piping is recommended to reduce maintenance requirements and improve long-term effectiveness of the system.

Another issue with the system piping is its size, which may be causing significant pressure drops within the line causing the reduction of vacuum applied at the VEW wellheads. Pipe material used for the extraction lines was a 1.0-inch inside diameter (ID) HDPE coiled tubing which allowed installation of a continuous pipe without connectors which can cause significant friction loss resulting in reduced airflow. Evidence of pressure drops within the piping suggests that the 1.0-inch ID pipe is not optimal and that a larger diameter pipe would allow for a higher vacuum to be applied to the VEW wellheads. Also, as mentioned in the “*AOC-65 Soil Vapor Extraction Interim Treatability Test Report*,” the 1.0-inch ID pipe likely causes increased condensation within the line compared to larger diameter pipes.

The radius of influence (ROI) for each VEW was estimated using a pore volume exchange rate (PVER) of 300 times. The ROI estimates range from a low radius of 35 ft to a high radius of 55 ft. ROI estimates for the shallow VEWs (AOC65-VEW15 and AOC65-VEW19) were generally higher than most of the deeper VEWs, which is likely attributable to higher air permeability of the shallower UGR material. The ROI and airflow rates for the VEWs are summarized on **Table 2.2**.

Table 2.2 AOC-65 VEW Airflow and ROI Estimates

Well	Screened Interval (ft bgs)	Average Airflow (scfm)	Radius @ 300 PVER (ft)
AOC65-VEW13-LGR	15-40	46.05	NM
AOC65-VEW14-LGR	40-60	19.91	41.7
AOC65-VEW15-UGR	5-12	19.06	49.6
AOC65-VEW16-UGR	15-40	34.14	35.1
AOC65-VEW17-LGR	22-52	22.80	55.1
AOC65-VEW18-LGR	15.5-55.5	35.98	49.7
AOC65-VEW19-UGR	5-25	19.86	46.1

ft bgs: Feet below ground surface

NM: Not measured due to accumulation of water in well

PVER: Pore Volume Exchange Rate

scfm: standard cubic feet per minute

The ROI calculated for the AOC-65 VEWs are low because of the low velocities produced by the installed equipment and piping. Improvements to the system piping to address restrictions to airflow would likely produce greater ROI. The ROI for the VEWs using the 300 PVER estimates are depicted on **Figure 2.6**.

Review of the startup testing and O&M data indicates that the highest contaminant concentrations were observed in the shallower VEWs, whereas the highest airflow rates occurred in the deeper VEWs. The shallow VEWs, AOC65-VEW15 and AOC65-VEW19, are 12 and 22 ft deep, respectively, and consistently exhibited the highest PCE concentrations during the sampling events. The highest airflow rates measured during the monitoring events were measured in deeper VEWs with AOC65-VEW13, AOC65-VEW16, and AOC65-VEW17 typically having the highest flows.

2.4.2 Building 90 SVE

The SVE system operating under Building 90 has proven to be effective at reducing contaminant levels beneath the building. The Building 90 SVE system appears to be operating as anticipated. Testing is planned as part of O&M activities to determine if removal rates can be optimized by shutting off flow from non-contributing VEWs. No additional modifications or upgrades beyond the optimization are planned under this task order.

2.4.3 SWMU B-3 SVE

Soil gas screening and pressure response monitoring for the former SWMU B-3 SVE system were performed at system startup in December 2003. Field screening results indicate that VOC concentrations are elevated in each of the monitoring zones (14-24 ft, 32-42 ft, and 70-80 ft bgs) at the two nearby VMPs. Additionally, oxygen levels were lowest in the shallowest zone and increased with depth while carbon dioxide concentrations exhibited an opposite change indicating that biological degradation activity is greatest in the shallow material.

Results of the pressure response measurements during the startup testing showed the greatest influence of the applied vacuum occurred in the deep monitoring interval (70-80 ft bgs) in each of the VMPs. The highest vacuum response was observed at VMP CS-B3-VMP8. The higher vacuum response in CS-B3-VMP8 may be attributable to being closer to the VEWs, especially CS-B3-VEW19 which is screened at 34-84 ft bgs. The airflow rates measured at the VEWs were considerably higher than the rates measured at the AOC-65 SVE system which is attributable to the larger diameter extraction piping used at SWMU B-3. The ROI of the deeper interval was estimated at 50 ft.

Table 2.3 SWMU B-3 VEW Airflow and ROI Estimates

Well	Screened Interval (ft bgs)	Average Airflow (cfm)	ROI (ft)
CS-B3-VEW19	34-84	44.95	50
CS-B3-VEW20	25-50	44.12	50

ft bgs: Feet below ground surface

cfm: cubic feet per minute

The SWMU B-3 SVE system operated without incident until January 2005 when the SVE blower malfunctioned. A new blower was procured in August 2005 and subsequently installed. However the system was only started to determine proper connections and then shut down as plans for the SWMU B-3 excavation and bioreactor were being implemented. If SVE operations are to be continued after the bioreactor is in operation, this blower and associated equipment may be relocated and used for the new system.



● VEW / VMP Locations

▤ Trenches

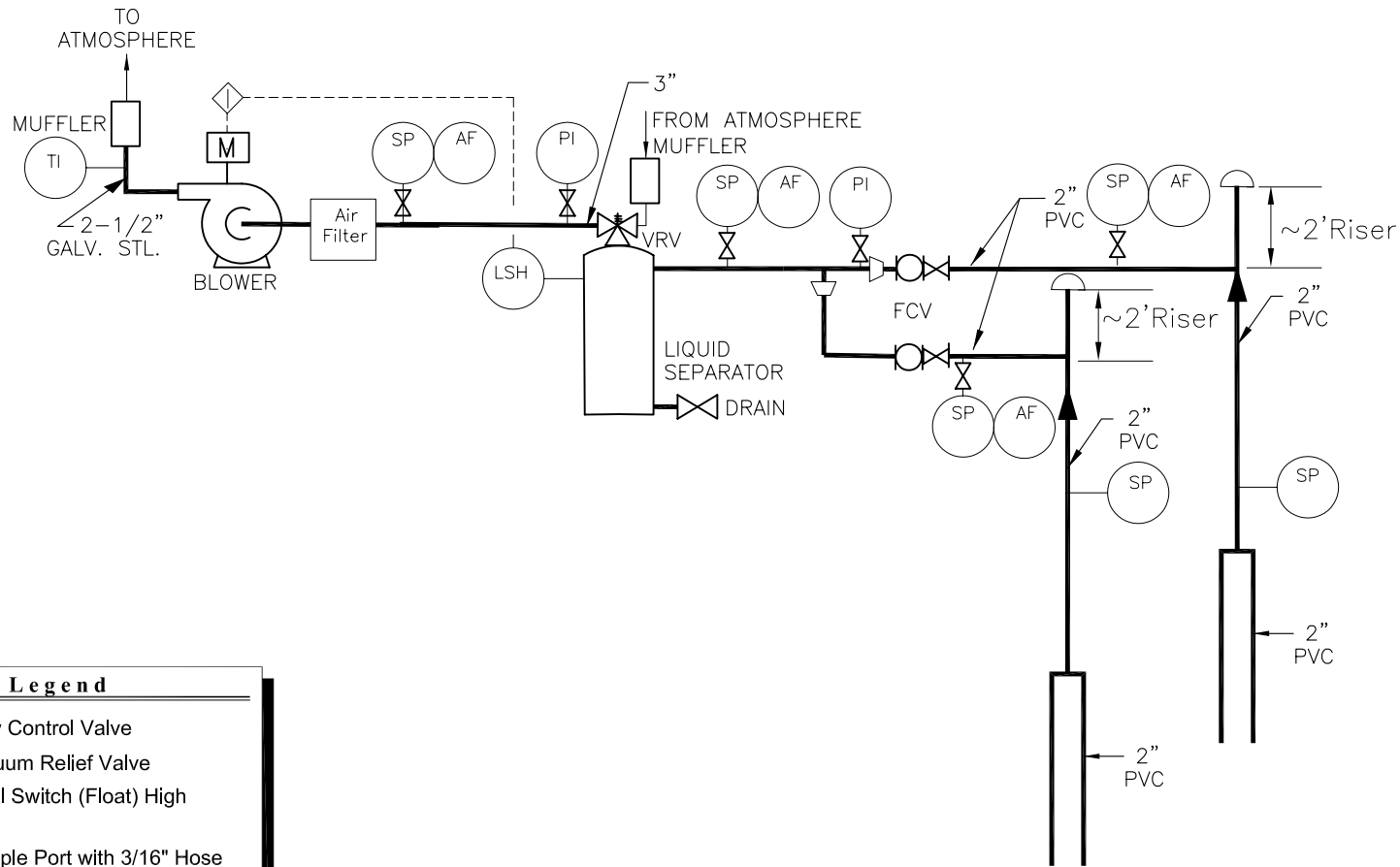
0 25 50 100 Feet

Figure 2.4

SWMU B-3 Layout
 VEW, VMP and Blower Location
 Camp Stanley Storage Activity

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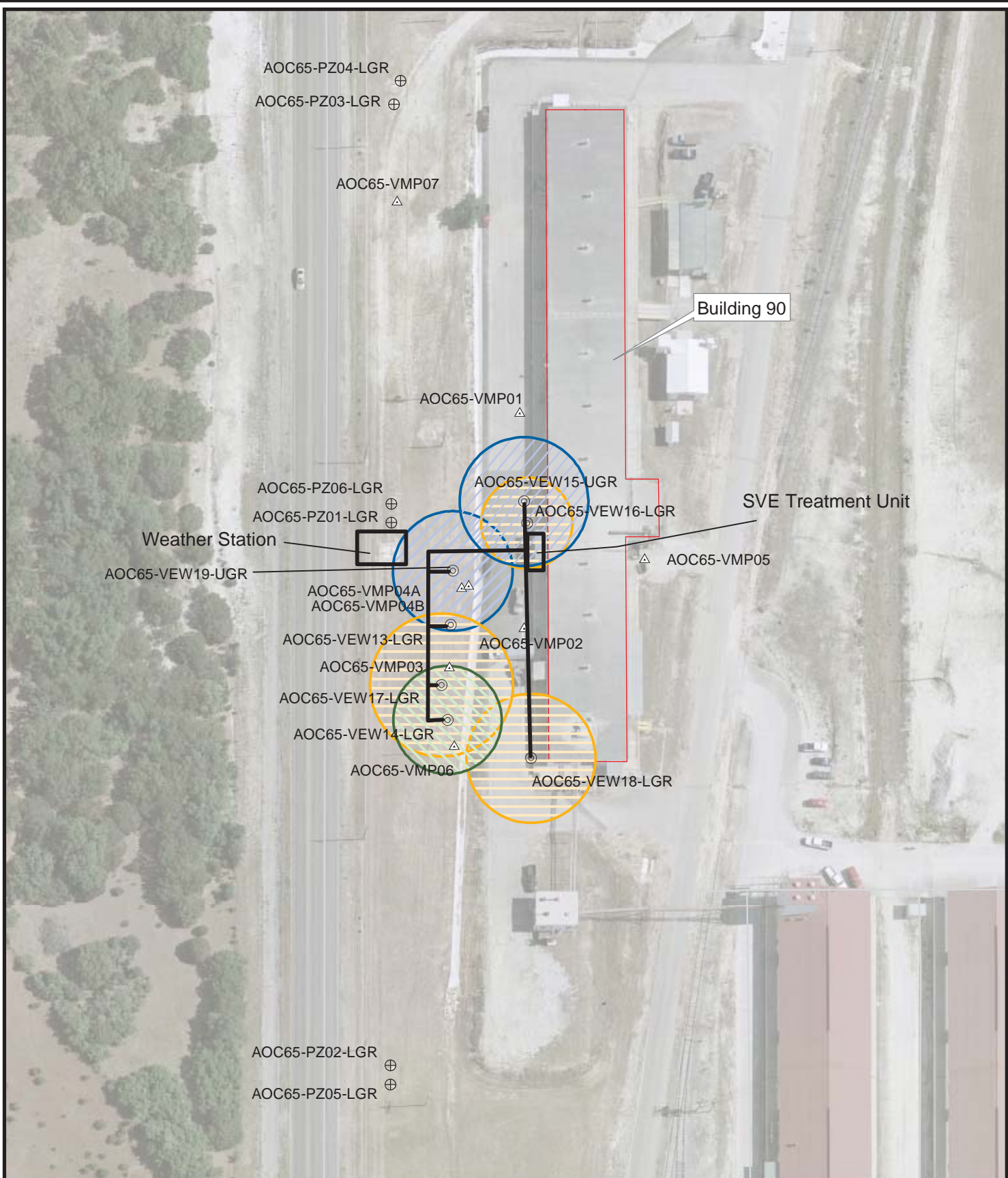
Legend	
FCV	Flow Control Valve
VRV	Vacuum Relief Valve
LSH	Level Switch (Float) High
SP	Sample Port with 3/16" Hose Bard/Ball Valve
AF	Flow Measuring Port
PI	Pressure or Vacuum Indicator
TI	Temperature Indicator

OCTOBER 2005

Not to Scale

Figure 2.5
 SWMU B-3 Blower System Schematic
 Camp Stanley Storage Activity
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AOC65-PZ04-LGR ⊕

AOC65-PZ03-LGR ⊕

AOC65-VMP07
△

Building 90

AOC65-VMP01
△

AOC65-PZ06-LGR ⊕

AOC65-VEW15-UGR

SVE Treatment Unit

AOC65-PZ01-LGR ⊕

AOC65-VEW16-LGR

Weather Station

AOC65-VEW19-UGR

AOC65-VMP05
△

AOC65-VMP04A
AOC65-VMP04B
△

AOC65-VEW13-LGR

AOC65-VMP02
△

AOC65-VMP03
△

AOC65-VEW17-LGR

AOC65-VEW14-LGR




AOC65-VMP06
△

AOC65-VEW18-LGR

AOC65-PZ02-LGR ⊕

AOC65-PZ05-LGR ⊕

Zone of Influence (300 PVER)

-  Upper Glen Rose Formation only (VEW-15, VEW-19)
-  Across both Upper and Lower Glen Rose Formations including marl layer at approximately 28-32 ft. bgs (VEW-16, VEW-17, VEW-18)
-  Lower Glen Rose Formation only (VEW-14)




-  VEW Locations
-  VMP Locations
-  Peizometer Locations



Figure 2.6

Calculated Radius of Influence
AOC-65 SVE System
Camp Stanley Storage Activity



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SECTION 3

SOIL VAPOR EXTRACTION SYSTEM EXPANSIONS

The planned expansions to the AOC-65 and SWMU B-3 SVE systems at CSSA include the following activities:

- Installing additional shallow and intermediate depth VEWs for the AOC-65 SVE system west of Building 90's drainage ditch;
- Installing a nested VEW system adjacent to the Building 90 western loading dock, which will consist of two VEWs installed in a common borehole;
- Reconfiguring the SVE piping for the AOC-65 SVE system to establish two separate SVE systems outside Building 90. One system will consist of VEWs located adjacent to the Building 90 loading dock, and the other will consist of VEWs located west of Building 90's drainage ditch;
- Installing a new SVE blower, blower housing, and extraction piping west of the drainage ditch at AOC-65; and
- Evaluating the need to re-install the blower at SWMU B-3 and if appropriate, install new VEWs and inflow piping to allow continuation of SVE operations at this site..

The planned activities are discussed in detail in the following sections.

3.1 OBJECTIVES

The objective of the SVE system expansions is to improve the rate of mass removal of VOCs from the subsurface as well as contaminated soil gas from areas currently not being influenced or treated by the current configurations. The system expansions will include installing new VEWs for the AOC-65, testing existing AOC-65 VEWs to determine which wells could be removed from extraction, installing a new blower for the AOC-65 system, reconfiguring the piping connections for the AOC-65 system, and evaluating the need to reinstall the SVE blower at SWMU B-3 and install new VEWs..

3.2 PLANNING

Planning for the SVE system expansions will include:

- Selecting appropriate locations and depths for new extraction wells;
- Selecting an appropriately-sized SVE blower for the new system;
- Determining appropriate piping configurations;
- Evaluating the performance of the expanded SVE systems; and
- Securing the necessary approvals and permits for installing and operating the expanded systems.

Required approvals will include the State Historic Preservation Office (SHPO) if modifications to Building 90 are planned. Modifications to existing air permits must be completed prior to initiating operation or testing of the expanded system. Detailed scopes of work will be prepared for drilling, analytical, and removal action subcontractors. The statement of work (SOW) for the expansion activities will include engineering specifications for temporary

control measures and building restoration that will require CSSA approval. A technical memorandum describing the technical basis for recommended extraction well placement and screened intervals will be prepared for submittal to Air Force Center for Environmental Excellence (AFCEE) and CSSA. The system will be expanded after locations and construction details are approved.

3.2.1 Permitting

3.2.1.1 State Historical Program Office

Building 90 at CSSA is considered a historic building by the Texas SHPO. If it is determined that expansion of the current SVE system west of the west loading dock of the building will result in modifications or replacement to parts of the structure, Parsons will consult the SHPO and obtain any requisite permits and approvals.

3.2.1.2 Air Permitting

The existing air permit for the SVE systems (Building 90, AOC-65, and SWMU B-3) will be reviewed with regard to general applicability with consideration of the planned expansion efforts. The current permit by rule (PBR) applications address discharges from the SVE systems at AOC-65 and SWMU B-3 separately. The current PBR application for AOC-65 addresses emissions from the Building 90 and AOC-65 SVE systems as an aggregate since their exhaust is connected and their emissions emanate from one location. A separate PBR application will be required for the new SVE blower system that will be installed west of the drainage ditch at Building 90.

Appropriate modifications to the existing PBR applications will be made as required. Modifications will include the additional discharges resulting from expansion of the other SVE systems. A new PBR application will be prepared for the SVE system to be installed west of Building 90. Parsons will prepare and submit the new PBR application and appropriate updated application documents to the Texas Commission on Environmental Quality (TCEQ) on behalf of CSSA and respond to any air permitting issues that arise. The PBR will assume that the current off-gas treatment operations at Building 90 will continue and no new air abatement actions will be implemented.

3.3 EXTRACTION WELL INSTALLATION

New VEWs will be installed as part of the expansion activities for the AOC-65 and new VEWs may be installed at SWMU B-3 if SVE operations are to be continued. New VEWs will be installed at AOC-65 to expand the SVE system into areas where elevated VOCs are expected in the shallow bedrock material. A deep nested extraction well cluster will also be installed near the west loading dock at AOC-65 to remove VOCs from deeper zones beneath Building 90. Also, any new VEWs installed at SWMU B-3 will address VOCs present in the soil and shallow bedrock material.

3.3.1 AOC-65

Expansion of the SVE system at AOC-65 will include installation of additional VEWs to extract VOCs from zones within the shallow bedrock where elevated levels of VOCs are present.

Expansion of the system will include installation of shallow (20-ft) and intermediate-depth (50-ft) VEWs west of the drainage ditch next to Building 90 where results from existing VEWs and groundwater concentrations suggest that significant VOC mass removal may be possible from this area. Additionally, a deeper two-VEW nest will be installed adjacent to the western loading dock of Building 90 to assess the potential for significant mass removal from deeper zones beneath the building, and to investigate the possible vertical extent under the buildings and suspected source areas.

Four shallow VEWs will be installed west of the drainage ditch to expand the removal of VOCs from shallow bedrock material. The proposed shallow VEW locations are depicted on **Figure 3.1**. Locations of the new shallow VEWs were selected by applying the estimated ROI for the existing shallow VEWs to the area where additional mass removal might logically be achieved such that ROIs for each well overlap. The shallow wells will be installed to an approximate depth of 20 ft bgs, and will be equipped with 15 ft of well screen. The shallow wells will be constructed using 4-inch ID schedule 40 PVC well material.

Three intermediate depth VEWs will be installed west of the drainage ditch at AOC-65. The intermediate VEWs will be installed at locations currently not addressed by the current configuration to expand the coverage from extraction wells to increase VOC mass removal rate. The location of the proposed VEWs is shown on **Figure 3.2**. The intermediate VEWs will be installed to an approximate depth of 50 ft bgs, and will be equipped with 25 ft of well screen. The shallow wells will be constructed using 4-inch ID schedule 40 PVC well material.

One nested VEW system will be installed adjacent to the western loading dock of Building 90 to remove contaminants from depths currently not addressed by the system. The deep nested VEW cluster will consist of two extraction wells installed within a common borehole. The nested VEWs will be screened at depths of 180-140 ft and 125-85 ft bgs. Final construction details will be made following collection of soil gas packer and borehole geophysical data from the well. The nested VEWs will be constructed using 2-inch ID schedule 40 PVC well material. The screened sections of the VEWs will be separated by filling the borehole with cement grout. The proposed location of the nested VEW is shown on **Figure 3.3**.

3.3.2 SWMU B-3

New VEWs may be installed at the SWMU B-3 unit to expand VOC removal activities to areas currently not affected by the bioreactor. The need to re-install the SVE blower and new VEWs will be determined once the bioreactor has been operational for at a minimum of 6 months. Additional SVE operations at SWMU B-3 will not be initiated until after the potential impacts of water and substrate infiltration at the bioreactor are understood. Additionally, the impact of increasing oxygen levels in the formation by operation of the SVE system could adversely impact the bioreactor effectiveness and must be evaluated when determining whether to re-install the SVE system.

The location and depths for the new VEWs will be based on field observation of the bioreactor infiltration activities, data collected during the installation of the four Westbay[®] wells installed at the site, and soil gas packer data collected during drilling of the VEWs boreholes. Information regarding the planned drilling activities for the Westbay[®] wells is contained in the

“*Draft Work Plan for Enhanced Anaerobic Biodegradation Pilot Test at SWMU B-3*,” (Parsons, July 2005) and the “*Draft TO-006 Work Plan Addendum*,” (Parsons, July 2005).

If new VEWs are to be installed at SWMU B-3, up to 400 ft of total drilling and well installation footage is planned for SWMU B-3, but the total number of VEWs will be determined based on recommended depths for the screened intervals. The depths for the new extraction wells will be determined based on the locations and expected depths to the impacted shallow bedrock material where the greatest contaminant removal could be realized.

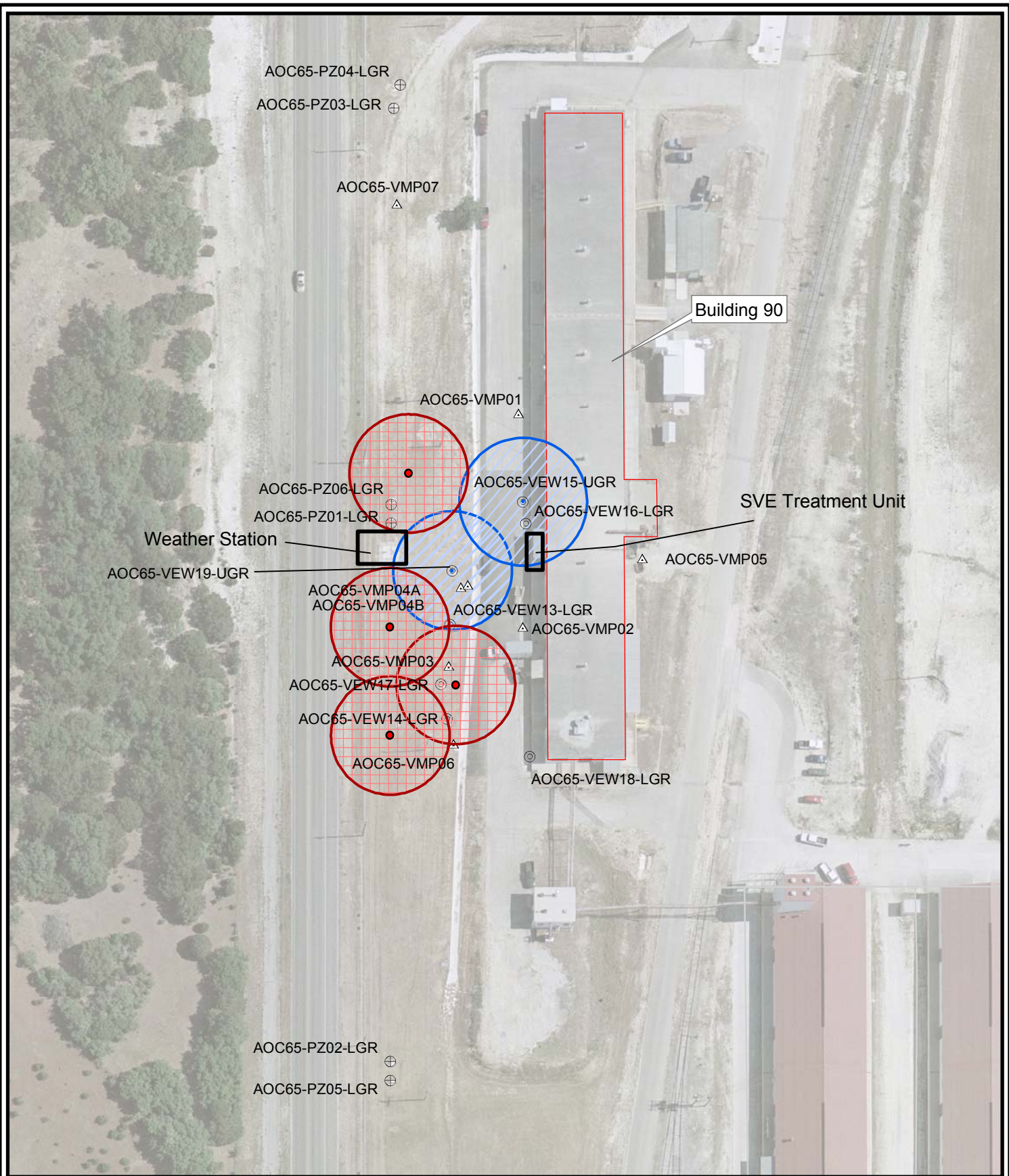
3.3.3 Drilling and Borehole Testing Procedures

Drilling for installation of the VEWs at AOC-65 and SWMU B-3 will be accomplished using air rotary drilling technology. The borehole for each VEW will be advanced to achieve the desired depth for that location. Well depths for SWMU B-3 will be based on field screening and packer testing performed during installation of the Westbay[®] wells.

Rock coring may be performed on the initial VEWs installed at AOC-65 and SWMU B-3 to verify geologic conditions. Optical televiewer logging, induction logging, and other borehole geophysical methods may be utilized during installation of the Westbay[®] wells and may provide useful information for construction of the SWMU B-3 VEW. Additional details regarding drilling, well installation, and borehole testing are included in the “*Draft TO 006 Sampling and Analysis Plan Addendum*,” (Parsons, July 2005) and CSSA’s “*Sampling and Analysis Plan and Quality Assurance Project Plan*,” Volume 1-4, CSSA Environmental Encyclopedia.

3.3.4 VEW Screen and Casing

The new VEWs at AOC-65 and SWMU B-3 will be constructed of 4-inch nominal diameter, flush-threaded, schedule 40 PVC screen and riser, with the exception of the nested VEW well pair which will be constructed of 2.0-inch ID PVC material to allow construction inside a common borehole. The screens will be factory slotted with 0.020-inch openings. Total well depth, and screen and riser lengths for each VEW will be based on results of the borehole coring activities. Additionally, the casing string will be fitted with a PVC bottom cap and a locking end cap. A diagram of the VEW completion is shown of **Figure 3.4**. A diagram of the nested VEW construction is shown in **Figure 3.5**.

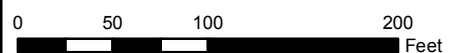
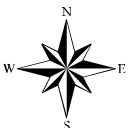
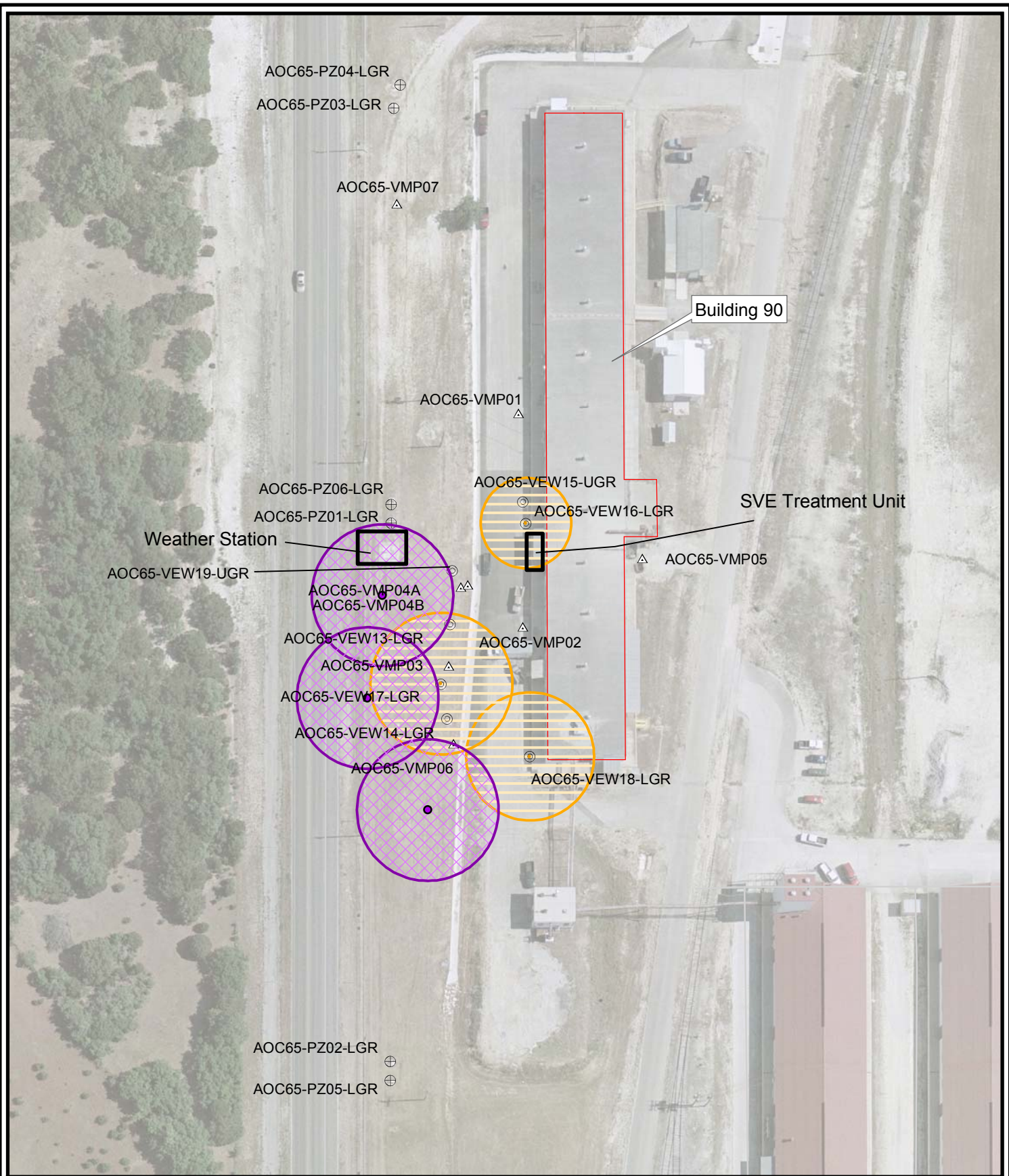


- Radius of Influence (300 PVER)
- Existing Shallow VEWs and calculated radius of influence
- Proposed Shallow VEWs and projected radius of influence
- VEW Locations
- VMP Locations
- Peizometer Locations

Figure 3.1
Proposed Shallow VEWs
AOC-65 SVE System
Camp Stanley Storage Activity

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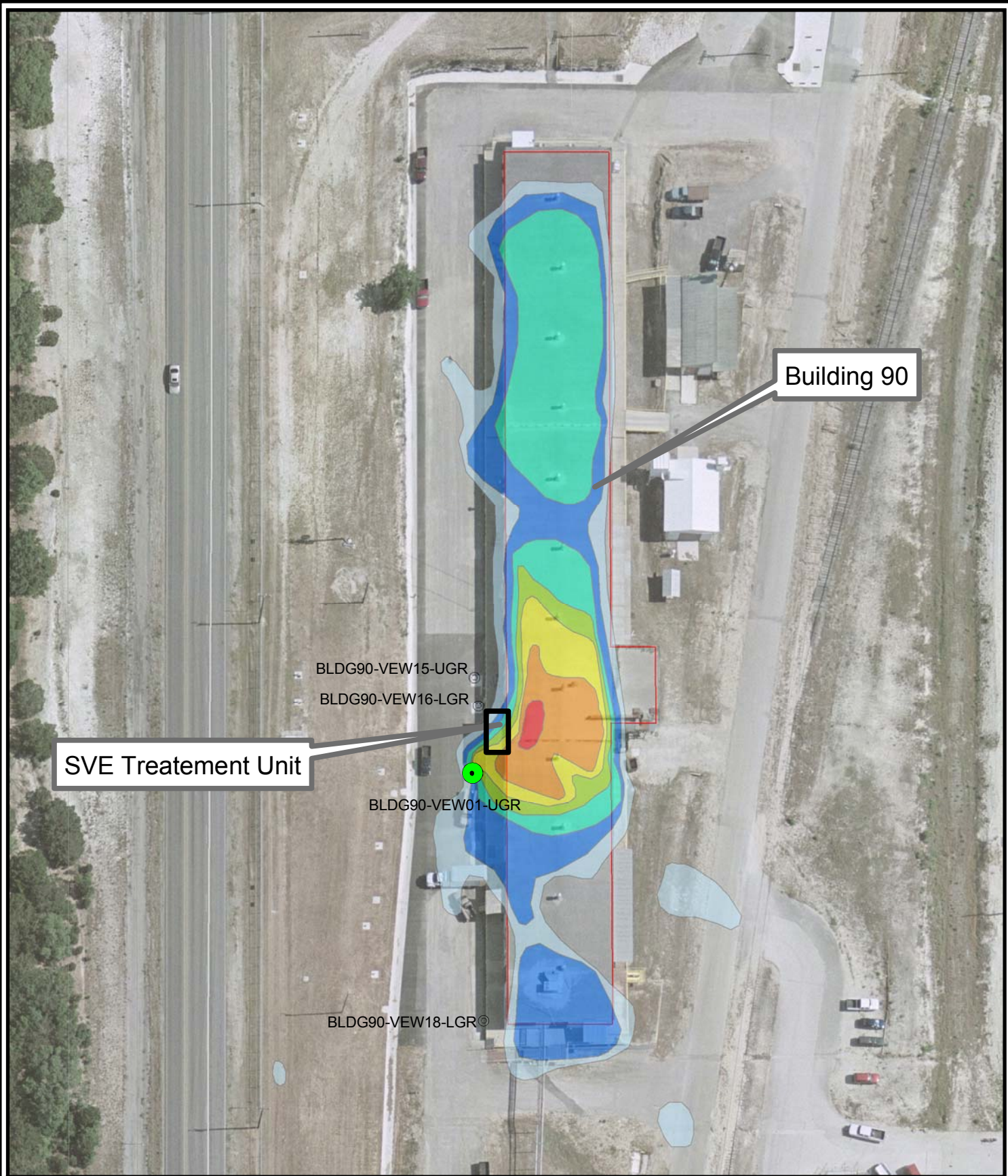
- ⊙ Existing Intermediate VEWs and calculated radius of influence
- ⊙ Proposed Intermediate VEWs and projected radius of influence
- ⊙ VEW Locations
- △ VMP Locations
- ⊕ Peizometer Locations

Figure 3.2

**Proposed Intermediate VEWs
AOC-65 SVE System
Camp Stanley Storage Activity**

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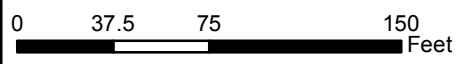
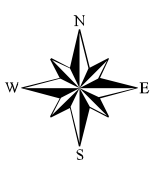
Building 90

SVE Treatment Unit

BLDG90-VEW15-UGR
 BLDG90-VEW16-LGR

BLDG90-VEW01-UGR

BLDG90-VEW18-LGR



Symbol	Description	Soil Gas PCE Contours (ppb)
Ⓢ	VEW locations	20,000 ppb
●	Proposed Nested VEW	1000
		500
		100
		10
		1
		<1

Figure 3.3

Proposed Nested VEW Location
 AOC-65
 Camp Stanley Storage Activity

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PVC END PLUG AND SAMPLING PORT WITH 3/16" HOSE BARB/BALL VALVE

12" DIA FLUSH MOUNT PROTECTIVE WELL COVER

2" PVC PIPE TO SVE SYSTEM

PVC TEE FITTING

CEMENT/BENTONITE GROUT

2" DIA SCH 40 PVC RISER PIPE

2" BENTONITE SEAL

2" DIA. SCH 40 PVC SCREEN 0.050" SLOT

NO. 10-20 SILICA SAND

2" BENTONITE SEAL

10' CEMENT/BENTONITE GROUT

NO. 10-20 SILICA SAND

2" DIA. SCH 40 PVC SCREEN 0.050" SLOT

7 7/8"

85'

40'

15'

40'

Not to Scale

Figure 3.5

Nested VEW Extraction Well Construction Detail
AOC-65

Camp Stanley Storage Activity



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3.3.5 VEW Well Completion

A number 10-20 sand pack will be placed around the screen interval of the VEWs from the bottom of the borehole or screened interval to approximately 2-4 ft above the top of the screen. A 2-ft-thick granular bentonite seal will be installed immediately above the sand pack in 0.5-ft lifts. Between each lift, the bentonite will be hydrated with potable water to ensure complete hydration of the seal. The annular space above the bentonite seal will be filled to within 2 ft of land surface with a 5 percent cement/bentonite grout mixture.

The VEWs will have individual control valves to control the vacuum at each VEW. Each VEW will also be constructed with a pressure monitoring port to measure pressure response when not being utilized as an extraction well. The flexibility of the system will allow extraction from any or all of the VEWs as well as collection of data from the VEWs not involved in the extraction.

The surface completion for the well will include installation of a protective casing and construction of a 4 ft by 4 ft concrete well pad with steel protective posts at each corner. Construction of the well pad and protective posts will be completed after the VEW piping is installed and connected to the VEWs. The surface completion for the nested well at AOC-65 will include a flush-mount protective well cover, and surface completion at all other VEWs at AOC-65 and SWMU B-3 will involve an above ground protective cover.

3.3.6 VEW Well Development

Since the wells will be constructed above the water table, well development will not be required.

3.3.7 Datum Survey

The location and elevation of the injection well will be surveyed by a registered surveyor upon completion of construction activities. Horizontal locations will be measured relative to Universal Transverse Mercator coordinate system to the nearest 0.1 ft. Elevation of the ground surface adjacent to each monitoring well and measurement datum (top of the casing) will be measured relative to an existing CSSA benchmark location. Vertical elevations will be measured with respect to the National Vertical Datum of 1998 to the nearest 0.01 ft.

3.3.8 VEWs and Perched Water

If ground water is encountered during VEW installation, a grab water sample will be collected and submitted for VOC analyses with minimum screening level QA/QC.

3.4 SVE PIPING CONFIGURATION

3.4.1 AOC-65 System Piping and Manifold Layouts

To alleviate potential airflow problems associated with the existing SVE piping at AOC-65, the piping for this system will be reconfigured and new piping installed during expansion of this SVE system. The current AOC-65 SVE configuration will be split into two separate systems, one east of the ditch and one west of the ditch to alleviate problems associated with the

depression of the piping beneath the ditch. The SVE system east of the ditch will utilize the existing AOC-65 blower. A new blower will be installed for the SVE system west of the ditch.

The piping installed for the SVE system west of the ditch will utilize 2-inch ID schedule 40 PVC piping to reduce friction loss and improve airflow. The piping will be connected using PVC glued-joint connections. Flow control valves will be installed in the system piping to allow added flexibility of shutting down individual extraction wells as desired to maximize system performance. To allow installation of flow control valves for individual VEWs, extraction piping from each well will be extended to a common header pipe manifold located near the blower assembly. The planned piping schematic is included in **Figure 3.6**.

During installation of the system, piping west of the ditch, the 1-inch diameter pipe currently connected to the existing wells will be removed. The extraction piping to these VEWs will be replaced with 2-inch ID PVC piping by retrofitting the wellheads to accept the 2-inch pipe. Retrofitting the existing VEWs with 2-inch PVC pipe will require removing a portion of the concrete well pad to expose the below-grade pipe tee connection so the 1-inch pipe can be removed and the 2-inch pipe connected. Once the new 2-inch pipes are connected to the blower and tested, the piping can be covered and the well pad reconstructed.

For the system east of the ditch, the existing 1-inch ID piping currently in place for VEWs wells AOC65-VEW15, AOC65-VEW16, and AOC65-VEW18 will continue to be utilized. The proposed nested VEW system will be added to the eastern AOC-65 system by extending the extraction piping from these VEWs to the nearby pipe manifold at the Building 90 loading dock using 2-inch ID PVC piping. The piping from the nested VEWs will be extended below ground from the wellhead to the nearby piping manifold. The piping leading to the wells west of the ditch will be disconnected at the piping manifold.

3.4.2 SWMU B-3 System Blower, Piping and Manifold Layouts

Continuation of SWMU B-3 SVE operations will require that the SVE blower, appurtenances, piping manifold, and building be reinstalled. The blower and associated components including the building were removed from their former location during the B-3 removal actions completed in July 2006. The new location of the SVE system will be determined once impact from or to the bioreactor operation have been evaluated.

If SVE operations are resumed, new VEWs must be installed and will be connected to the SVE blower assembly using 2-inch PVC piping. SVE piping installed during reconstruction will utilize 2-inch ID schedule 40 PVC piping consistent with previous piping connections. The piping will be connected using glued-joint connections. Flow control valves will be installed in the system piping to allow added flexibility of shutting down extraction wells as desired to maximize system performance. To allow for installation of flow control valves for individual VEWs, extraction piping from each well will be extended to a common header pipe located near the blower assembly. A final layout for reinstallation of the SWMU B-3 SVE system will be prepared after evaluation of the bioreactor operations. A typical system configuration for the system is shown on **Figure 3.7**.

3.5 AOC-65 BLOWER INSTALLATION

To allow reconfiguration of the SVE piping, a new blower will be installed west of the ditch to extract air from all VEWs situated west of the ditch. Installing a new blower and reconfiguring the piping design for the VEWs west of the ditch will eliminate the need for extraction pipes to travel under the ditch. The new blower will be located north of the existing weather station at AOC-65 to prevent potential interference of the weather monitoring equipment. Additionally, the location for the blower will be convenient to potential power supplies. The proposed location of the new AOC-65 blower is depicted on **Figure 3.6**.

The blower will be sized to supply the expected airflow rate while maintaining an adequate vacuum on the system. Review of the airflow rates for the existing VEWs indicates that the shallow wells averaged 19.5 cfm during previous operation. The mid-range VEWs average 30 cfm each. The one deep VEW included with this system (AOC65-VEW14-LGR) is expected to produce flow of 20 cfm. Therefore, a blower will be selected that is capable of producing 19.5 cfm airflow from four VEWs screened in the upper 30 feet (98 cfm total), 30 cfm airflow from three intermediate depth VEWs (90 cfm total), and 20 cfm from one deeper VEW (AOC65-VEW 14LGR) screened at a depth of 40 – 60 feet, giving a total flow for the system of approximately 210 cfm. It will also be sized to provide some excess capacity to allow for future expansions, if any, to be connected to the blower.

The vacuum blower system will include a moisture separator vessel to remove water droplets from the air stream prior to entering the blower. Condensation removed from the system will be treated at the on-post GAC system, as stated in the *“Final CSSA SVE O&M Update”* (January 2006). Housing will be constructed around the blower to protect its components and allow maintenance personnel easy access to the blower gauges and measurement ports. A schematic of the blower system and associated appurtenances is shown on **Figure 3.8**. The proposed layout of the new SVE blower system and housing are depicted on **Figure 3.9**.

The new blower will require connection to CSSA’s electrical service lines. A power drop from the nearby electrical power lines will be installed adjacent to the SVE housing. The blower is expected to require 230 volts single phase or three phase power. The exact power requirements will be established based on available blower requirements and discussions with CSSA personnel regarding electrical service available at the selected area.

3.6 SVE STARTUP AND TESTING

The initial system check of the AOC 65 system will be performed at startup following completion of system expansion activities. An initial system check will also be performed at SWMU B-3 if the SVE system is reinstalled. The startup procedure will be as follows:

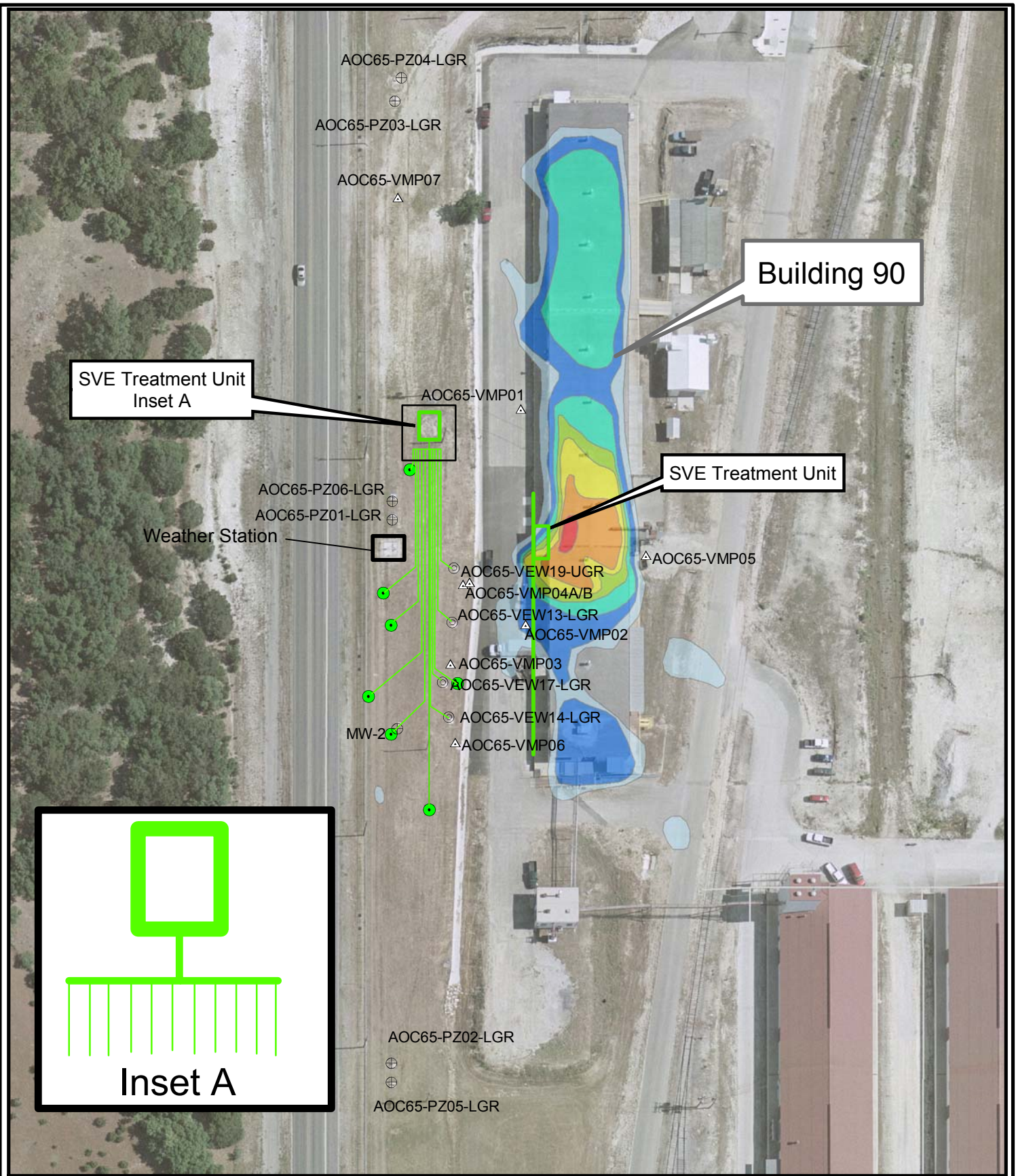
- Prior to startup of the expanded SVE system, all VEWs and VMPs for the system being started will be field monitored for oxygen, carbon dioxide, and TVH levels to assess static conditions;
- Turn the SVE blower on;

- A soil gas sample will be collected from the SVE blower exhaust for VOC analytical method TO-15 analysis before 30 minutes of operation have expired following initial startup;
- After collection of the blower exhaust sample, system operational measurements (airflow and vacuum) and field screening readings (oxygen, carbon dioxide, and TVH) will be measured at the blower intake and at each VEW. Additionally, one soil gas sample will be collected from each VEW and submitted for TO-15 analysis; and
- Approximately 8 and 24 hours after startup, system operational measurement and field screening readings will be collected from the influent flows at each operating SVE blower for TO-15 analysis.

Procedures for the measurement of system operational parameters and field screening readings are included in the “*AOC-65 Treatability Study Sampling and Analysis Plan Addendum,*” (Parsons, July 2002)

3.7 OPERATION AND MAINTENANCE

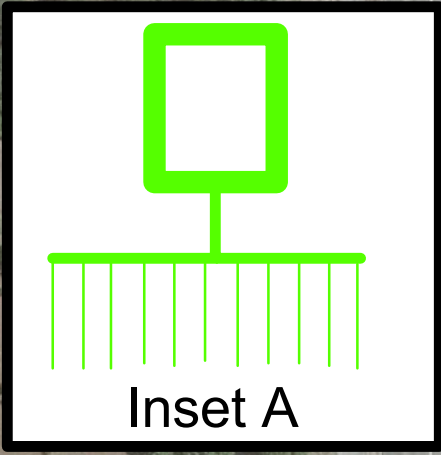
Following completion of the system expansions, the SVE systems at AOC 65 and SWMU B-3 will be operated and maintained continuously following startup. The activities to be performed during the O&M activities are described in the “*Draft Operation and maintenance Plan for AOC-65 & SWMU B-3 Soil Vapor Extraction Systems,*” (Parsons, updated June 2005).



Building 90

SVE Treatment Unit
Inset A

SVE Treatment Unit



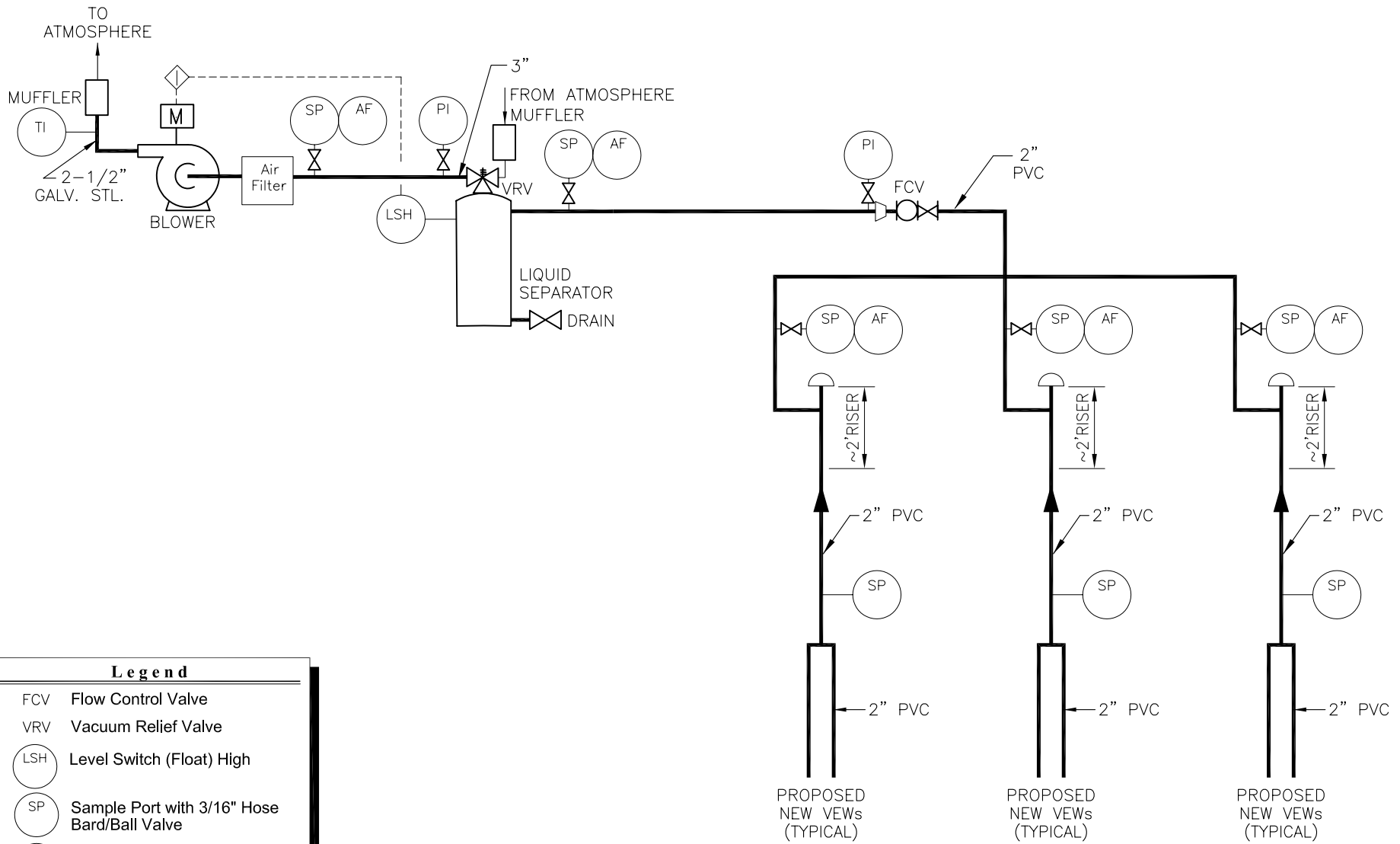
	⊕ Piezometer Locations	Soil Gas PCE Contours (ppb) 20,000 ppb 1000 500 100 10 1 <1
	⊙ VEW Locations	
	△ VMP Locations	
	● Proposed new VEWs	
	~ Proposed piping SVE system	
0 50 100 200		
Feet		

Figure 3.6

Planned Piping Configuration
AOC-65 SVE System
Camp Stanley Storage Activity

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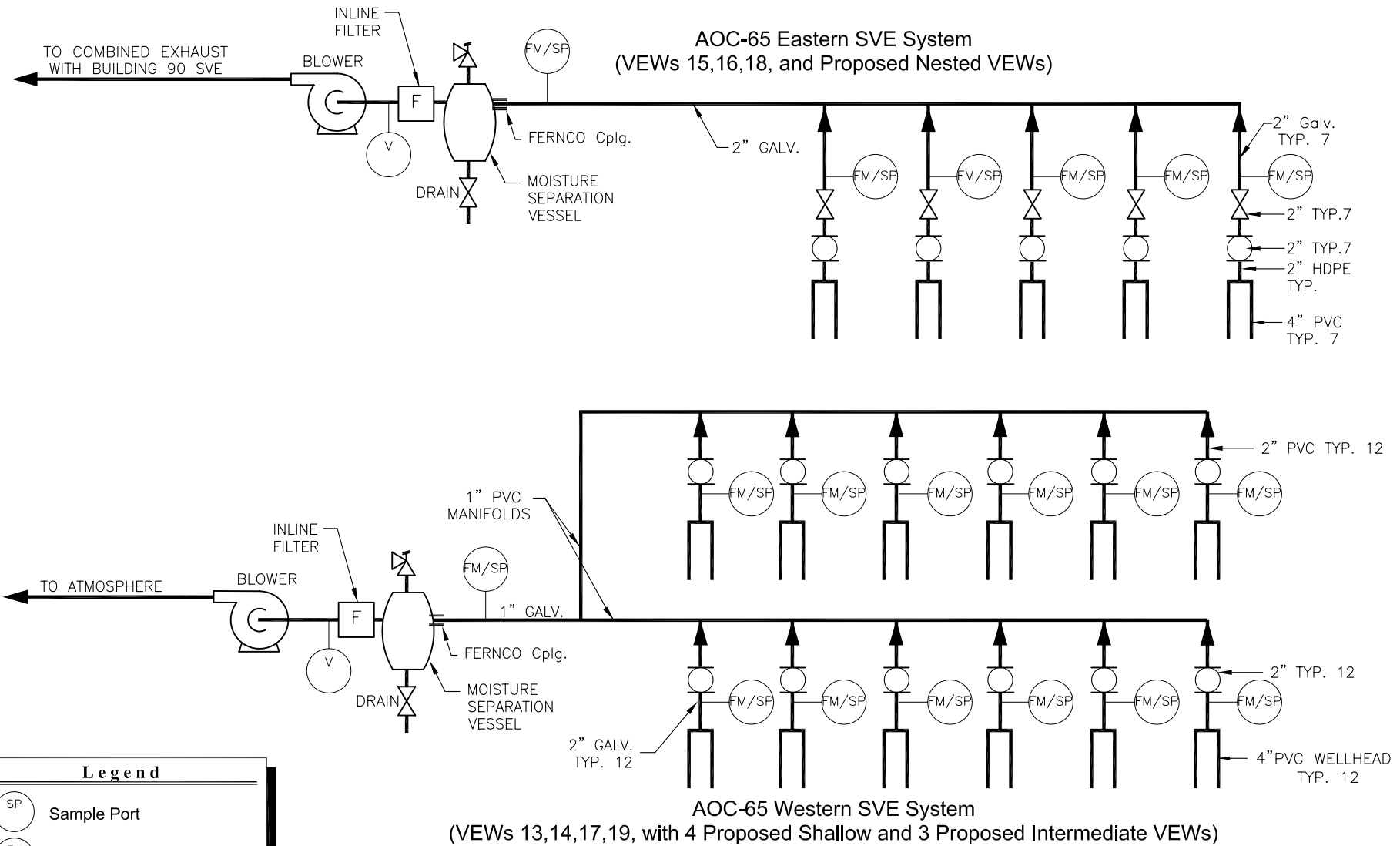
Legend	
FCV	Flow Control Valve
VRV	Vacuum Relief Valve
LSH	Level Switch (Float) High
SP	Sample Port with 3/16" Hose Bard/Ball Valve
AF	Flow Measuring Port
PI	Pressure or Vacuum Indicator
TI	Temperature Indicator

SEPTEMBER 2005

Not to Scale

Figure 3.7
SWMU B-3 SVE Blower System
General Configuration
Camp Stanley Storage Activity


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Legend	
	Sample Port
	Flow Measuring Port
	Pressure/Vacuum Indicator
	Gate Valve
	Ball Valve
	Vacuum Relief/Bleed Valve

SEPTEMBER 2005

Not To Scale

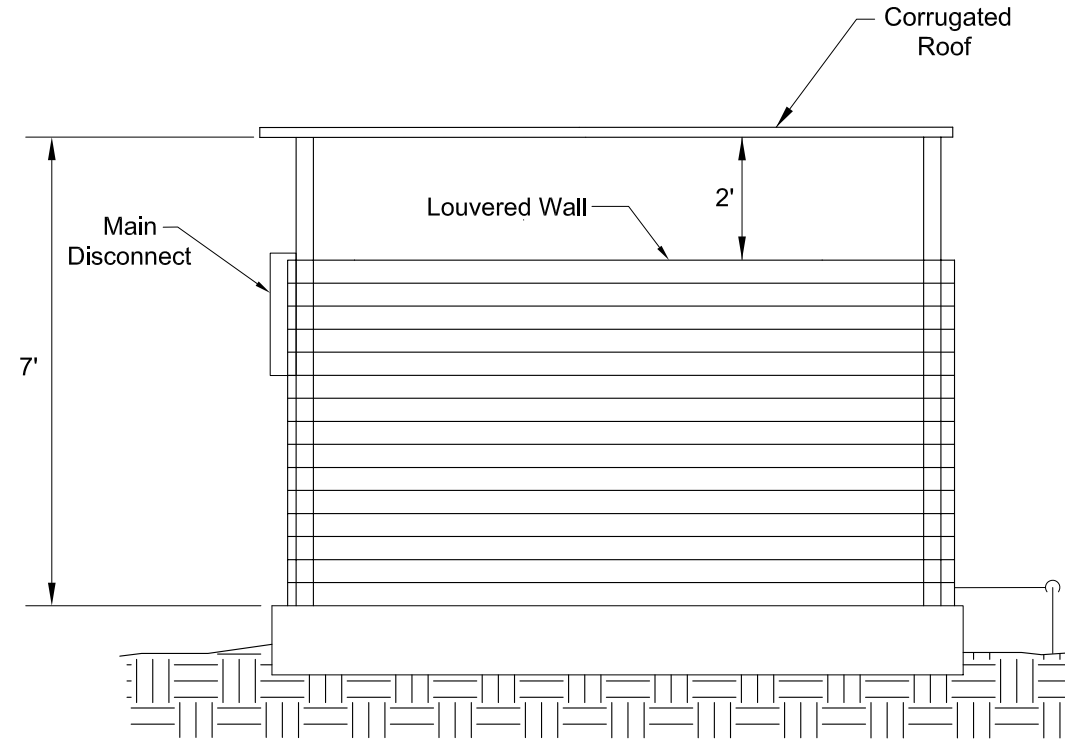
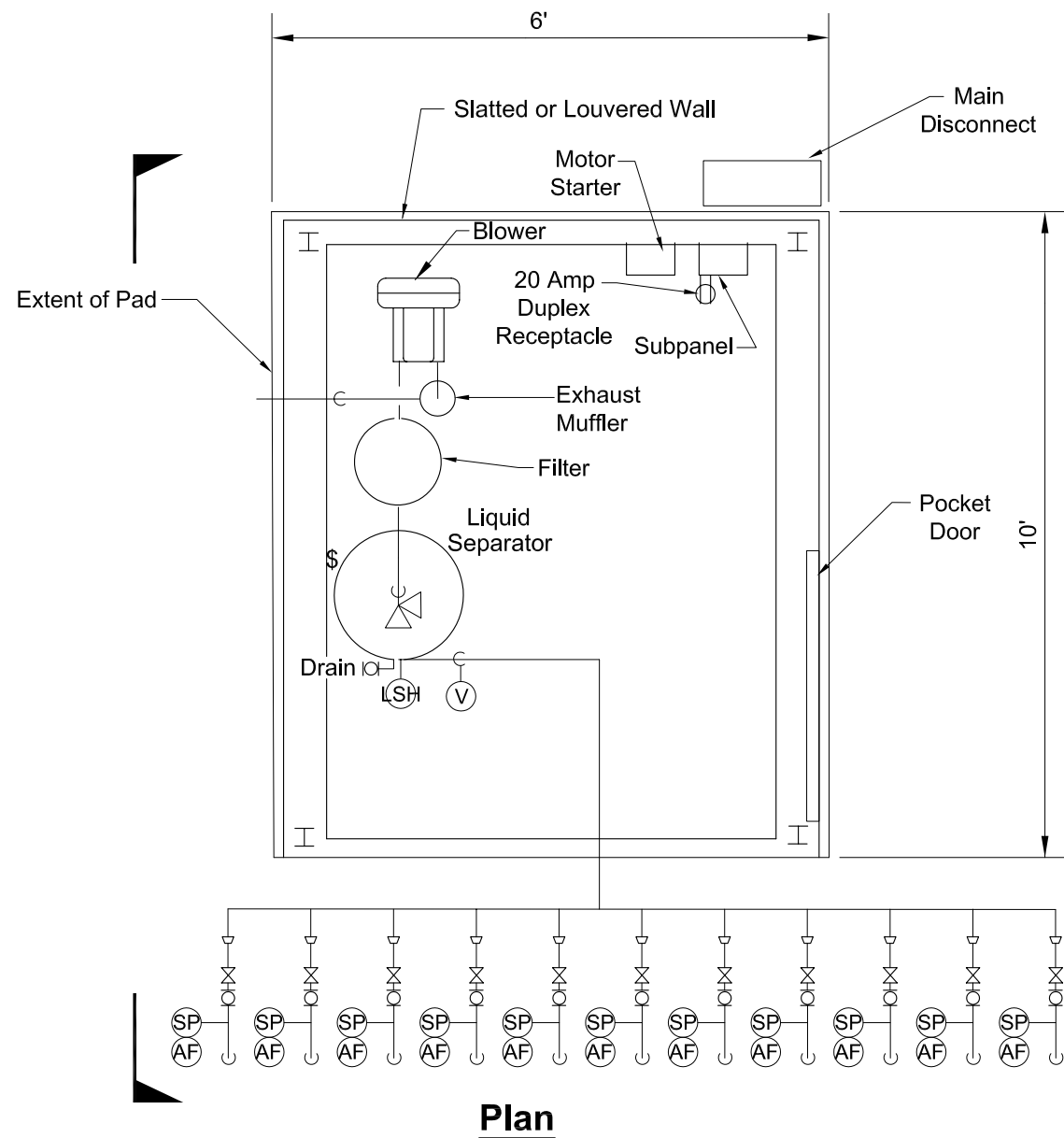
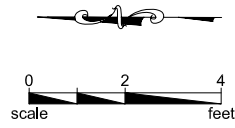
Figure 3.8

AOC-65 SVE Blower System Expansion

Camp Stanley Storage Activity

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Legend	
	Sample/Flow Monitoring Port
	Vacuum Gauge

Figure 3.9
 Proposed AOC-65 Blower Enclosure
 Plan & Section
 Camp Stanley Storage Activity

Note: Dimensions are approximate.

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SECTION 4 SCHEDULING

SVE expansion activities will commence upon approval of this WP and the technical memorandum recommending well locations. New and modified PBR applications will be prepared and submitted to the TCEQ. Drilling and construction activities for the AOC-65 system expansion are tentatively planned to run concurrently with each other. Installation of the new VEWs at SWMU B-3 will not be initiated for at least 6 months after the operation of the bioreactor has been initiated. Implementation of installation activities for all sites is estimated to require six to eight weeks to complete. Startup and testing of the expanded SVE system will be initiated once the new piping is installed at all modified SVE systems. Startup and shakedown testing of the new and modified SVE systems will be completed in one to two weeks. O&M activities will then be initiated on the SWMU B-3 SVE system.

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SECTION 5

REPORTING

A Long Term Operations/Monitoring Report (CDRL A001G) will be prepared for each SVE system after 12 months of operation to summarize the O&M activities. The O&M reports will also document the VEW expansion activities. Analytical data report packages (CDRL A001C) will be prepared and submitted for all definitive data produced under the SVE expansion and O&M activities, and will be updated into the CSSA GIS system (CDRL B009).

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