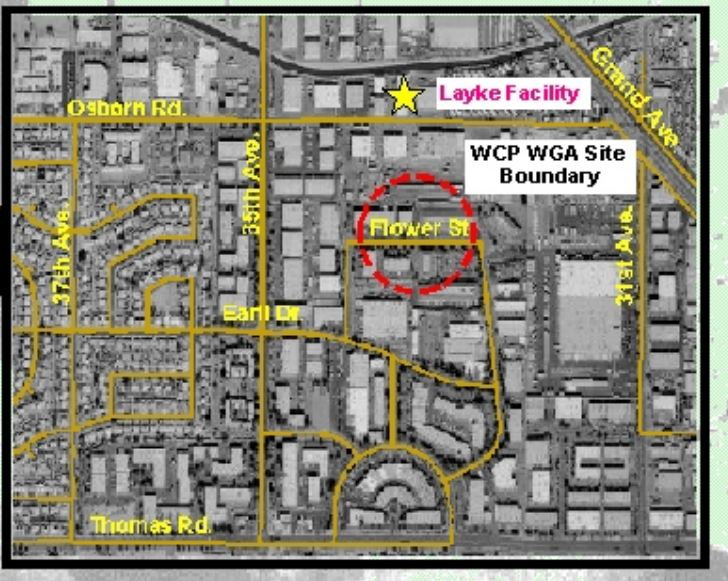
Draft
Remedial Investigation Report

West Central Phoenix
West Grand Avenue Site
Phoenix, Arizona

Volume I of III
(Report, Tables, Figures)



January 2004

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EXECUTIVE SUMMARY

The Arizona Department of Environmental Quality (ADEQ) has prepared this draft remedial investigation (RI) report for the West Central Phoenix (WCP) West Grand Avenue (WGA) Water Quality Assurance Revolving Fund (WQARF) Registry site to meet the requirements established under Arizona Revised Statutes (A.R.S.) §49-287.03.

The Layke Incorporated (Layke) facility, located at 3330 West Osborn Road in Phoenix, Arizona, has been identified as the source of groundwater contamination in the WCP WGA site. Historical records and information obtained from Layke indicate that Layke began operations at the facility in 1967. The operations included the manufacturing of various metal parts. These manufacturing processes required Layke to use various chemical cutting oils, water-soluble cutting fluids, and solvents such as tetrachloroethylene (PCE), trichloroethylene (TCE) and 1,1-trichloroethane (TCA). TCE was the primary solvent used for parts cleaning/degreasing in a vapor degreaser that had been used at the facility from 1969 to approximately 1985. PCE was reportedly used in 1982 only. TCA was used from 1983 to 1988. Reportedly, solvents and cutting oils were stored in 55-gallon drums in the waste storage area. Water-soluble oils were stored in an underground storage tank (UST). Various subcontractors for disposal or recycling then transported waste chemicals off-site. The UST was removed in October 1990.

Field investigation activities for the WCP WGA site RI have been conducted between 1989 and 2002. The RI field activities have included: soil and soil-gas sampling, groundwater monitoring well installations, groundwater monitor well sampling, and Hydropunch® sampling. The distribution of contaminant concentrations in soil-gas, soil, and groundwater during the WCP WGA site RI investigation indicates that the source of soil and groundwater contamination in the WCP WGA site was the former UST located at the Layke facility. When the UST was removed in October 1990, it appeared structurally intact. However, evidence of leakage existed around the entrance to the tank and the tank cover, leading to the conclusion that the UST had overflowed at various times.

Several contaminants have been detected in soil and groundwater samples collected during field investigations at the WCP WGA site. The primary contaminants of concern are PCE, TCE, and 1,1-dichloroethylene (1,1-DCE). These compounds have been detected in soil samples collected on the Layke facility, and/or in groundwater samples collected from wells in the WCP WGA site. PCE and TCE are considered the precursor degreasing solvents released into the environment. The presence of 1,1-DCE is most likely due to degradation of a TCA release.

The PCE and TCE contamination found in the soil beneath the Layke facility exceeded Soil Remediation Levels (SRLs) and Groundwater Protection Levels (GPLs). However, TCE is the only contaminant found at levels above the Arizona Aquifer Water Quality Standard of 5 µg/L in the groundwater in the WCP WGA site. The lateral extent of TCE contamination in the WCP WGA site has been defined to determine the appropriate cleanup actions needed at the site. Further definitive characterization of the vertical extent of groundwater contamination will be addressed during the FS, if needed, based on the selected remedial alternative.

Layke, Inc. implemented an early response action (ERA) consisting of soil vapor extraction (SVE) from March 1995 until 1998 to remediate the PCE and TCE contamination beneath the Layke facility. Between 2001 and 2002, confirmatory soil samples were collected in the area of the former UST to determine the effectiveness of the SVE system in remediating soils onsite. The soil data indicates that the previous source of TCE and PCE contamination had been effectively remediated by the SVE system.

Land uses for the Layke facility property and within the WCP WGA site area are expected to remain predominantly industrial or light industrial. The zoning pattern in the area has been long established and there are no foreseeable changes for the future. Current and future groundwater uses within the WCP WGA site area include: the possible need for additional City of Phoenix drinking water wells to augment production in the WCP area sometime in the future, a potential water treatment plant to be built by SRP on the Grand Canal sometime in the future which would change the use of the groundwater from irrigation to drinking water, and the continuing usage of the Michigan Trailer Park and Danone Water private drinking water wells.

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ACRONYMS

A.A.C.	Arizona Administrative Code
AEC	Applied Environmental Consultants
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
A.R.S.	Arizona Revised Statutes
ASTM	American Society for Testing and Materials
AWQS	Aquifer Water Quality Standards
bgs	below ground surface
BTEX	benzene, ethylbenzene, toluene, xylenes (total)
°C	degrees Celsius
CLP	Contract Laboratory Program
COP	City of Phoenix
CPT	cone penetrometer test
1,1-DCE	1,1-dichloroethylene or 1,1-dichloroethene
DO	dissolved oxygen
Earth Tech	The Earth Technology Corporation
f_{oc}	fraction of organic carbon
ft/d	feet per day
EPA	Environmental Protection Agency
GPL	Groundwater Protection Level
GWG	The GeoWest Group, Inc.
gpm	gallons per minute
K_d	distribution coefficient
K_{oc}	organic carbon partition coefficient
LAU	Lower Alluvial Unit
Layke	Layke, Inc.
lbs/day	pounds per day
LUST	leaking underground storage tank
MAU	Middle Alluvial Unit
MCL	Maximum Contaminant Level
MDL	method detection limit
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mL	milliliter
mg/L	milligrams per liter
NFA	no further action
PA	preliminary assessment
PCE	tetrachloroethylene or tetrachloroethene
PID	photoionization detector
PVC	polyvinyl chloride
R_d	retardation factor
Redox	oxygen-reduction potential
RI	remedial investigation
RI/FS	remedial investigation/feasibility study

ACRONYMS (Continued)

SRL	Soil Remediation Level
SRP	Salt River Project
SRV	Salt River Valley
SI	site inspection
SVE	soil vapor extraction
TCA	1,1,1-trichloroethane
TCE	trichloroethylene or trichloroethene
UAU	Upper Alluvial Unit
USGS	United States Geological Survey
USCS	Unified Soil Classification System
UST	underground storage tank
VOC	volatile organic compound
Verde	Verde Companies, Inc.
WCP	West Central Phoenix
WESTON	Weston Solutions, Inc. (formerly Roy F. Weston, Inc.)
WGA	West Grand Avenue
WOC	West Osborn Complex
WQARF	Water Quality Assurance Revolving Fund

1.0 INTRODUCTION

The Arizona Department of Environmental Quality (ADEQ) has prepared this draft remedial investigation (RI) report for the West Central Phoenix (WCP) West Grand Avenue (WGA) Water Quality Assurance Revolving Fund (WQARF) Registry site to meet the requirements established under Arizona Revised Statutes (A.R.S.) §49-287.03 and Arizona Administrative Code (A.A.C.) R18-16-406. The purpose of the RI is to collect sufficient information to determine the appropriate cleanup actions needed at the site. The information collected during the RI includes: the physical characteristics of the site; the nature, extent and sources of the contamination; and the actual and potential impacts of contaminants on the site to public health, welfare and the environment. The RI also identifies present and reasonably foreseeable uses of land and waters of the state that have been or are threatened to be impacted by the contamination.

1.1 WCP WGA Site Background

In 1982, a volatile organic compound (VOC), trichloroethylene (TCE), was detected in several City of Phoenix (COP) municipal wells located in WCP. Subsequent groundwater sampling confirmed the presence of TCE at concentrations above the U.S. Environmental Protection Agency (EPA) Maximum Contaminant Levels (MCLs). ADEQ subsequently designated the area of groundwater contamination as the WCP WQARF area and recommended further study under the WQARF State Superfund program. The WCP WQARF area was placed on the WQARF Priority List in 1987.

In 1998, the following five WQARF Registry sites were established pursuant to A.R.S. §49-287.01 within the WCP WQARF area:

- West Osborn Complex;
- West Grand Avenue;
- East Grand Avenue;
- North Canal; and
- North Plume.

Figure 1-1 presents the WCP WGA site boundary originally established in 1998, as well as the currently designated WQARF boundary as redefined in June 2003.

The contaminant known to be present at levels above regulatory limits in the groundwater in the WCP WGA site includes the chlorinated solvent TCE. The Layke Incorporated (Layke) facility, located at 3330 West Osborn Road in Phoenix, Arizona, has been identified as the source of the groundwater contamination in the WCP WGA site (Figure 1-2).

1.2 Layke Operational History

The Layke facility is located at 3330 West Osborn Road in Phoenix, Arizona (Figure 1-2). The facility is depicted on the United States Geological Survey (USGS) Fowler, Arizona 7.5 minute topographic quadrangle map in the southeast ¼, of the southwest ¼, of the northwest ¼, of Section 26, Range 2 east, and Township 2 north of the Gila and Salt River Baseline and Meridian. The area surrounding the site is predominantly comprised of mixed industrial and commercial properties with a low-density residential area located east of the Layke facility.

Layke began operations at the facility in 1967. Operations include the manufacturing of various metal parts for precision machining equipment used in the aircraft, aerospace, and electronic industries. These manufacturing processes required Layke to use cutting oils, water-soluble cutting fluids, and solvents such as TCE, tetrachloroethylene (PCE), and 1,1-trichloroethane (TCA). Machined parts were cleaned in two ways: in a vapor degreaser that contained TCE or inserted into buckets with solvents located at workstations. TCE was the primary solvent used for parts cleaning/degreasing in a vapor degreaser that operated from 1969 to approximately 1985. The location of this vapor degreaser varied during the years of operation, but it was decommissioned in 1987 and sold in 1989. PCE was reportedly used only in 1982. TCA was used from 1983 to 1988. Aliphatic solvents such as lacolene are currently used to clean parts and a solvent recycling unit is currently used to recycle the solvents (ADEQ, 1989b; AEC, 1991).

Reportedly, chemicals were purchased in 5-gallon buckets or in 55-gallon drums. All chemicals were drawn as needed in small containers and used at various equipment areas. Waste water-soluble fluids were transferred for storage to a 1,000-gallon concrete underground storage tank (UST) through a sink next to it until shipped off-site for disposal. Used cutting oils and solvents were reportedly stored in drums and shipped off-site for disposal or recycling (ADEQ, 1989b; AEC, 1991).

Layke utilized the UST for waste chemical storage from 1967 to 1989. According to Layke, the UST was originally used for a variety of liquid wastes. However, when regulations on disposal of certain materials came into effect, Layke limited the UST for the disposal of water-soluble fluids only (ADEQ, 1989b). During the years the UST was in used, it appears that the UST was periodically overfilled and leaked between the lid and main structure. The amount of waste lost to the environment is currently unknown.

Layke installed a soil vapor extraction (SVE) system at the facility in March 1995 to remediate the contamination around the UST area. The SVE system operated until 1998. In December 2000, Layke submitted a request for a no further action (NFA) determination for a portion of the facility pursuant to A.R.S. §49-287.01. The NFA request was restricted to TCE only in soil and groundwater, in the area around the former UST. Based on the analytical data collected during the NFA Investigation described in Section 2.8 of this report, ADEQ concluded that the source of TCE contamination previously detected in the soil beneath the former UST basin had been effectively removed by the SVE system. As a result, ADEQ granted the NFA request on December 19, 2002, pursuant to A.R.S. §49-287.01.

2.0 FIELD INVESTIGATIONS

Field investigation activities for the WCP WGA site RI have been conducted between 1989 and 2002. The RI field activities have included: soil and soil-gas sampling, groundwater monitoring well installations, groundwater monitor well sampling, and Hydropunch® sampling. As required under A.R.S. §49-287.03(E) and A.A.C. R18-16-406, data has been collected to adequately characterize the site for the purpose of developing and evaluating effective remediation alternatives. The data collected during the field investigations presented in this section were used to develop an understanding of the site characteristics (Section 4.0), nature and extent of contamination (Section 5.0), and fate and transport of the contaminants (Section 6.0).

Several parties have conducted the field activities described in the sections below. These include: EPA; The Earth Technology Corporation (Earth Tech) and Weston Solutions, Inc. (WESTON) on behalf of ADEQ; and Applied Environmental Consultants (AEC) and The GeoWest Group, Inc. (GWG) on behalf of Layke.

2.1 1989 EPA PA/SI Investigation

In 1989, a preliminary assessment (PA) was conducted at the Layke facility. The PA was performed by ADEQ for the EPA and included a reconnaissance of the facility. Upon completing the PA, ADEQ recommended that a site inspection (SI) be conducted at the facility due to the historic use of TCE and potential disposal practices at the site (ADEQ, 1989a).

2.1.1 Soil-Gas Investigation

In 1989, ADEQ conducted the SI investigation at the Layke facility. The SI investigation included the advancement of two test holes, LAY-1 located in the vicinity of the concrete UST, and LAY-2 located near the chemical storage and handling area (Figure 2-1). A cone penetrometer test (CPT) rig was used to advance the test holes to provide information on site stratigraphy and aid in the determination of the optimum depth to collect soil and soil-gas samples. Based on the CPT data, the soils ranged from silty clay to sand (ADEQ, 1989b).

Soil-gas samples were collected by replacing the CPT assembly with a disposable sampling probe. A peristaltic vacuum pump was used to induce the flow of soil-gas into the probe. Soil-gas was then extracted from the exhaust line using a glass syringe and taken to a mobile laboratory to perform on-site analysis. One soil-gas sample was collected from a depth of approximately 10 feet below ground surface (bgs) from borings LAY-1 and LAY-2. Chemical analysis of the soil-gas samples indicated the presence of TCE at concentrations of 910 µg/L and 56 µg/L, respectively (ADEQ, 1989b).

2.1.2 Soil Sampling

One soil sample was also obtained from location LAY-2 due to its proximity to the hazardous waste storage area. The soil sample was collected at a depth of approximately 15.5 feet bgs and was sent off-site to the EPA Contract Laboratory Program (CLP) laboratory for analysis. At the time the SI Report was completed, the soil sampling results had not been received from the CLP laboratory (ADEQ, 1989b). The analytical results later received from the laboratory did not detect the presence of TCE in the soil sample obtained from location LAY-2 (EPA, 1989).

Based on the results of the soil-gas samples obtained during the SI investigation, as well as the information collected regarding Layke's chemical usage, ADEQ referred the site for further investigation and remedial action (ADEQ, 1989b).

2.2 1990 Phase I Testing

In 1990, Layke hired AEC to conduct the Phase I Testing activities at its facility. Phase I Testing activities included collecting samples of the UST contents/sludge, subsurface soil samples from the Chemical Storage Area, excavation/removal of the UST, and collection of soil samples from the UST basin (AEC, 1990b). Drilling activities were conducted in two phases and Earth Tech provided oversight for ADEQ during the investigation. Drilling, sampling, and decontamination procedures were completed in accordance with the sampling plan approved by ADEQ (AEC, 1990a; Earth Tech, 1990a).

The first phase of the investigation was conducted from September 10-11, 1990 to sample the UST contents/sludge and the chemical storage area. First, the contents of the UST were removed using a backhoe and a sample obtained using a trowel or hand scoop. Next, three boreholes (SS1 through SS3) were advanced inside the chemical storage area using a hand auger to depths of approximately 6 feet bgs. Finally, two borings (SB1 and SB2) were drilled adjacent to Chemical Storage Area using a hollow-stem auger drill to depths of approximately 21 feet bgs (Figure 2-2).

Backhoe and hand auger samples were manually packed into pre-cleaned, wide mouth glass sampling jars with Teflon®-lined lids. Soil samples collected with the hollow-stem auger were collected in brass sleeves, sealed with Teflon® liners and plastic end caps. All samples were sealed with tape, labeled, placed in an ice chest with ice, and sent to an off-site laboratory for analysis (AEC, 1990b; Earth Tech 1990a).

The second phase of the investigation was conducted on October 17, 1990 to excavate the UST and sample below the UST and associated piping. The UST was removed by excavating soil from around the tank, removing the tank lid, and then lifting the tank out of the excavation with a backhoe. The concrete tank appeared to be structurally intact, but evidence of leakage existed around the entrance of the tank and the tank cover (Earth Tech, 1990b). The depth of the excavation was approximately 12 feet bgs. Soil samples UST-N (north end of excavation), UST-S (south end of excavation), and UST-P (sidewall of excavation near tank piping) were collected

from within the UST basin (Figure 2-2). These soil samples were collected from the bucket of the backhoe used during the excavation and removal of the UST. The samples were manually packed into pre-cleaned, wide mouth glass sampling jars with Teflon®-lined lids, sealed with tape, labeled, placed in an ice chest with ice, and sent to an off-site laboratory for analysis (AEC, 1990b; Earth Tech, 1990b).

A total of 13 soil samples and one sludge sample were collected and submitted for VOC chemical analysis during the Phase I Testing. A summary of the analytical results is presented in Table 2-1 (AEC, 1990B). The results of the split soil samples collected by ADEQ while overseeing the investigation are presented in Table 2-2 (Earth Tech 1990a, 1990b). Analytical results indicated elevated concentrations of benzene, toluene, ethylbenzene and xylenes (BTEX) and TCE in soil samples collected from beneath the former UST. Concentrations of TCE in these samples ranged from 20.8 to 230 mg/kg. In addition, a sample collected beneath the UST and analyzed for Total Metals using the Toxicity Extraction Procedure (EP Tox) detected a concentration of arsenic of 19 mg/kg. A sample of the UST contents/sludge detected a concentration of TCE of 1,400 mg/kg. AEC recommended that additional soil sampling be conducted to determine the nature and extent of the release from the former UST (AEC, 1990b).

Layke reported the release to the ADEQ UST Section and the facility was assigned leaking underground storage tank (LUST) case file number 0922.01. The ADEQ Remedial Projects Unit continued to provide regulatory oversight due to the presence of TCE in soil beneath the former UST. The Remedial Projects Unit provided comments regarding the Phase I Testing and proposed the Phase II Testing to be conducted at the Layke facility. The Remedial Projects Unit requested that Phase II Testing include the advancement of soil borings and collection of soil samples to define the vertical and lateral extent of contamination in the vicinity of the UST basin. Layke was also requested to provide detailed descriptions of facility operations, chemical usage, and chemical disposal practices performed at the facility (ADEQ, 1991).

2.3 1991 Phase II Testing

In 1991, AEC subcontracted GWG to perform Phase II Testing at the Layke facility. Phase II Testing included the advancement of seven soil borings and collection of soil samples in the vicinity of the former UST basin (GWG, 1991). Drilling activities were conducted in two phases and Earth Tech provided oversight for ADEQ during the investigation (Earth Tech, 1991). Drilling, sampling, and decontamination procedures were completed in accordance with the Phase I Testing sampling plan approved by ADEQ and subsequent amendments (AEC, 1990a; ADEQ, 1991).

Soil borings LU-101 through LU-103 and LU-201 through LU-204 were advanced in the vicinity of the former UST basin to depths ranging from 40 to 90 feet bgs using a hollow-stem auger drill rig (Figure 2-3). Soil samples were collected in brass sleeves, sealed with Teflon® liners and plastic end caps. The samples were then sealed with tape, labeled, placed in an ice chest with ice, and sent to an off-site laboratory for analysis. A summary of the analytical results is presented in Table 2-3 (GWG, 1991). The results of the split soil samples collected by ADEQ

while overseeing the investigation are presented in Table 2-4 (Earth Tech 1991a, 1991b). Soil sample analytical results indicated concentrations of TCE ranging from below laboratory MDLs to 76 mg/kg at a depth of 10 feet bgs. The soil borings LU-201, LU-202, and LU-203 were converted to soil vapor extraction (SVE) wells to depths of 60, 60, and 48 feet bgs, respectively. The other borings were backfilled with granular bentonite (GWG, 1991).

GWG concluded that the majority of the hydrocarbon and VOC contamination was detected in the soil beneath the former UST extending to a depth of approximately 30 feet bgs and that low concentrations of VOCs were detected in a silty clay unit located at approximately 55 to 65 feet bgs. To confirm the effectiveness of the silty clay unit as a barrier to the vertical migration of VOCs, GWG recommended the installation of an additional boring to a depth of 90 feet bgs at the location of the former UST. GWG also recommended the new boring to be completed as a new SVE well (GWG, 1991). However, this recommended boring/SVE well was never installed.

2.4 1992-1994 ADEQ Installation of Monitor Wells WCP-4 and WCP-8

From 1992 to 1994, Earth Tech, on behalf of ADEQ, performed a groundwater investigation in the WCP project area. Several groundwater monitoring wells were installed throughout the WCP project area, including wells WCP-4 and WCP-8 (Figure 2-4).

Monitor well WCP-4 was installed at the Layke facility, southeast of the UST excavation. The installation of this well had two purposes. First, to collect soil samples and determine the vertical extent of VOC soil contamination at the Layke facility, specifically beneath the silty clay layer identified during the 1991 Phase II Testing. Second, to determine if the release from the UST at the Layke facility had impacted groundwater. Monitor well WCP-8 was installed north of the Grand Canal as the upgradient well of the Layke facility (Earth Tech, 1992b, 1994).

Monitor well drilling, installation, and sampling activities were conducted in accordance with the sampling plan prepared by Earth Tech for ADEQ (Earth Tech, 1992a).

2.4.1 Monitor Well WCP-4 Soil Sampling

Soil boring Layke-1 was the initial boring for monitor well WCP-4 and was drilled using a hollow-stem auger. Layke-1 was originally sited near the center of the former UST excavation (Figure 2-4). However, this boring penetrated the UST excavation liner and was terminated. This boring was backfilled and new boring Layke-1A, drilled about 10 feet south of the former UST excavation, was completed as monitoring well WCP-4 (Earth Tech, 1992b).

Soil samples were collected from boring Layke-1 and Layke-1A in accordance with Earth Tech's sampling plan submitted to ADEQ. Soil samples were collected in brass sleeves, sealed with Teflon® liners and plastic end caps. The samples were then sealed with tape, labeled, placed in an ice chest with ice, and sent to an off-site laboratory for analysis. A summary of the soil

analytical results is presented in Table 2-5. A concentration of TCE of 49,000 µg/kg (49 mg/kg) was detected at a depth of 19 feet bgs in boring Layke-1. Also, concentrations of TCE were detected below the silty clay layer, between 60.5 and 94.5 feet bgs, from boring Layke-1A. A maximum TCE concentration of 90 µg/kg (0.090 mg/kg) was detected in the soil sample from boring Layke-1A collected at 75.5 feet bgs (Earth Tech, 1992b).

2.4.2 Monitor Wells WCP-4 and WCP-8 Groundwater Sampling

Monitor well WCP-4 was developed by surging the well with a surge block, and then purging the well with a submersible pump until parameters stabilized (Earth Tech 1992b). Monitor well WCP-8 was developed in ten-foot increments by using a submersible pump until parameters stabilized (Earth Tech, 1993a). Dedicated pumps and sounding tubes were installed after well development. Well construction details can be found in Table 2-6.

In general, the first sampling event occurred 72 hours after well development and a second sampling event approximately 30 days later. The wells were purged of at least three to five well volumes and allowed to stabilize before the groundwater samples were collected.

Analytical results of groundwater samples collected from WCP-4 between 1992 and 1994 indicate concentrations of TCE ranged from 340 to 420 µg/L (Earth Tech, 1993a and b; 1994a and b). Groundwater samples collected from WCP-8 between 1992 and 1994 did not have any detections of TCE above the method detection limit of 0.5 µg/L. A summary of the analytical results is presented in Table 2-7.

2.5 1995 ADEQ Installation of Monitor Wells WCP-10 and WCP-11

In 1995, Earth Tech, on behalf of the ADEQ, performed a groundwater investigation at the Layke facility. Two shallow groundwater monitoring wells (WCP-10 and WCP-11) were installed to the south (downgradient) and west (cross-gradient) of the Layke facility (Figure 2-4). Monitor well WCP-4 at the Layke facility was also sampled. Monitor well drilling, installation, and sampling activities were conducted in accordance with the sampling plan prepared by Earth Tech for ADEQ (Earth Tech, 1995a).

The wells were installed using a hollow-stem auger rig. Well construction details can be found in Table 2-8. Monitor wells WCP-10 and WCP-11 were developed approximately two weeks after construction because the drill rig was not available. The wells were developed by surging and bailing, then purging the well with a submersible pump until parameters stabilized. Dedicated pumps and sounding tubes were not installed (Earth Tech, 1995b).

Analytical results of the groundwater sample collected from WCP-4 in 1995 detected 140 µg/L of TCE (Earth Tech, 1995). Groundwater samples collected in 1995 from WCP-10 contained 37-45 µg/L of TCE. Samples from WCP-11 did not contain TCE above the method detection limit of 0.5 µg/L. A summary of the analytical results is presented in Table 2-9.

2.6 1996 ADEQ Groundwater Sampling

In 1996, Earth Tech, on behalf of the ADEQ, performed an annual groundwater sampling of monitor wells throughout the WCP area, including wells WCP-4, WCP-8, WCP-10, and WCP-11. Analytical results of groundwater samples collected from WCP-4 in 1996 indicate concentrations of TCE of 190 µg/L (Earth Tech, 1996). A summary of the analytical results is presented in Table 2-10.

2.7 1996-2001 West Osborn Complex Remedial Investigation

Between 1996 and 1999, United Industrial Corporation (United) monitored wells WCP-4, WCP-8, WCP-10, WCP-11, and MW-103s as part of the WCP West Osborn Complex (WOC) RI investigative activities (Figure 2-5). ADEQ conducted monitoring of the same wells in 2001. Summaries of the analytical results received from United on the above-mentioned wells, as well as the results from ADEQ's split sampling data, are presented in Tables 2-11 and 2-12 (WESTON, 2002a).

2.8 2001-2002 Layke NFA Soil, Soil-Gas, and Groundwater Investigation

In December 2000, Layke submitted to ADEQ a request for a no further action (NFA) for a portion of the facility. The NFA request was restricted to TCE in soil and groundwater, in the area covered within a diameter of 80 feet (24.4 meters), centered on the location of the former UST (Quarles & Brady, 2000, 2001). ADEQ performed an evaluation of the Layke NFA request by reviewing previous investigation reports and remedial actions conducted at the facility. After this review, ADEQ concluded that there was insufficient information to grant a NFA determination due to the following: (1) need for confirmatory soil borings in the area remediated by the SVE system; (2) need to investigate other areas of potential concern; and (2) need to evaluate any residual groundwater contamination beneath the Layke facility (WESTON, 2001b).

The Layke NFA Investigation, conducted by ADEQ between March 2001 and January 2002, included the sampling of selected wells, the advancement of soil borings, and the collection of soil, soil-gas, and Hydropunch® samples for chemical analysis. Investigative activities were conducted in accordance with the plans prepared by WESTON for ADEQ (WESTON, 2001a, c, d, and e).

2.8.1 Groundwater Sampling

In March 2001, WESTON, on behalf of ADEQ, collected one round of groundwater samples from monitor wells WCP-4 and WCP-10. Groundwater monitor well WCP-11, located west of the Layke facility was not sampled because the well was dry. (WESTON, 2002b). These activities were conducted following the guidance of the sampling plan prepared for the WCP East Grand Avenue Remedial Investigation/Feasibility Study (RI/FS) (WESTON, 2001a).

The monitor wells were purged utilizing a submersible pump operated at a low frequency, limiting groundwater flow to approximately 0.5 gallons per minute (gpm). Well purging was considered complete when a minimum of one well casing volume of purged groundwater had been removed and the groundwater parameters had stabilized. Analytical results of groundwater samples collected from WCP-4 indicated concentrations of TCE were below the laboratory MDL. TCE was detected in well WCP-10 at a concentration of 8 µg/L. A summary of the analytical results is presented in Table 2-13 (WESTON, 2002b).

2.8.2 Soil and Soil-Gas Investigation

Between December 26, 2001 and January 14, 2002, WESTON, on behalf of ADEQ, drilled nine soil borings (LAY-SB-1 through LAY-SB-9) in the vicinity of the former UST basin and chemical storage and handling area (Figure 2-6). Soil and soil-gas samples were collected during the advancement of these soil borings at approximate 20-foot intervals.

Soil boring locations were selected based on analytical data and chemical storage records obtained during previous environmental investigations conducted at the facility. The nine soil borings were advanced in areas known and/or suspected as having been impacted by VOCs. Soil borings LAY-SB-1 through LAY-SB-5 were advanced in the vicinity of the former UST basin. They were designed to provide confirmatory soil and soil-gas sample analytical results to determine the effectiveness of the SVE system in remediating this area (Figure 2-6).

Soil borings LAY-SB-6 through LAY-SB-9 were advanced in the vicinity of the chemical storage and handling area (Figure 2-6). This area was suspected as a possible source of VOC contamination due to the use and storage of chemicals and the presence of a vapor degreaser. These soil borings were designed to determine the presence and/or absence of VOCs.

Three additional soil borings were planned but not completed because of site utility constraints and sample analytical data obtained from the initial nine soil borings. Eight contingency soil borings were also planned in the original scope of work but were determined not necessary, based on evaluation of sample analytical data obtained form the initial nine soil borings.

Soil borings were drilled to a total completion depth of approximately 136 feet bgs using a hollow-stem auger drill rig. Soils designated for chemical analysis were collected utilizing an EnCore™ sampling device. The EnCore™ sampler consisted of a 5-gram cartridge sampler that was pushed into the soil contained in the split barrel sampler. The EnCore™ sampler was removed, sealed, labeled, reinserted into its original airtight package, and stored on ice in a cooler (WESTON, 2002b).

Soil-gas samples were collected in conjunction with the soil samples at 20-foot intervals from 10 feet bgs to 126 feet bgs using a SimulProbe® sampler. The SimulProbe® sampler with ¼-inch Teflon™ vacuum line was attached to the drill rods, lowered to the bottom of the borehole, and then advanced approximately 21 inches into undisturbed soil. The SimulProbe® was retracted approximately 4 inches to expose the screen. The vacuum line was attached to the vacuum pump

and the pump was operated for approximately one minute to purge the line prior to collecting the sample. When purging was considered complete, a soil-gas sample was collected in a Tedlar™ bag for submittal to an off-site laboratory for analysis (WESTON, 2002b).

Soil-gas samples collected and analyzed as part of the Layke NFA Investigation contained low concentrations of VOCs (TCE: 1.2 µg/L to 6.1 µg/L; 1,1-DCE: 1.1 µg/L to 1.8 µg/L). Soil sample analytical results indicated no detection of VOCs above the laboratory MDLs. A summary of the analytical results for the soil and soil-gas samples is presented in Table 2-14 and Table 2-15, respectively.

2.8.3 Hydropunch® Groundwater Sampling

The groundwater samples were collected to determine the presence and/or absence of VOCs in the shallow aquifer beneath the Layke facility. Groundwater samples were collected utilizing Hydropunch® sampling techniques at the completion depth of each of the nine soil borings drilled. At the completion depth of the boreholes (approximately 136 feet bgs), the Hydropunch® sampler was attached to the drill rods and driven approximately 4 feet in advance of the auger flights. The outer casing on the Hydropunch® sample tool was raised to expose the screen, allowing groundwater to enter the sample chamber. A dedicated disposable bailer was lowered into the Hydropunch® sampling chamber and a groundwater sample was recovered. The samples were decanted from the bailer into laboratory provided containers.

Hydropunch® groundwater analytical results indicated no detection of VOCs above the laboratory MDLs. A summary of the analytical results is presented in Table 2-16.

3.0 EARLY RESPONSE ACTION ACTIVITIES

As stated in Sections 2.2 and 2.3 of this report, investigations at the Layke facility discovered evidence of leakage around the entrance of the UST and the tank cover. The soil sampling data collected during the Phase I and II Testing investigations indicated TCE and PCE contamination beneath the UST area was above SRLs and GPLs.

Soil borings LU-201, LU-202, and LU-203 drilled during the 1991 Phase II Testing were converted to soil vapor extraction (SVE) wells in anticipation that VOC and petroleum hydrocarbon contamination remediation would be necessary at the Layke facility (Figure 2-3). As a result, an early response action (ERA) consisting of a SVE system was implemented by Layke at its facility from March 1995 until 1998.

3.1 SVE Well Construction Details

The SVE wells were constructed of 2-inch diameter Schedule 40 PVC blank and slotted casing (Figure 3-1). The blank casing was installed from ground surface to approximately 10 feet bgs. Slotted casing (0.020 inches) was installed from 10 feet bgs to 60 feet bgs in LU-201 and LU-202, and to approximately 48 feet bgs in LU-203. Lonestar #3 silica sand was placed from approximately 10 feet bgs to the total depth of the well and was overlain by 1 foot of bentonite pellets, properly saturated to promote sealing. Backfill was placed from 1 to 9 feet bgs around the blank casing. The wells were completed to the surface with cement slurry and a flush-mounted structure with a locking well cover (Verde, 1995).

3.2 Installation of SVE System

Installation of the SVE system was conducted from March 1 through May 26, 1995 in accordance with the SVE system design approved by ADEQ on November 23, 1994. The system consisted of moisture separator and a 1.5 horsepower blower/motor connected to the three SVE wells using a 2-inch diameter Schedule 40 PVC pipe (Figure 3-2).

On March 29, 1995, the SVE system was started-up and tested. Radius of influence tests were conducted to demonstrate the effect of the blower at different distances (Earth Tech, 1995c). The system was operated under an air quality permit (Ref. No. 9500194) from the Maricopa County Environmental Services Department. The SVE system was constructed without an air emissions control system on the discharge of the system because VOC concentrations were below ambient air quality guidelines. These guidelines are used to establish allowable VOC emissions into the ambient air and are employed during the initial permitting process (Verde, 1995; AEC, 1996).

3.3 SVE Operation and Maintenance

Verde Environmental Services (Verde) operated the system on behalf of Layke. Verde conducted monitoring of the SVE system that included collecting vapor samples of the system exhaust, screening the system exhaust vapors with a photoionization detector (PID), and preparing quarterly reports summarizing system performance for submittal to the ADEQ and Maricopa County. Verde collected soil vapor samples of the system exhaust using time-weighted carbon adsorption tubes on March 30, April 26, and July 28, 1995. Analytical results of these samples detected extremely low concentrations of VOCs ranging from 10^{-4} to 10^{-3} µg/L (Earth Tech, 1995c). Earth Tech also collected soil vapor samples from the system exhaust using Tedlar™ bags on behalf of ADEQ on April 7 and October 5, 1995. Analytical results from these samples indicated concentrations of TCE of 520 and 6.4 µg/L, respectively. Earth Tech concluded that the time-weighted carbon adsorption tubes used by Verde were not accurate and recommended another sampling technique for soil vapor analysis (Earth Tech, 1995d).

Several performance issues were raised by ADEQ regarding the operation and sampling of the SVE system. An evaluation of the quarterly reports submitted by Verde to ADEQ indicate that most of the SVE system exhaust air sample results, collected during the system operation from March 1995 to July 1997, are questionable due to lack of valid sampling and analysis documentation. None of the reports submitted by Verde presented complete SVE system exhaust sampling methodologies in enough detail to fully validate the data. The reports did not present detailed sampling methodology, sampling locations, field data sheets, flow rate and emission rate concentration calculations, or documentation of PID calibration and data conversion (QST, 1998). Due to these performance issues, it is difficult to accurately estimate the actual mass of TCE and BTEX removed from the soil at the Layke facility. Layke's contractor estimated approximately 100 pounds of TCE were extracted during the first six months of operation of the treatment system (AEC, 1996). ADEQ's contractor estimated that 250 to 300 pounds of TCE were extracted during this same time period (Earth Tech, 1995d).

Review of the soil-gas data submitted by Verde indicates there was a trend of declining TCE concentrations during the first few months of operation. Initial VOC removal rates were estimated as high as approximately 6 pounds per day (lbs/day), exceeding the Maricopa County VOC permit of 3 lbs/day. Given the available data, it cannot be determined how many days the SVE system exceeded the permitted discharge amount. However, after this period, the TCE removal rates decreased at a much lower rate. Based on the results of vapor samples collected in November 1997, the rate of TCE removal was conservatively estimated to be less than 0.007 lbs/day (Earth Tech, 1995c; QST, 1998; WESTON, 2001b).

Layke shut down the treatment system in June 1998 due to financial reasons and due to the fact that VOC concentrations in the treatment system exhaust were no longer detectable. A rebound test was planned, but was never performed

4.0 SITE CHARACTERISTICS

Geological and hydrogeological characteristics were investigated to understand their effect on the distribution and migration of contaminants at the WCP WGA site. The characteristics of the subsurface were evaluated by examining soil samples recovered during the advancement of soil borings and reviewing literature on the geology and hydrogeology for the area. Historic water level data was used to evaluate the direction and gradient of groundwater movement beneath the site.

4.1 Regional Geology

The WCP WGA site is located within the West Salt River Valley (SRV), as defined by the ADWR. The SRV is an alluvial basin characteristic of Basin and Range physiography. Typically, the SRV consists of thick basin fill deposits of unconsolidated to semi-consolidated late Tertiary-to Quaternary-Age sediments overlying bedrock. The basin-fill deposits range in thickness from less than 100 feet near the margins of the basin to over 10,000 feet in the central areas of the basin (Corkhill et al., 1993). The basin-fill deposits consist of interbedded sequences of conglomerate, gravel, sand, silt, clay, and evaporites. These deposits comprise the regional aquifer in the SRV and have been divided into hydrogeologic units, as discussed in later sections.

The SRV is surrounded by generally northwest-southeast trending, fault-blocked mountain ranges characteristic of the Basin & Range physiographic province. The rocks that comprise the floor of the SRV and surrounding mountain ranges predominantly consist of Precambrian to middle Tertiary-age crystalline and middle Tertiary-to Quaternary-age extrusive rocks (Brown and Pool, 1989). The crystalline rocks are composed of metamorphic and granitic rocks including schist, gneiss, metavolcanics, quartzite, and granite. The extrusive rocks include rhyolites and basalts. These crystalline units may transmit small quantities of water where they are fractured, but are not considered a regional scale aquifer (Corkhill et al., 1993).

The red unit, also known as the Tempe beds and the Camel's Head Formation, is a sedimentary rock of late Tertiary-age. This unit consists of reddish-colored, well-cemented breccia, conglomerate, sandstone, and siltstone, and it locally forms the bedrock in the valley (Laney and Hahn, 1986). The breccia and conglomerate are poorly sorted and particle size ranges from clay to boulders. The upper portion of the red unit contains interbedded volcanic flows and pyroclastic rocks. The red unit is not a significant source of groundwater on a regional scale due to its limited areal extent and cementation (Corkhill et al., 1993).

4.1.1 Site Geology

Nine soil borings were advanced to approximately 136 feet bgs during the 2001-2002 NFA Investigation conducted at the Layke facility. Soil samples were collected at 5-foot intervals using a split-barrel. The samples were described and identified using the Visual-Manual Procedure in accordance with the ASTM Standard Practice D2488-93. Lithologic descriptions

were based on the visual/manual descriptions of particle-size distribution, color, moisture condition, odor, consistency, and its reaction with HCl. The particle-size distribution was used to assign a USCS symbol and name (WESTON, 2002b).

The stratigraphy beneath the Layke facility and surrounding area is consistent with the regional geologic setting generally consisting of heterogeneous alluvial/fluvial valley-fill deposits. The stratigraphic sequence consisted of alternating sequences of coarse- and fine-grained materials. Several fine-grained sequences consisting of silt, silt with sand, sandy silt, lean clay, and lean clay with sand were encountered during the investigation. Coarse-grained zones of silty sand, well-graded sand, well-graded sand with silt, poorly-graded sand, clayey sand, and well-graded gravel were found interspersed with the fine-grained layers. Dense calcified caliche zones were encountered at varying depths ranging from 75 to 120 feet bgs. Stratigraphic units encountered during the subsurface investigations have been illustrated on cross-section A-A' (Figures 4-1 and 4-2). A complete lithologic description of sediments encountered during the investigation is presented in the lithologic logs provided in Appendix A (WESTON, 2002b).

4.2 Regional Hydrogeology

The SRV consists of two distinct but interconnected alluvial groundwater basins, the West SRV and the East SRV. The WCP WGA site lies within the West SRV. A lower unit consisting of mostly conglomerate and gravel, a middle unit of predominantly silt and clay, and an upper unit of mostly sand and gravel generally characterize the basin-fill deposits of the valleys. Corkhill presents a correlation of the units as defined by the United States Bureau of Reclamation, ADWR, and the USGS (Corkhill et al., 1993). This report uses the hydrogeologic units as defined by ADWR in Corkhill, which are based on particle size, lithologic data, and the unique hydraulic properties of the units (Corkhill et al., 1993). The three hydrogeologic units are, in descending stratigraphic order:

- Upper Alluvial Unit (UAU);
- Middle Alluvial Unit (MAU); and
- Lower Alluvial Unit (LAU).

The UAU consists of gravels, sands, and silts deposited during the final stages of development of the alluvial basin. The UAU is predominantly gravel and sand near the riverbeds of the Salt and Gila Rivers and along the margins of the basins, whereas in other areas the unit is typically sand and silt. The relatively uniform thickness of the unit and association of coarser-grained sediments with the locations of major drainage suggest that the unit was deposited by the ancestral Salt River after the establishment of through-flowing drainages and from alluvial fans along the mountain fronts. The UAU is reported to be between 300 and 400 feet thick in the West SRV (Corkhill et al., 1993). The UAU was once the primary source of groundwater for the West SRV. However, the unit has been dewatered in many areas due to groundwater withdrawal.

Groundwater within the UAU is typically unconfined. However, semi-confined conditions exist locally where there is an increase in finer-grained materials (United States Bureau of Reclamation, 1977). Hydraulic conductivity for the UAU reported by Corkhill is 20 to 250 feet per day (ft/d) and is highest near the Salt and Gila Rivers (Corkhill et al., 1993). Additionally, potential yield to wells completed in this unit were reported to range from 1,500 to 5,500 gpm.

The MAU is generally considered an aquitard, but does yield water from interbedded, coarser deposits and sandy horizons (United States Bureau of Reclamation, 1977). The MAU consists of clay, silt, mudstone, and gypsiferous mudstone with some interbedded sand and gravel. The unit is estimated to be approximately 650 feet thick in the West SRV with the top of the unit at 300 to 400 feet bgs. Corkhill et al. stated that the MAU is the primary source of groundwater in the SRV and speculated that the recoverable groundwater in the unit originated from interbedded coarse layers (1993). Hydraulic conductivity values reported for the MAU ranged from 5 to 50 ft/d and potential yield for wells screened in the unit range from 350 to 2,200 gpm.

The LAU overlies, or is in fault contact with, the crystalline rock unit and the red unit. The LAU is composed predominantly of conglomerate and gravel deposits near the basin margins, grading to mudstone, gypsiferous and anhydritic mudstone and anhydrite beds in the central portions of the basins. The thickness of the LAU near the basin margins is less than 100 feet, but the thickness of the unit is unknown in the central portions of the basin due to the lack of deep drilling data. Therefore, wells tapping the LAU are typically located around the periphery of the valley. Hydraulic conductivity for the LAU range from 5 to 60 ft/d and potential well yields range from 50 to 3,500 gpm. Corkhill et al. stated that most of the recoverable groundwater from this unit is from the upper 500 feet. The LAU is estimated to be encountered around 1,000 feet bgs in the West SRV and may be up to 1,600 feet thick (1993).

The regional groundwater flow in the West SRV is greatly influenced by groundwater pumping. Historical water level elevation contour maps, developed from data from 1913, show a west to southwest flow direction having a gradient of approximately 0.002 (United States Bureau of Reclamation, 1977). Major sources of recharge in the SRV are from infiltration in the Salt River, seepage losses from irrigation canals, and infiltration of excess irrigation. Within the WCP area, the Grand Canal, an irrigation canal that transports water across the SRV, was a major source of artificial recharge to the UAU. The source of water in the canal is from surface water from the Salt and Verde Rivers and from groundwater pumped by the Salt River Project (SRP). The Grand Canal has been lined in recent years in many areas, reducing its influence on recharge of the UAU.

4.2.1 Site Hydrogeology

Interpretations of the site hydrogeology are based on groundwater data collected from investigations conducted at the Layke facility and within the WCP WGA site. In addition to these data, water levels have been collected from over 150 monitor wells located within the former WCP site area, as part of the ADEQ area-wide water level monitoring program established in April 1999 (Tables 4-1 and 4-2). These data sets were compiled from wells in and

around the WCP WGA site to evaluate the hydrogeology beneath the Layke facility and surrounding area.

Soil borings drilled during the 2001-2002 NFA Investigation described in Section 2.8 were advanced into the saturated zone to collect groundwater samples utilizing a Hydropunch® sampler. Groundwater was encountered during the advancement of these soil borings at depths ranging from 130.14 to 132.15 feet bgs (WESTON, 2002b). Monitor well WCP-4 is currently the only monitor well located on the Layke facility. At the time of installation, groundwater was measured at approximately 98 feet bgs (Table 2-7) (Earth Tech, 1992b). Groundwater levels decreased below the well construction depth of approximately 130 feet bgs in August 2001 (Table 4-1 and Figure 4-3). These declines can be attributed to the lining of the Grand Canal in January 1999 in the vicinity of the Layke facility in addition to the ongoing regional drought. This decrease in groundwater levels of approximately 30 feet is consistent with decreases measured in other monitor wells in the area. Monitor wells WCP-10 and WCP-11 were installed in February 1995 and are located hydraulically down and cross gradient from the Layke facility. At the time of installation, groundwater was measured in WCP-10 and WCP-11 at depths of approximately 93 and 94 feet bgs, respectively (Table 2-9) (Earth Tech, 1994b). The groundwater elevation decreased below the well construction depth of 125 feet bgs in WCP-11 in October 2000. Groundwater was measured in monitor well WCP-10 at approximately 124 feet bgs in April 2002 and decreased below the well construction depth of 130 feet bgs before September 2002 (Table 4-1 and Figure 4-3).

Depth-to-groundwater data collected by ADEQ during the last four years have been used to calculate groundwater flow directions and produce potentiometric surface maps for the WCP WGA site for April 1999, September 2000, and December 2001. Groundwater data collected and contoured from the April 1999 monitoring event indicates that groundwater flows to the east beneath the Layke facility and within the WCP WGA site during the spring (Figure 4-4). These flow directions correlate with pumping data obtained from SRP indicating the operation of the irrigation well 10.5E-7.5N, located approximately 900 feet east of the Layke facility. Groundwater data collected and contoured from the September 2000 and December 2001 monitoring events indicate that groundwater generally flows to the south-southwest beneath the Layke facility and within the WCP WGA WQARF site when SRP does not operate the irrigation well, with a gradient of approximately 0.003 (Figures 4-5 and 4-6). The SRP irrigation well 10.5E-7.5N did not operate during the September 2000 and December 2001 monitoring periods and has not operated the well since April 1999 as part of an agreement with the ADEQ.

Other pumping wells located in the vicinity of the Layke facility and the WCP WGA site include the Michigan Trailer Park well (MTP-1), located approximately 950 feet east of the Layke facility, and Danone Waters well (Danone), located approximately 1500 feet south of the Layke facility. These wells do not appear to have an influence on groundwater flow beneath the Layke facility and WCP WGA site; however, well construction and operation records are limited for these wells, providing less information for interpretation.

5.0 NATURE AND EXTENT OF CONTAMINATION

The present understanding of the nature and extent of soil contamination beneath the Layke facility and groundwater contamination in the WCP WGA site has been developed from data generated during the field investigations presented in Section 2.0. The description of the VOC contaminants and their distribution in soil and groundwater are discussed in the following sections.

5.1 Contaminants of Concern

Several contaminants have been detected in soil and groundwater samples collected during field investigations at the Layke facility and in the WCP WGA site. The primary contaminants of concern are TCE, PCE, and 1,1-DCE. These compounds have been detected in soil samples collected on the Layke facility, and/or in groundwater samples collected from wells in the WCP WGA site. PCE and TCE are considered the precursor degreasing solvents released into the environment. The presence of 1,1-DCE is most likely due to degradation of a TCA release, a chemical in groundwater samples in 1992. The relevant standards against which these contaminants are compared are established by the State of Arizona and are as follows:

- **SRLs and GPLs**: Soil contaminant concentrations are compared to the Arizona Soil Remediation Levels (SRLs) and to the minimum Groundwater Protection Levels (GPLs).

  The SRLs are pre-determined standards established for residential and non-residential use. These standards are established in A.A.C. R18-7-205.

  Any soil remediation conducted pursuant to R18-7-205 must be conducted so that any concentration of contaminants remaining in the soil after remediation does not cause or threaten to cause a violation of the AWQSs. For this reason, the GPLs were developed by the Leachability Working Group of the Cleanup Standards/Policy Task Force and can be used to satisfy the criteria set in A.A.C. R18-7-203(B)(1).

- **AWQS**: Contaminant concentrations in groundwater are compared with the Arizona AWQSs, which are established in A.A.C. R18-11-406.

The following table lists the relevant standards for the contaminants of concern at the WCP WGA site:

Contaminant of Concern	AWQS (µg/L)[1]	GPL (mg/kg)[2]	Residential SRL (mg/kg)[2]	Nonresidential SRL (mg/kg)[2]
TCE	5	0.61	27	70
PCE	5	1.3	53	170
1,1-DCE	7	0.81	0.36	0.8

[1] µg/L = micrograms per liter
[2] mg/kg = milligrams per kilogram

Detectable concentrations of TCE and PCE above SRLs and GPLs were observed in soil samples collected at the Layke facility prior to the installation and operation of the SVE system. However, neither TCE nor PCE were detected in soil samples collected during the 2001-2002 Layke NFA Investigation. This indicates that the source of TCE and PCE contamination previously detected in the soil beneath the former UST basin had been effectively removed by the SVE system.

Historically, TCE has exceeded the AWQS in groundwater monitoring wells WCP-4 and WCP-10. However, samples collected from WCP-4 after November 1996 have not detected TCE above the AWQS. This well went dry after July 2001. The last groundwater sample collected from WCP-10 was obtained in June 2001. This sample, collected as part of the WCP WOC RI, contained 5 µg/L of TCE. Monitor well WCP-10 has also gone dry and not been sampled since.

PCE has never been detected in wells WCP-4, WCP-8, WCP-10, or WCP-11 near the Layke facility. 1,1-DCE has been detected in groundwater monitor well samples collected at the WCP WGA site, but has never exceeded the AWQS.

5.2 Other Detected Contaminants

Detectable concentrations of several petroleum hydrocarbons had been previously observed in soil samples collected from investigations conducted at the Layke facility prior to the installation and operation of the SVE system. Benzene was detected above the SRL and GPL in one soil sample (LU-101B-10). Petroleum hydrocarbons previously detected in soil samples at the Layke facility below SRLs and GPLs include toluene, ethylbenzene, and xylenes (total). However, these contaminants were not detected in soil samples collected during the 2001-2002 NFA Investigation indicating that the source of hydrocarbon contamination had been effectively removed by the SVE system.

In the past, other contaminants have been detected in groundwater in the WCP WGA site at concentrations below their respective AWQSs. These included benzene, toluene, 1,1-dichloroethane (1,1-DCA) and TCA. These contaminants were not detected in any of the wells within the WCP WGA site during the most recent sampling events.

Other Contaminants Detected	AWQS (µg/L)[1]	GPL (mg/kg)[2]	Residential SRL (mg/kg)[2]	Nonresidential SRL (mg/kg)[2]
Benzene	5	0.71	0.62	1.4
Toluene	1,000	400	790	2,700
Ethylbenzene	700	120	1,500	2,700
Xylenes (total)	10,000	2,200	2,800	2,800
1,1-DCA	NE	NE	500	1,700
TCA	200	NE	1,200	4,800

[1]µg/L = micrograms per liter
[2]mg/kg = milligrams per kilogram
NE = Not Established

5.3 Physical and Chemical Properties of the Contaminants of Concern

The physical and chemical properties of chemicals are directly responsible for behavior, fate, and transport of the chemicals in the environment.

All chlorinated ethenes consist of an ethene (C=C) backbone structure with various numbers of chlorine atoms substituted for hydrogen atoms. The number of chlorine atoms affects the chemical properties of the specific compound. With increasing chlorine content, the solubility, vapor pressure, and Henry's Law constants decrease. Specific characteristics for each compound are presented in Table 5-1.

5.4 Contaminant Sources

Historical records and information obtained from Layke indicate that Layke began operations at the facility in 1967. The operations included the manufacturing of various metal parts. These manufacturing processes required Layke to use various chemical cutting oils, water-soluble cutting fluids, and solvents such as TCE. TCE was the primary solvent used for parts cleaning/degreasing and that a vapor degreaser had been used at the facility from 1969 to approximately 1989. Spent chemicals (solvents, water soluble oils) were stored in 55-gallon drums in the waste storage area or in the former UST (water soluble oils) prior to disposal. Spent chemicals were pumped from the 55-gallon drums and/or UST when necessary and transported by various subcontractors for disposal or recycling. At various times, it appears that the UST overflowed, causing the waste inside the tank to leak out (AEC, 1991).

The distribution of contaminant concentrations in soil-gas, soil, and groundwater during the WCP WGA site RI investigation indicates that the source of soil and groundwater contamination in the WCP WGA site was the former UST.

5.5 Distribution and Trends of Soil Contamination

Soil and soil-gas sample analytical data collected at the Layke facility between 1989 and 1992 identified the former UST basin as a source of TCE and PCE contamination (Tables 2-1 through 2-5, 2-14 and 2-15). The soil sampling data indicated that TCE contamination extended from approximately 3 feet to 95 feet bgs, in the area between the UST pipeline and the southern edge of the UST excavation (Figures 5-1 and 5-2). The PCE contamination extended from approximately 3 feet to 20 feet bgs, in the same UST area as the TCE contamination. The TCE and PCE contamination found beneath the UST pipeline, between 3 feet and 20 feet bgs, exceeded SRLs and GPLs.

Analytical data collected during the 2001-2002 Layke NFA Investigation were obtained from the advancement of nine soil borings in order to evaluate Layke's NFA request. Soil and soil-gas samples were collected around potential source areas, including the former UST area and the chemical storage area. The soil-gas samples collected and analyzed in the area around the

former UST contained low concentrations of TCE (less than 6.1 µg/L). When these soil-gas samples are compared to the TCE soil-gas sample concentrations detected in 1989 near the UST basin (910 µg/L), a significant decline in TCE concentrations can be observed. Also, soil sample analytical results obtained from samples in this area indicated no detection of VOCs above the laboratory MDLs. These analytical data, coupled with the operation of the SVE system, indicate that the previous source of VOC contamination within the UST basin has been removed. Soil-gas samples collected from the chemical storage area contained a maximum concentration on 1,1-DCE of 1.8 µg/L, with no detections of any VOCs in the soil samples above the laboratory MDLs.

5.6 Distribution and Trends of Groundwater Contamination

Groundwater investigation activities conducted in the WCP WGA site included collecting groundwater samples from monitor wells WCP-4, WCP-8, WCP-10, and WCP-11 from 1992 to 2001, as well as groundwater data obtained from wells installed for the WCP West Osborn Complex RI (Table 5-2). In addition, groundwater data obtained from wells installed for the WCP East Grand Avenue site RI (Table 5-3) have been obtained and evaluated. Groundwater investigation activities also included the collection of Hydropunch® groundwater samples from the nine soil borings advanced on the Layke facility during the 2001-2002 NFA Investigation (Table 2-16).

Groundwater elevations have shown a general decline since the first groundwater monitoring well (WCP-4) was installed on the Layke facility in May 1992 (Table 5-2 and Figure 4-3). Groundwater levels have declined as follows:

- WCP-4: Approximately 29 feet from May 1992 to July 2001;
- WCP-8: Approximately 27 feet from December 1992 to January 2001;
- WCP-10: Approximately 31 feet from February 1995 to April 2002; and
- WCP-11: Approximately 29 feet from February 1995 to September 2000.

Currently, all four wells are dry.

Contaminant concentrations obtained from groundwater samples collected from these wells have also shown a general decrease over time. In the past, the concentration of TCE in groundwater in the WCP WGA site had exceeded the AWQS in two wells: WCP-4 and WCP-10. Concentrations of TCE in WCP-4 ranged from 420 µg/L in May 1992 to below laboratory MDLs in June 2001. Concentrations of TCE in samples collected from monitor well WCP-10 ranged from 45 µg/L in March 1995 to 5 µg/L in June 2001. Monitor well WCP-10 is located hydraulically downgradient from the Layke facility.

Concentrations of 1,1-DCE in groundwater were detected in wells WCP-4 and WCP-10 below the AWQS. Currently, 1,1-DCE is not detected in any of the wells within the WCP WGA site.

Analytical data for TCE was used to develop concentration contour maps. Figures 5-3 through 5-5 present TCE concentration contour maps for groundwater samples for selected periods of time. From Figures 5-3 and 5-4, it can be observed that while the source of TCE still remained at the Layke facility, groundwater contamination was detected beneath the facility. After the source of TCE was removed from the facility, the plume became a "slug" moving downgradient from the UST location (Figure 5-5). This slug is predominantly controlled by the groundwater gradient and groundwater flow direction in the area. The lateral extent of the dissolved TCE plume is approximately defined by wells WCP-4, WCP-8, WCP-10, and WCP-11 (Figure 5-5).

Further definitive characterization of the vertical extent of groundwater contamination is unknown at this time and will be addressed during the FS, if needed, based on the selected remedial alternative.

6.0 FATE AND TRANSPORT

Once a contaminant is released into the environment, there are several mechanisms that control the transport of VOCs in the soil and groundwater at any given site due to the nature of the subsurface medium, as well as the geochemical conditions in the material through which the compound is migrating. As explained in Section 5.3, the environmental fate and transport of a contaminant is also controlled by the compound's physico-chemical properties. Table 6-1 explains how the physico-chemical properties of contaminants can affect fate and transport of contaminants in soil and groundwater.

6.1 Fate and Transport of TCE, PCE, and 1,1-DCE in Soils

Based on the specific gravity and K_{oc} values for TCE, PCE and 1,1-DCE, these VOCs will pass more quickly than water through an unsaturated soil horizon, leaving less residual liquid in the soil and dissipating more rapidly from the soil. TCE and 1,1-DCE are expected to have high mobility in soil, while PCE is expected to have moderate mobility in soil (Tables 5-1 and 6-1).

The size and interconnectedness of the pore space in the soil, measured by permeability, also affects retention of liquids in soil. Small pore spaces retain water by capillary forces. Coarse gravels and cobbles do not retain liquids passing through them because of their large, interconnected pore spaces. Extremely fine particles, such as silt and clay, retain liquids by the capillary forces produced by their small pore sizes and reduced interconnectedness of the pores. Thus, VOC contamination would be expected to dissipate (i.e., drain and volatilize) most rapidly in coarse-grained soils, such as gravel and sand, and least rapidly in silts and clays.

Volatilization of TCE, PCE, and 1,1-DCE from moist soil surfaces is an important fate process given their Henry's Law constants (Tables 5-1 and 6-1). The moisture content of a soil is a significant factor in migration and retention of VOCs both in liquid and vapor phases. Moisture filling the pores of a soil can act as a barrier to migration of VOC liquids. Conversely, penetration of VOC liquids through the vadose zone is enhanced by dry soil conditions (Cohen and Mercer, 1993). Moist soils inhibit downward migration and can result in lateral migration of VOC liquids.

Contact of VOCs in liquid or vapor phases with moisture in soils results in VOC contamination of the soil moisture, which is also known as pore water. Release of VOCs dissolved in pore water is typically much slower than volatilization from a free-phase VOC liquid. Therefore, moist soils retain evidence of VOCs that have passed through the soil column longer than equivalent soils with low moisture content (Cohen and Mercer, 1993).

Applying these VOC soil migration principles to the site-specific conditions at the Layke facility provides the framework for analysis of the soil site data. As presented in Table 2-13, most of the soil samples recovered from borings at the facility were characterized as being dry (3% moisture) to moist (18% moisture), thereby enhancing the speed of vertical migration in the soils and limiting the amount of residual contamination in the dry soils.

Soils beneath the facility vary from silt, silt with sand, sandy silt, lean clay, and lean clay with sand, to coarse-grained zones of silty sand, well-graded sand, well-graded sand with silt, poorly-graded sand, clayey sand, and well-graded gravel found interspersed with the fine-grained layers (Figure 4-2). Transitions from coarse sediments to fine sediments result in reduced permeability, which may cause ponding and lateral migration of VOCs. VOC migration in the coarse sediments is likely to be nearly vertical, presenting a relatively small target for a vertical soil drilling and sampling program. Coarse sediments with low moisture content are unlikely to have residual VOC contamination even in areas where VOC liquids may have passed through from a potential surface release.

Most of the soil samples with detectable concentrations of TCE and PCE recovered from beneath the Layke facility were from fine-grained sediments consisting of silts and sandy silts (Figure 4-2). Several of the samples with TCE and PCE contamination were recovered from the top of a fine-grained unit, immediately beneath coarser, sand-dominated units. The observed detections of contaminants at the top of fine-grained units is consistent with downward migration of VOCs that would tend to spread laterally at the transition from coarse sediments to fine sediments due to reduction in permeability.

6.2 Fate and Transport of TCE and 1,1-DCE in Groundwater

Contaminant plumes are dissolved in groundwater and will move in the direction of flow. However, other natural processes can modify the movement of plumes, causing contaminant concentrations to change or causing contaminants to move at different rates than the groundwater. The major processes affecting groundwater plume movement at the WCP WGA site are: advection, hydrodynamic dispersion, and retardation due to adsorption of the contaminants to the aquifer material.

VOCs in groundwater are transported in the direction of groundwater flow through advection and in all directions through the processes of diffusion and dispersion. Advection is movement parallel to groundwater flow paths either under the influence of gravity (unconfined conditions) or pressure (confined conditions). However, contaminants can disperse perpendicular to groundwater flow lines, dependent on the concentration of the contaminant, the quantity of the contaminant released, the hydraulic gradient and the tortuosity of the groundwater flow system. In groundwater, chemicals gradually spread and occupy an increasing aquifer volume beyond what would be expected from advective transport solely due to groundwater movement. The spreading of a chemical mass is called dispersion. Dispersion has both advective and diffusive components. Diffusion is the process of contaminant movement from areas of high concentration to areas of lower concentration by random molecular action. Diffusion takes place in all directions from a source of high concentration. Rates of diffusion, however, are typically much lower than rates of advective (flow) transport and therefore are typically a minor component of dispersion of contaminants in groundwater systems. Dispersion is affected by local groundwater velocity, both in direction and magnitude, and by how tortuous the flow paths are. Flow velocity variations occur as a result of changes in porosity, variations in hydraulic conductivity, and the presence of retarding layers. Dispersion takes place both longitudinally (in

the direction of groundwater flow) and transversely (perpendicular to groundwater flow). Longitudinal dispersion is greater than transverse dispersion. Thus, a VOC dispersion plume is typically elongated in the direction of flow, emanating from the source area.

Because TCE and 1,1-DCE are denser than water, vertical migration in the saturated zone may occur. The extent of the vertical migration of the contaminant plume is dependent upon the aquifer materials and the presence of a free-phase VOC liquid in the saturated zone. As in soil migration, VOC movement would be greater in coarse-grained areas and more retarded in finer-grained aquifer materials. However, based on analytical results from soil borings and groundwater monitoring activities at the WCP WGA site, there has been no indication of the existence of free-phase VOCs or DNAPLs beneath the site. Analytical results have not indicated anomalous upgradient or crossgradient concentrations of VOCs, which would suggest that DNAPLs existed at the site. Analytical results indicate TCE has migrated in the direction of groundwater flow. These results would tend to support the conclusion that TCE within the WCP WGA site exists as a dissolved compound within the groundwater or adsorbed onto soils.

The K_{oc} values for TCE and 1,1-DCE indicate that these VOCs are not expected to adsorb to suspended solids and sediment in the groundwater. However, adsorption of TCE and 1,1-DCE onto suspended solids or sediment in groundwater depends upon the fraction of organic carbon (f_{oc}) of the sediments in the aquifer. The adsorption of a contaminant onto an aquifer material results in a reduction of concentration in the aqueous phase and a "retardation" of the velocity of contaminant migration. Retardation of TCE and 1,1-DCE occurs because these chemicals are nonpolar and this causes them to partition to the organic matter in the soil. Partitioning is a reversible process; molecules that have partitioned to the organic matter will move back into the groundwater as relative concentrations change. Retardation and, therefore, retardation factors are a function of the f_{oc} of the aquifer.

In order to determine the f_{oc} of the soil at any given site, an analysis for Total Organic Carbon (TOC) must be conducted on the soil. At the WCP WGA site, none of the soil samples obtained from any of the field investigations were analyzed for TOC. However, soil samples from the WCP WOC facility nearby were collected and analyzed for TOC in 1991. The TOC results for the soils at the WCP WOC facility ranged from 0.08% to 0.11% (f_{oc} = 0.0008 to 0.0011) (Brown & Caldwell, 1992).

Saturated soils, especially at the top of the groundwater zone, can form a barrier to migration resulting in ponding or lateral migration of free-phase VOC liquids in addition to direct groundwater contamination. The lateral migration of VOCs in soils at the groundwater interface, or capillary fringe area, contributes to the lateral migration of contaminated groundwater. As groundwater levels decline, VOCs may be retained in the soils or sorbed to soil particles at the capillary fringe, thereby decreasing the contaminant concentrations in the groundwater.

6.3 Groundwater Transport Calculations

The transport of VOCs in groundwater is first dependent upon the properties of the soil matrix supporting advective and diffusional flow system. Other considerations include physico-chemical interactions between the VOCs and the soil matrix. The affinity of a VOC for soil is defined by the solid-water partition coefficient (also known as distribution coefficient), K_d. The distribution coefficient K_d relates to the mass of contaminant dissolved in groundwater to the mass sorbed to the soil and is calculated using the following equation:

$$K_d = K_{oc}\, f_{oc}$$

where:
- K_d = Distribution Coefficient, in milliliters water per grams soil (mL_{water}/g_{soil})
- K_{oc} = Organic Carbon Partition Coefficient, in milliliters water per grams organic carbon (mL_{water}/g_{oc})
- f_{oc} = Fraction of Organic Carbon, in grams organic carbon per grams soil (g_{oc}/g_{soil}).

The retardation factor of a VOC in the soil present a site can be calculated using the following equation:

$$R_d = 1 + \frac{\rho_b(K_d)}{n_e}$$

where:
- R_d = Retardation Factor, no units
- ρ_b = Bulk Density, grams per cubic centimeter (g/cm^3)
- K_d = Distribution Coefficient, mL_{water}/g_{soil}
- n_e = Effective Porosity, milliliters water per cubic centimeter soil (mL_{water}/cm^3_{soil}).

As stated in Section 6.2, the f_{oc} for soils at the WCP WGA site can be assumed to be 0.0011 (Brown & Caldwell, 1992). Reasonable values for bulk density of 1.8 g/cm^3 and an effective porosity of 30% (0.30) can be assumed for the UAU aquifer material at the WCP WGA site (ADEQ, 1996). The following table summarizes the results of the calculations obtained from the above equations for the UAU beneath the WCP WGA site:

Chemical	K_{oc}	f_{oc}	K_d	R_d
TCE	101	0.0011	1.1E-01	1.67
1,1-DCE	64	0.0011	7.04E-02	1.42

Average groundwater velocity is calculated according to the following equations:

$$V = K\ i/n_e \quad \text{and} \quad K = T/b$$

where:
- V = Average Groundwater Velocity, ft/day
- K = Hydraulic Conductivity, ft/d
- i = Gradient, ft/ft
- n_e = Effective Porosity, mL_{water}/cm^3_{soil}
- T = Transmissivity, ft^2/d
- b = Aquifer Thickness, ft

Retardation factors are then used to adjust the average groundwater velocity to reflect an average contaminant velocity in the UAU using the following relationship:

$$R_d = V/V_c$$

where,
- R_d = Retardation Factor, no units
- V = Average Groundwater Velocity, ft/d
- V_c = Contaminant Velocity, ft/d

At the WCP WGA site, no aquifer tests have been conducted on any of the wells to obtain transmissivity or hydraulic conductivity values. However, aquifer and slug tests have been conducted at the WCP WOC site nearby. A hydraulic conductivity of approximately 11 ft/day was obtained for monitoring well WOC MW-5S, approximately 1600 feet west of the Layke facility (Brown and Caldwell, 1992; HSI Geotrans, 1997). As stated in Section 4.2.1, the current gradient at the WCP WGA site is 0.003. The following table summarizes the results of the calculations obtained from the above equations for the UAU beneath the WCP WGA site:

Chemical	V (ft/yr)	V_c (ft/yr)
TCE	40	24
1,1-DCE	40	28

The Layke facility has been in operation at its location since 1967. Reportedly, Layke used TCE as a degreasing agent from 1975 until 1983 only, and waste chemicals generated during these processes were stored in 55-gallon drums and/or the former 1,000-gallon concrete UST. Layke utilized the UST for waste chemical storage from 1967 to 1989. Assuming that the time of release occurred since time of operation (or 36 years ago), the estimated length of the contaminant plume (L_c) can be calculated by the following equation:

$$L_c = V_c(\text{Age of release})$$

The estimated contaminant migration distance downgradient from the source at the Layke facility for the TCE and 1,1-DCE in the UAU are approximately 864 ft and 1008 ft, respectively. In June 2001, monitoring well WCP-10, located approximately 900 feet downgradient from the source at the Layke facility, contains a TCE concentration of 5 µg/L. In the past, concentrations of 1,1-DCE in groundwater were also detected in WCP-10 below the AWQS, but it is currently not detected in any of the wells within the WCP WGA site.

Contaminant velocities and estimated length of the plume should be viewed as qualitative indicators. Actual migration rates can vary greatly from these estimates for many reasons, including horizontal and vertical heterogeneities in hydraulic conductivity, porosity, TOC, and changes in hydraulic gradient. In addition, the above calculations use simplifying assumptions and neglect the effects of contaminant degradation and dispersion, as well as the effects of the SVE removing the source of contamination.

7.0 LAND AND WATER USE

The Arizona Department of Environmental Quality (ADEQ) prepared a Land and Water Use report for WCP WGA site to meet the requirements established under A.A.C. R18-16-406 (D). The purpose of the report is to gather information regarding current and foreseeable uses of land or waters that have been or are threatened to be impacted by a contaminant release. The written report is presented in its entirety in Appendix E.

7.1 Summary of Uses

The land and water uses most likely relevant to discussion of remedial objectives are presented below.

7.1.1 Land Uses

The zoning pattern in the area has been long established and there are no foreseeable changes for the future. Land uses for the Layke facility property and within the WCP WGA site area are expected to remain predominantly industrial or light industrial.

7.1.2 Groundwater Uses

Current and future groundwater uses within the WCP WGA site area include the following:

- The COP anticipates the possible need for additional drinking water wells to augment production in the WCP area sometime in the future.
- SRP owns several irrigation wells in the area and will continue to need operational wells to supplement surface water supplies. A water treatment plant may be built on the Grand Canal sometime in the future, which would change the use of the groundwater from irrigation to drinking water.
- The Michigan Trailer Park is expected to continue to use their well to provide drinking water to park residents.
- Danone Water is expected to continue to use the well located on their property in their bottling operations.

7.1.3 Surface Water Uses

Surface water has not been impacted.

8.0 SUMMARY AND CONCLUSIONS

The purpose of the RI conducted at the WCP WGA site was to determine the nature and extent of contamination at the site. The RI also identified present and reasonably foreseeable uses of land and waters of the state that have been or are threatened to be impacted by the contamination. Based upon the data collected, the following represents the conclusions drawn:

Soil

- The source of soil contamination at the Layke facility was the former UST.
- TCE contamination in the soil beneath the Layke facility extended from approximately 3 feet to 95 feet bgs, in the area between the UST pipeline and the southern edge of the UST. The PCE contamination extended from approximately 3 feet to 20 feet bgs, in the same area as the TCE contamination. The TCE and PCE contamination found beneath the UST pipeline, between 3 feet and 20 feet bgs, exceeded SRLs and GPLs.
- Based on the analytical data collected during the 2001-2002 NFA Investigation, the source of TCE and PCE previously detected in the soil beneath the former UST basin at the Layke facility was effectively removed by the SVE system.

Groundwater

- The source of groundwater contamination in the WCP WGA site was the former UST at the Layke facility.
- The lateral extent of TCE contamination in the WCP WGA site has been adequately defined to determine the appropriate cleanup actions needed at the site. The lateral extent of the dissolved TCE plume is approximately defined by wells WCP-4, WCP-8, WCP-10, and WCP-11.
- Since the source of TCE in the groundwater has been removed by the SVE system at the Layke facility, the plume is now a "slug" that moves downgradient. This slug is predominantly controlled by the groundwater gradient and groundwater flow direction. The plume appears to be localized in a small area approximately 900 feet downgradient of the UST.
- The most recent sample collected from WCP-10 (the downgradient well) indicated a concentration of 5 µg/L TCE, which is equivalent to the AWQS.
- Further definitive characterization of the vertical extent of groundwater contamination will be addressed during the FS, if needed, based on the selected remedial alternative.

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LIST OF TABLES

Table 2-1
Soil Analytical Results
1990 Phase I Testing

Sample Number	Sample Date	Extraction Date	Sample Depth (ft bgs)	TCE (mg/kg)	1,1-DCE (mg/kg)	PCE (mg/kg)	BTEX (mg/kg)
UST-VOC (sludge)	9/10/90	9/11/90	5'-6'	**1,400**	**2**	**24**	B: 4 T: 200 E: 10 X: 52
SS1-VOC	9/11/90	9/13/90	5'-6'	<0.01	<0.01	<0.01	T: 0.05
SS2-VOC	9/11/90	9/13/90	4'7''-5'8"	<0.01	<0.01	<0.01	T: 0.54
SS3-VOC	9/11/90	9/13/90	4'7''-5'10"	<0.01	<0.01	<0.01	T: 0.39
SB1-VOC-2.5	9/11/90	9/13/90	2.5'	<0.01	<0.01	<0.01	T: 0.06
SB1-VOC-10-11	9/11/90	9/13/90	10'-11'	<0.01	<0.01	<0.01	
SB1-VOC-20-21	9/11/90	9/13/90	20'-21'	<0.01	<0.01	<0.01	
SB2-VOC-1.5-2.5	9/11/90	9/13/90	1.5'-2. 5'	<0.01	<0.01	<0.01	T: 0.03
SB2-VOC-10-11	9/11/90	9/13/90	10'-11'	**0.01**	<0.01	<0.01	
SB2-VOC-20T	9/11/90	9/13/90	20'	<0.01	<0.01	<0.01	T: 0.06
SB2-VOC-20B	9/11/90	9/13/90	20'	<0.01	<0.01	<0.01	
UST-N (north)	10/17/90	10/17/90	11'	<0.01	<0.01	**0.2**	T: 0.50 E: 0.03 X: 0.08
UST-S (south)	10/17/90	10/17/90	12'	**20.8**	<0.01	**0.6**	T: 1.9 E: 0.65 X: 0.95
UST-P (pipe)	10/17/90	10/17/90	3'	**230**	<0.05	**4.9**	T: 10 E: 8.7 X: 7.7
Non-Residential ADEQ SRL (mg/kg)				70	0.8	170	B: 0.62 T: 790 E: 1,500 X: 2,800
Residential ADEQ SRL (mg/kg)				27	0.36	53	B: 1.4 T: 2,700 E: 2,700 X: 2,800
ADEQ GPL (mg/kg)				0.61	0.81	1.3	B: 0.71 T: 400 E: 120 X: 2,200

Table 2-1 (Continued)
Soil Analytical Results
1990 Phase I Testing

Notes:

TCE	= Trichloroethylene
PCE	= Tetrachloroethylene
1,1-DCE	= 1,1-Dichloroethylene
BTEX	= Benzene, Toluene, Ethylbenzene, Xylenes (total)
mg/kg	= milligrams per kilogram
SRL	= Soil Remediation Level
GPL	= Groundwater Protection Level
ft bgs	= feet below ground surface

Samples were analyzed using EPA Method 8010/8020.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate soil sample exceeds SRL (residential or non-residential) and/or GPL.

Table 2-2
Soil Analytical Results
1990 Phase I Testing - ADEQ Split Sampling

Sample Number	Sample Date	Extraction Date	Sample Depth (ft bgs)	TCE (mg/kg)	1,1-DCE (mg/kg)	PCE (mg/kg)	BTEX (mg/kg)
SB1-20	9/11/90	9/11/90	20	<0.01	<0.01	<0.01	
SB2-11	9/11/90	9/11/90	11	<0.01	<0.01	<0.01	
SS1	9/11/90	9/11/90	5-5.5	<0.01	<0.01	<0.01	
SS3	9/11/90	9/11/90	5-5.5	<0.01	<0.01	<0.01	
UST-1 (south)	10/17/90	10/17/90	12	**46.1**	<0.01	**1.45**	T: 1.65 E: 0.43 X: 1.72
UST-2 (north)	10/17/90	10/17/90	11	**0.5**	<0.01	**0.03**	T: 0.06 X: 0.14
UST-3 (pipe)	10/17/90	10/17/90	3	**63.9**	<0.5	**1.3**	T: 6 X: 7
Non-Residential ADEQ SRL (mg/kg)				70	0.8	170	B: 0.62 T: 790 E: 1,500 X: 2,800
Residential ADEQ SRL (mg/kg)				27	0.36	53	B: 1.4 T: 2,700 E: 2,700 X: 2,800
ADEQ GPL (mg/kg)				0.61	0.81	1.3	B: 0.71 T: 400 E: 120 X: 2,200

Notes:

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes (total)
mg/kg = milligrams per kilogram
SRL = Soil Remediation Level
GPL = Groundwater Protection Level
ft bgs = feet below ground surface

Samples were analyzed using EPA Method 8010/8020.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate soil sample exceeds SRL (residential or non-residential) and/or GPL.

Table 2-3
Soil Analytical Results
1991 Phase II Testing

Sample Number	Sample Date	Extraction Date	Sample Depth (ft bgs)	TCE (mg/kg)	1,1-DCE (mg/kg)	PCE (mg/kg)	BTEX (mg/kg)
LU-101B-10	3/9/91	3/15/91	10	**76**	<1.0	**2.2**	B: 3.9 T: 76 E: 16 X: 61
LU-101B-20	3/9/91	3/15/91	20	**3.7**	<0.20	**0.35**	T: 1.4 X: 0.59
LU-101B-30	3/9/91	3/15/91	30	<0.01	<0.01	<0.01	
LU-101B-40	3/9/91	3/15/91	40	<0.01	<0.01	<0.01	
LU-101B-50	3/9/91	3/15/91	50	<0.01	<0.01	<0.01	
LU-101B-60	3/9/91	3/15/91	60	<0.01	<0.01	<0.01	
LU-101B-70	3/9/91	3/15/91	70	<0.01	<0.01	<0.01	
LU-101B-80	3/9/91	3/15/91	80	<0.01	<0.01	<0.01	
LU-101B-85	3/9/91	3/15/91	85	<0.01	<0.01	<0.01	
LU-101B-90	3/9/91	3/15/91	90	<0.01	<0.01	<0.01	
LU-102B-10	3/9/91	3/15/91	10	<0.01	<0.01	<0.01	
LU-102B-20	3/9/91	3/15/91	20	<0.01	<0.01	<0.01	
LU-102B-30	3/9/91	3/15/91	30	<0.01	<0.01	<0.01	
LU-102B-40	3/9/91	3/15/91	40	<0.01	<0.01	<0.01	
LU-102B-50	3/9/91	3/15/91	50	<0.01	<0.01	<0.01	
LU-102B-60	3/9/91	3/15/91	60	**0.021**	<0.01	<0.01	
LU-102B-70	3/9/91	3/15/91	70	<0.01	<0.01	<0.01	
LU-102B-80	3/9/91	3/15/91	80	<0.01	<0.01	<0.01	
LU-DUP-102[(1)]	3/9/91	3/15/91	20	<0.01	<0.01	<0.01	
LU-103B-10	3/9/91	3/15/91	10	<0.01	<0.01	<0.01	
LU-103B-20	3/10/91	3/15/91	20	<0.01	<0.01	<0.01	
LU-103B-30	3/10/91	3/15/91	30	<0.01	<0.01	<0.01	
LU-103B-40	3/10/91	3/15/91	40	<0.01	<0.01	<0.01	
LU-103B-50	3/10/91	3/15/91	50	<0.01	<0.01	<0.01	
LU-103B-60	3/10/91	3/15/91	60	<0.01	<0.01	<0.01	
LU-103B-70	3/10/91	3/15/91	70	<0.01	<0.01	<0.01	
LU-103B-80	3/10/91	3/15/91	80	<0.01	<0.01	<0.01	

Table 2-3 (Continued)
Soil Analytical Results
1991 Phase II Testing

Sample Number	Sample Date	Extraction Date	Sample Depth (ft bgs)	TCE (mg/kg)	1,1-DCE (mg/kg)	PCE (mg/kg)	BTEX (mg/kg)
LU-201B-20	5/4/91	5/7/91	20	**0.6**	<0.1	<0.1	
LU-201B-30	5/4/91	5/7/91	30	**0.02**	<0.01	<0.01	
LU-201B-40	5/4/91	5/7/91	40	<0.01	<0.01	<0.01	
LU-201B-50	5/4/91	5/7/91	50	<0.01	<0.01	<0.01	
LU-201B-60	5/4/91	5/7/91	60	**0.15**	<0.01	<0.01	
LU-201B-65	5/4/91	5/7/91	65	**0.02**	<0.01	<0.01	
LU-DUP-1[2]	5/4/91	5/7/91	30	**0.01**	<0.01	<0.01	
LU-202B-20	5/4/91	5/7/91	20	**0.03**	<0.01	<0.01	
LU-202B-30	5/4/91	5/7/91	30	<0.01	<0.01	<0.01	
LU-DUP-2[3]	5/4/91	5/7/91	30	<0.01	<0.01	<0.01	
LU-202B-40	5/4/91	5/7/91	40	<0.01	<0.01	<0.01	
LU-202B-50	5/4/91	5/7/91	50	<0.01	<0.01	<0.01	
LU-202B-60	5/4/91	5/7/91	60	**0.24**	<0.01	<0.01	
LU-203B-20	5/4/91	5/7/91	20	**0.8**	<0.01	**0.05**	T: 0.12
LU-203B-30	5/4/91	5/7/91	30	**0.01**	<0.01	<0.01	
LU-203B-40	5/4/91	5/7/91	40	<0.01	<0.01	<0.01	
LU-203B-45	5/4/91	5/7/91	45	<0.01	<0.01	<0.01	
LU-203B-50	5/4/91	5/7/91	50	<0.01	<0.01	<0.01	
LU-204B-20	5/4/91	5/7/91	20	<0.01	<0.01	<0.01	
LU-204B-30	5/4/91	5/7/91	30	**0.03**	<0.01	<0.01	
LU-204B-40	5/4/91	5/7/91	40	<0.01	<0.01	<0.01	
Non-Residential ADEQ SRL (mg/kg)				70	0.8	170	B: 0.62 T: 790 E: 1,500 X: 2,800
Residential ADEQ SRL (mg/kg)				27	0.36	53	B: 1.4 T: 2,700 E: 2,700 X: 2,800
ADEQ GPL (mg/kg)				0.61	0.81	1.3	B: 0.71 T: 400 E: 120 X: 2,200

Table 2-3 (Continued)
Soil Analytical Results
1991 Phase II Testing

Notes:

(1) Duplicate of LU-102B-20
(2) Duplicate of LU-201B-30
(3) Duplicate of LU-202B-30

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes (total)
mg/kg = milligrams per kilogram
SRL = Soil Remediation Level
GPL = Groundwater Protection Level
ft bgs = feet below ground surface

Samples were analyzed using EPA Method 8010/8020.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate soil sample exceeds SRL (residential or non-residential) and/or GPL.

Table 2-4
Soil Analytical Results
1991 Phase II Testing - ADEQ Split Sampling

Sample Number	Sample Date	Extraction Date	Sample Depth (ft bgs)	TCE (mg/kg)	1,1-DCE (mg/kg)	PCE (mg/kg)
LU-101-50	3/9/91	3/13/91	50	<0.01	<0.01	<0.01
LU-101-80	3/9/91	*	80	*	*	*
LU-101-85	3/9/91	*	85	*	*	*
LU-101-90	3/9/91	3/13/91	90	<0.01	<0.01	<0.01
LU-102-60	3/9/91	3/13/91	60	**0.14**	<0.01	<0.01
LU-103-80	3/10/91	3/13/91	80	<0.01	<0.01	<0.01
LU-201-40	5/4/91	N/A	40	**	**	**
LU-202-40	5/4/91	N/A	40	<0.005	<0.005	<0.005
LU-203-10	5/4/91	N/A	10	**3,700**	<0.005	**440**
Non-Residential ADEQ SRL (mg/kg)				70	0.8	170
Residential ADEQ SRL (mg/kg)				27	0.36	53
ADEQ GPL (mg/kg)				0.61	0.81	1.3

Notes:

* According to the chain-of-custody report, split samples collected by Earth Tech were submitted to a local laboratory on 3/12/91. However, laboratory analytical reports are not available because they were not submitted with the technical memorandum prepared by Earth Tech dated 3/19/91.

** According to the chain-of-custody report, a split sample collected by Earth Tech was sent to out-of-state laboratory on 3/12/91. However, laboratory analytical report erroneously reported sample as a water sample, and reported VOC concentrations as ND (Non Detect) in micrograms per liter (µg/L).

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
mg/kg = milligrams per kilogram
SRL = Soil Remediation Level
GPL = Groundwater Protection Level
ft bgs = feet below ground surface
N/A = Not Available

Samples were analyzed using EPA Method 8010.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate soil sample exceeds SRL (residential or non-residential) and/or GPL.

Table 2-5
Soil Analytical Results
1992 ADEQ Monitoring Well Installation and Sampling

Sample Number	Sample Date	Extraction Date	Sample Depth (ft bgs)	TCE (µg/kg)	1,1-DCE (µg/kg)	PCE (µg/kg)	BTEX (µg/kg)
Layke-1-19	5/19/92	N/A	19	**49,000**	<0.5	**2,900**	T: 5,000 E: 11,000 X: 6,300
Layke-1A-10.5	5/20/92	N/A	10.5	<50	<50	<50	
Layke-1A-20.5	5/20/92	N/A	20.5	<50	<50	<50	
Layke-1A-30.5	5/20/92	N/A	30.5	<50	<50	<50	
Layke-1A-40.5	5/20/92	N/A	40.5	<50	<50	<50	
Layke-1A-50.5	5/20/92	N/A	50.5	<50	<50	<50	
Layke-1A-60.5	5/20/92	N/A	60.5	**70**	<50	<50	
Layke-1A-60.5 (D)	5/20/92	N/A	60.5	**44**	<50	<50	
Layke-1A-75.5	5/20/92	N/A	75.5	**90**	<50	<50	
Layke-1A-85.5	5/20/92	N/A	85.5	<50	<50	<50	
Layke-1A-94.5	5/20/92	N/A	94.5	**80**	<50	<50	
Non-Residential ADEQ SRL (µg/kg)				70,000	800	170,000	B: 620 T: 790,000 E: 1,500,000 X: 2,800,000
Residential ADEQ SRL (µg/kg)				27,000	360	53,000	B: 1,400 T: 2,700,000 E: 2,700,000 X: 2,800,000
ADEQ GPL (µg/kg)				610	810	1,300	B: 710 T: 400,000 E: 120,000 X: 2,200,000

Notes:

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes (total)
µg/kg = micrograms per kilogram
SRL = Soil Remediation Level
GPL = Groundwater Protection Level
ft bgs = feet below ground surface
D = Duplicate Sample
N/A = Not Available

Samples were analyzed using EPA Method 8010/8020.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL).
Shaded areas indicate soil sample exceeds SRL (residential or non-residential) and/or GPL.

Table 2-6
Well Construction Details
Monitoring Wells WCP-4 and WCP-8

	WCP-4	WCP-8
Date Completed	5/21/92	11/27/92
ADWR Number	55-535334	55-537381
ADEQ ID Number	57115	57263
Latitude	33° 29’ 17.33”	33° 29’ 22.38”
Longitude	112° 07’ 49.11”	112° 07’ 52.46”
Well Elevation (ft amsl)	1109.25	1109.92
Total Borehole Depth (ft)	130	124
Well Casing Type	Schedule 40 PVC	Schedule 40 PVC
Borehole Diameter (in)	10	10
Casing Diameter (in)	4	4
Screen Slot Size (in)	0.010	0.020
Screened Interval (ft bgs)	90-130	84-124
Blank Casing Interval (ft)	0-90	0-84
Filter Pack (ft bgs)	88-130	82-124
Bentonite Seal (ft bgs)	85-88	79-82
Grout (ft bgs)	0-85	0-82

Notes:

in = inches
ft = feet
ft bgs = feet below ground surface
ft amsl = feet above mean sea level
PVC = polyvinyl chloride

Table 2-7
Groundwater Analytical Results
1992 ADEQ Monitoring Well Installation and Sampling

Monitor Well	Sample Date	Well Elev. ft amsl	GW Elev. ft amsl	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)	Other Analytes (µg/L)
WCP-4	5/29/92	1109.25	1011.45	**420**	<1.0	<1.0	Toluene: 48 1,1-DCA: 2.6
WCP-4	7/10/92	1109.25	1013.55	**340**	**2.0**	<0.5	1,1-DCA: 1.3 TCA: 3.9
WCP-4(D)	7/10/92	1109.25	1013.55	**290**	**1.5**	<0.5	1,1-DCA: 1.2 TCA: 3.8
WCP-4	12/4/92	1109.25	1012.15	**370**	**1.6**	<0.5	Benzene: 2.7 1,1-DCA: 2.0 TCA: 3.3
WCP-4	1/24/94	1109.25	1010.27	**380**	<5.0	<5.0	
WCP-8	12/4/92	1109.92	1013.24	<0.5	<0.5	<0.5	
WCP-8	2/18/93	1109.92	1011.55	<0.5	<0.5	<0.5	
WCP-8	1/20/94	1109.92	1011.64	<0.5	<0.5	<0.5	
Arizona AWQS (µg/L)				5	7	5	Benzene: 5 Toluene: 1,000 1,1-DCA: NE TCA: 200

Notes:

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
1,1-DCA = 1,1-Dichloroethane
TCA = 1,1,1-Trichloroethane
µg/L = micrograms per liter
Well Elev. = well elevation
GW Elev. = groundwater elevation
ft amsl = feet above mean sea level
MCL = Maximum Contaminant Level
AWQS = Aquifer Water Quality Standard
D = Duplicate Sample
NE = Not Established

Samples were analyzed using EPA Method 601/602.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate groundwater sample exceeds AWQS.

Table 2-8
Well Construction Details
Monitoring Wells WCP-10 and WCP-11

	WCP-10	WCP-11
Date Completed	2/7/95	2/9/95
ADWR Number	55-547462	55-547461
ADEQ ID Number	57422	57421
Latitude	33° 29’ 08.04”	33° 29’ 15.70”
Longitude	112° 07’ 47.71”	112° 07’ 56.66”
Well Elevation (ft amsl)	1102.50	1107.66
Total Borehole Depth (ft)	130	125
Well Casing Type	Schedule 40 PVC	Schedule 40 PVC
Borehole Diameter (in)	10	10
Casing Diameter (in)	4	4
Screen Slot Size (in)	0.020	0.020
Screened Interval (ft bgs)	86-126	84-125
Blank Casing Interval (ft)	0-86	0-84
Filter Pack (ft bgs)	82-129	79-125
Bentonite Seal (ft bgs)	78-82	76-79
Grout (ft bgs)	0-78	1.5-76

Notes:

in = inches
ft = feet
ft bgs = feet below ground surface
ft amsl = feet above mean sea level
PVC = polyvinyl chloride

Table 2-9
Groundwater Analytical Results
1995 ADEQ Monitoring Well Installation and Sampling

Monitor Well	Sample Date	Well Elev. ft amsl	GW Elev. ft amsl	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)	Other Analytes (µg/L)
WCP-4	3/28/95	1109.25	1014.83	**140**	<0.5	<0.5	1,1-DCA: 0.6
WCP-10	2/28/95	1102.50	1009.60(1)	**37**	**1.0**	<0.5	
WCP-10	3/28/95	1102.50	1010.54	**45**	**0.9**	<0.5	
WCP-10 (D)	3/28/95	1102.50	1010.54	**37**	**1.0**	<0.5	
WCP-11	2/28/95	1107.66	1013.46(1)	<0.5	<0.5	<0.5	
WCP-11 (D)	2/28/95	1107.66	1013.46(1)	<0.5	<0.5	<0.5	
WCP-11	3/28/95	1107.66	1014.20	<0.5	<0.5	<0.5	
Arizona AWQS (µg/L)				5	7	5	1,1-DCA: NE

Notes:

(1) Final groundwater elevations at the time well is completed obtained from well construction logs.

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
1,1-DCA = 1,1-Dichloroethane
µg/L = micrograms per liter
Well Elev. = well elevation
GW Elev. = groundwater elevation
ft amsl = feet above mean sea level
MCL = Maximum Contaminant Level
AWQS = Aquifer Water Quality Standard
D = Duplicate Sample
NE = Not Established

Samples were analyzed using EPA Method 601/602.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate groundwater sample exceeds AWQS.

Table 2-10
Groundwater Analytical Results
1996 ADEQ Groundwater Sampling

Monitor Well	Sample Date	Well Elev. ft amsl	GW Elev. ft amsl	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)	Other Analytes (µg/L)
WCP-4	2/7/96	1109.25	1010.00	**190**	<0.5	<0.5	1,1-DCA: 0.8
WCP-8	2/8/96	1109.92	1012.27	<0.5	<0.5	<0.5	
WCP-10	2/6/96	1102.50	1008.18	**33**	<0.5	<0.5	
WCP-11	2/7/96	1107.66	1011.18	<0.5	<0.5	<0.5	
Arizona AWQS (µg/L)				5	7	5	1,1-DCA: NE

Notes:

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
1,1-DCA = 1,1-Dichloroethane
µg/L = micrograms per liter
Well Elev. = well elevation
GW Elev. = groundwater elevation
ft amsl = feet above mean sea level
MCL = Maximum Contaminant Level
AWQS = Aquifer Water Quality Standard
NE = Not Established

Samples were analyzed using EPA Method 601/602.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate groundwater sample exceeds AWQS.

Table 2-11
Groundwater Analytical Results
1996-2001 WCP WOC RI Investigation

Monitor Well	Sample Date	Well Elev. ft amsl	GW Elev. ft amsl[1]	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)
WCP-4	11/25/96	1109.25	1008.87	**2.0**	<0.5	<0.5
WCP-4[2]	11/25/96	1109.25	1008.87	**3.1**	<0.5	<0.5
WCP-4	5/6/97	1109.25	998.67	<0.5	<0.5	<0.5
WCP-4	8/9/97	1109.25	994.25	**0.58**	<0.5	<0.5
WCP-4	11/14/97	1109.25	996.92	**0.76**	<0.5	<0.5
WCP-4	2/10/98	1109.25	996.94	**1.4**	<0.5	<0.5
WCP-4	5/26/98	1109.25	995.92	<0.5	<0.5	<0.5
WCP-4	8/28/98	1109.25	994.65	**2.7**	<0.5	<0.5
WCP-4	11/9/98	1109.25	992.50	**0.85**	<0.5	<0.5
WCP-4	2/11/99	1109.25	991.89	<0.5	<0.5	<0.5
WCP-4[3]	6/6/01	1109.25	983.60	<0.2	<0.2	<0.2
WCP-8	11/25/96	1109.92	1006.79	<0.5	<0.5	<0.5
WCP-8[2]	11/25/96	1109.92	1006.79	<0.5	<0.5	<0.5
WCP-8	5/9/97	1109.92	1001.27	<0.5	<0.5	<0.5
WCP-8	8/9/97	1109.92	995.68	<0.5	<0.5	<0.5
WCP-8	11/13/97	1109.92	1001.01	<0.5	<0.5	<0.5
WCP-8	2/12/98	1109.92	1000.27	<0.5	<0.5	<0.5
WCP-8	5/20/98	1109.92	998.61	<0.5	<0.5	<0.5
WCP-8	8/21/98	1109.92	997.45	<0.5	<0.5	<0.5
WCP-8	11/6/98	1109.92	995.34	<0.5	<0.5	<0.5
WCP-8	2/19/99	1109.92	994.79	<0.5	<0.5	<0.5
WCP-8[3]	6/01	DRY	DRY	DRY	DRY	DRY
WCP-10	11/22/96	1102.50	1002.61	**16**	<0.5	<0.5
WCP-10[2]	11/22/96	1102.50	1002.61	**20**	<0.5	<0.5
WCP-10	5/8/97	1102.50	998.80	**20**	<0.5	<0.5
WCP-10	8/4/97	1102.50	993.53	**19**	<0.5	<0.5
WCP-10	11/14/97	1102.50	994.67	**29**	<1.0	<1.0
WCP-10	2/10/98	1102.50	995.05	**11**	<0.5	<0.5
WCP-10	5/18/98	1102.50	994.41	**3.9**	<0.5	<0.5
WCP-10	8/20/98	1102.50	993.21	**5.9**	<0.5	<0.5
WCP-10	11/5/98	1102.50	991.00	**11**	<0.5	<0.5
WCP-10	2/8/99	1102.50	990.36	**13**	<0.5	<0.5
WCP-10[3]	6/7/01	1102.50	982.62	**5**	<0.2	<0.2

Table 2-11 (Continued)
Groundwater Analytical Results
1996-1999 WCP WOC RI Investigation

Monitor Well	Sample Date	Well Elev. ft amsl	GW Elev. ft amsl[1]	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)
WCP-11	11/22/96	1107.66	1006.62	<0.5	<0.5	<0.5
WCP-11[2]	11/22/96	1107.66	1006.62	**0.6**	<0.5	<0.5
WCP-11	5/6/97	1107.66	1001.35	<0.5	<0.5	<0.5
WCP-11	8/5/97	1107.66	996.37	**1.5**	<0.5	<0.5
WCP-11	11/14/97	1107.66	999.21	**2.1**	<0.5	<0.5
WCP-11	2/12/98	1107.66	998.25	**3.8**	<0.5	<0.5
WCP-11	5/18/98	1107.66	996.35	**2.7**	<0.5	<0.5
WCP-11	8/21/98	1107.66	995.19	**0.93**	<0.5	<0.5
WCP-11	11/9/98	1107.66	993.06	**0.70**	<0.5	<0.5
WCP-11	2/9/99	1107.66	992.21	**1.3**	<0.5	<0.5
WCP-11[3]	6/01	DRY	DRY	DRY	DRY	DRY
MW-103S	2/9/98	1100.81	994.02	**59**	**2.0**	<1.3
MW-103S	5/18/98	1100.81	993.53	**29**	<1.0	<1.0
MW-103S	8/21/98	1100.81	991.64	**28**	**0.78**	<0.5
MW-103S	11/6/98	1100.81	989.38	**29**	<0.5	<0.5
MW-103S	2/9/99	1100.81	988.81	**40**	**1.2**	**0.60**
MW-103S[3]	6/7/01	1100.81	980.62	**30**	**1**	**0.4**
Arizona AWQS (µg/L)				5	7	5

Notes:

Groundwater samples collected by United Industrial Corporation, except as noted.

[1] Groundwater elevations collected by United Industrial Corporation within a month of sampling date.
[2] Split groundwater sample collected by GZA GeoEnvironmental for ADEQ.
[3] Groundwater samples collected by Roy F. Weston for ADEQ in June 2001.

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
µg/L = micrograms per liter
Well Elev. = well elevation
GW Elev. = groundwater elevation
ft amsl = feet above mean sea level
MCL = Maximum Contaminant Level
AWQS = Aquifer Water Quality Standard

Samples were analyzed using EPA Method 601/602. Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate groundwater sample exceeds AWQS.

Table 2-12
Groundwater Analytical Results-Other Parameters
1996-2001 WCP WOC RI Investigation

Monitor Well	Sample Date	Specific Cond.(1) (µmhos/cm)	TDS(2) (mg/L)	TOC(3) (mg/L)	Chloride(4) (mg/L)	Alkalinity(5) (mg/L)	Sulfate(6) (mg/L)
WCP-4	11/25/96	890	470	2.7	170	140	53
WCP-8	11/25/96	2,300	1,400	6.3	470	320	190
WCP-10	11/22/96	1,400	780	3.7	210	240	91
WCP-11	11/22/96	870	480	4.2	140	240	61

Notes:

(1) Samples analyzed using Method SM2510B.
(2) Samples analyzed using Method SM2540C.
(3) Samples analyzed using EPA Method 415.2.
(4) Samples analyzed using EPA Method 300.0.
(5) Samples analyzed using Method SM2320B.
(6) Samples analyzed using EPA Method 300.0.

Groundwater samples collected by United Industrial Corporation.

Monitor Well	Sample Date	Fe^{+2}(1) (mg/L)	NO_2, NO_3(2) (mg/L)	Mg(3) (mg/L)	Chloride(4) (mg/L)	Alkalinity(5) (mg/L)	Sulfate(6) (mg/L)
WCP-4	6/7/01	<0.050	0.77	<0.0025	140	152	58
WCP-8	6/01	DRY	DRY	DRY	DRY	DRY	DRY
WCP-10	6/7/01	<0.050	4.3	<0.0025	270	259	73.5
WCP-11	6/01	DRY	DRY	DRY	DRY	DRY	DRY
MW-103S	6/7/01	<0.050	2.1	<0.0025	220	242	86.9

Notes:

(1) Samples analyzed using Method 3500FED.
(2) Samples analyzed using EPA Method 353.2.
(3) Samples analyzed using EPA Method 6010B.
(4) Samples analyzed using EPA Method 352.2.
(5) Samples analyzed using Method 2320B.
(6) Samples analyzed using EPA Method 375.4.

Groundwater samples collected by ADEQ.

Table 2-12 (Continued)
Groundwater Analytical Results-Other Parameters
1996-2001 WCP WOC RI Investigation

Monitor Well	Sample Date	Methane[(1)] (µg/L)	Ethane[(1)] (µg/L)	Ethene[(1)] (µg/L)
WCP-4	6/7/01	<2.0	<4.0	<3.0

Notes:

(1) Samples analyzed using Method RSK175.

Groundwater samples collected by ADEQ.

Other Notes:

Specific Cond.	= specific conductance
µmhos/cm	= micromohs per centimeter
TDS	= total dissolved solids
TOC	= total organic carbon
mg/L	= milligrams per liter
µg/L	= micrograms per liter
Fe^{+2}	= ferrous iron
NO_2, NO_3	= nitrate, nitrite
Mg	= manganese (dissolved)

Table 2-13
Monitor Well Groundwater Analytical Results
2001-2002 Layke NFA Investigation

Monitor Well	Sample Date	Well Elev. ft amsl	GW Elev. ft amsl	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)	DO (mg/L)	Redox (mV)
WCP-4	3/5/01	1109.25	984.30	<0.3	<0.3	<0.3	6.22	152
WCP-104[(1)]	3/5/01	1109.25	984.30	<0.3	<0.3	<0.3	--	--
WCP-10	3/5/01	1102.50	982.57	**8**	<0.3	<0.3	6.58	186
Arizona AWQS (µg/L)				5	7	5		

Notes:

[(1)] Duplicate sample of WCP-4.

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
µg/L = micrograms per liter
mg/L = milligrams per liter
Well Elev. = well elevation
GW Elev. = groundwater elevation
ft amsl = feet above mean sea level
DO = dissolved oxygen
Redox = oxidation-reduction potential
mV = millivolts
MCL = Maximum Contaminant Level
AWQS = Aquifer Water Quality Standard

Samples were analyzed using EPA Method 8260B.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate groundwater sample exceeds AWQS.

Table 2-14
Soil Analytical Results
2001-2002 Layke NFA Investigation

Sample Number	Sample Date	Extraction Date	Sample Depth (ft bgs)	TCE (mg/kg)	1,1-DCE (mg/kg)	PCE (mg/kg)	% Moist
LAY-SB-001-011	1/11/02	1/11/02	11	<0.046	<0.091	<0.046	12
LAY-SB-001-031	1/11/02	1/11/02	31	<0.047	<0.095	<0.047	15
LAY-SB-001-051	1/11/02	1/11/02	51	<0.049	<0.097	<0.049	4
LAY-SB-001-071	1/11/02	1/11/02	71	<0.047	<0.094	<0.047	4
LAY-SB-001-091	1/11/02	1/11/02	91	<0.045	<0.089	<0.045	9
LAY-SB-001-101	1/14/02	1/15/02	101	<0.045	<0.090	<0.045	9
LAY-SB-001-111	1/14/02	1/15/02	111	<0.047	<0.093	<0.047	10
LAY-SB-001-126	1/14/02	1/15/02	126	<0.047	<0.094	<0.047	4
LAY-SB-101-126[1]	1/14/02	1/15/02	126	<0.048	<0.097	<0.048	5
LAY-SB-002-011	1/8/02	1/9/02	11	<0.049	<0.098	<0.049	14
LAY-SB-002-031	1/8/02	1/9/02	31	<0.048	<0.096	<0.048	16
LAY-SB-002-051	1/8/02	1/9/02	51	<0.051	<0.10	<0.051	3
LAY-SB-002-071	1/8/02	1/9/02	71	<0.048	<0.096	<0.048	6
LAY-SB-002-091	1/8/02	1/9/02	91	<0.046	<0.092	<0.046	7
LAY-SB-002-111	1/8/02	1/9/02	111	<0.045	<0.090	<0.045	10
LAY-SB-002-126	1/8/02	1/9/02	126	<0.046	<0.093	<0.046	5
LAY-SB-002-126D	1/8/02	1/9/02	126	<0.044	<0.087	<0.044	--
LAY-SB-003-011	1/10/02	1/11/02	11	<0.043	<0.086	<0.043	8
LAY-SB-003-031	1/10/02	1/11/02	31	<0.052	<0.10	<0.052	16
LAY-SB-003-051	1/10/02	1/11/02	51	<0.050	<0.10	<0.050	3
LAY-SB-003-071	1/10/02	1/11/02	71	<0.044	<0.088	<0.044	11
LAY-SB-003-091	1/10/02	1/11/02	91	<0.044	<0.087	<0.044	10
LAY-SB-003-111	1/11/02	1/11/02	111	<0.047	<0.093	<0.047	12
LAY-SB-003-126	1/11/02	1/11/02	126	<0.056	<0.11	<0.056	3
LAY-SB-004-011	12/26/01	12/28/01	11	<0.047	<0.095	<0.047	17
LAY-SB-004-031	12/26/01	12/28/01	31	<0.049	<0.098	<0.049	12
LAY-SB-004-051	12/26/01	12/28/01	51	<0.045	<0.090	<0.045	3
LAY-SB-004-071	12/26/01	12/28/01	71	<0.049	<0.098	<0.049	14
LAY-SB-004-091	12/27/01	12/28/01	91	<0.050	<0.10	<0.050	9
LAY-SB-004-111	12/27/01	12/28/01	111	<0.043	<0.087	<0.043	12
LAY-SB-005-011	1/9/02	1/9/02	11	<0.043	<0.087	<0.043	13
LAY-SB-005-031	1/9/02	1/9/02	31	<0.050	<0.099	<0.050	14
LAY-SB-005-051	1/9/02	1/9/02	51	<0.047	<0.095	<0.047	2
LAY-SB-005-071	1/9/02	1/9/02	71	<0.046	<0.093	<0.046	5
LAY-SB-005-091	1/9/02	1/9/02	91	<0.047	<0.093	<0.047	6
LAY-SB-005-111	1/9/02	1/9/02	111	<0.050	<0.10	<0.050	11
LAY-SB-005-126	1/10/02	1/11/02	126	<0.049	<0.097	<0.049	4

Table 2-14 (Continued)
Soil Analytical Results
2001-2002 Layke NFA Investigation

Sample Number	Sample Date	Extraction Date	Sample Depth (ft bgs)	TCE (mg/kg)	1,1-DCE (mg/kg)	PCE (mg/kg)	% Moist
LAY-SB-006-011	1/3/02	1/4/02	11	<0.044	<0.088	<0.044	12
LAY-SB-006-031	1/3/02	1/4/02	31	<0.046	<0.092	<0.046	10
LAY-SB-006-051	1/3/02	1/4/02	51	<0.046	<0.091	<0.046	5
LAY-SB-006-071	1/3/02	1/4/02	71	<0.054	<0.11	<0.054	17
LAY-SB-006-091	1/3/02	1/4/02	91	<0.054	<0.11	<0.054	11
LAY-SB-006-111	1/3/02	1/4/02	111	<0.046	<0.091	<0.046	7
LAY-SB-006-126	1/4/02	1/4/02	126	<0.054	<0.11	<0.054	18
LAY-SB-007-011	12/31/01	1/2/02	11	<0.041	<0.083	<0.041	8
LAY-SB-007-031	1/2/02	1/2/02	31	<0.047	<0.094	<0.047	13
LAY-SB-007-051	1/2/02	1/2/02	51	<0.046	<0.093	<0.046	3
LAY-SB-107-051[2]	1/2/02	1/2/02	51	<0.049	<0.098	<0.049	4
LAY-SB-007-071	1/2/02	1/2/02	71	<0.053	<0.11	<0.053	18
LAY-SB-007-091	1/2/02	1/2/02	91	<0.048	<0.096	<0.048	13
LAY-SB-007-111	1/2/02	1/2/02	111	<0.046	<0.093	<0.046	8
LAY-SB-007-126	1/2/02	1/2/02	126	<0.046	<0.091	<0.046	8
LAY-SB-008-011	1/7/02	1/9/02	11	<0.046	<0.092	<0.046	14
LAY-SB-008-031	1/7/02	1/9/02	31	<0.048	<0.097	<0.048	16
LAY-SB-008-051	1/7/02	1/9/02	51	<0.051	<0.10	<0.051	6
LAY-SB-008-071	1/7/02	1/9/02	71	<0.047	<0.094	<0.047	14
LAY-SB-108-071[3]	1/7/02	1/9/02	71	<0.052	<0.10	<0.052	15
LAY-SB-008-091	1/7/02	1/9/02	91	<0.050	<0.10	<0.050	9
LAY-SB-008-111	1/7/02	1/9/02	111	<0.055	<0.11	<0.055	12
LAY-SB-008-126	1/7/02	1/9/02	126	<0.045	<0.089	<0.045	13
LAY-SB-009-011	12/28/01	12/29/01	11	<0.049	<0.098	<0.049	17
LAY-SB-009-031	12/28/01	12/29/01	31	<0.044	<0.088	<0.044	12
LAY-SB-009-051	12/28/01	12/29/01	51	<0.052	<0.10	<0.052	5
LAY-SB-109-051[4]	12/28/01	12/29/01	51	<0.052	<0.10	<0.052	9
LAY-SB-009-071	12/28/01	12/29/01	71	<0.047	<0.095	<0.047	15
LAY-SB-009-091	12/28/01	12/29/01	91	<0.049	<0.097	<0.049	6
LAY-SB-009-111	12/31/01	1/2/02	111	<0.041	<0.082	<0.041	11
Non-Residential ADEQ SRL (mg/kg)				70	0.8	170	
Residential ADEQ SRL (mg/kg)				27	0.36	53	
ADEQ GPL (mg/kg)				0.61	0.81	1.3	

Table 2-14 (Continued)
Soil Analytical Results
2001-2002 Layke NFA Investigation

Notes:

(1) Duplicate sample of LAY-SB-001-126.
(2) Duplicate sample of LAY-SB-007-051.
(3) Duplicate sample of LAY-SB-008-071.
(4) Duplicate sample of LAY-SB-009-051.

TCE	= Trichloroethylene
PCE	= Tetrachloroethylene
1,1-DCE	= 1,1-Dichloroethylene
mg/kg	= milligrams per kilogram
SRL	= Soil Remediation Level
GPL	= Groundwater Protection Level
ft bgs	= feet below ground surface
D	= Duplicate Sample
% Moist	= percent moisture

Samples were analyzed using EPA Method 8260B.

Table 2-15
Soil-Gas Analytical Results
2001-2002 Layke NFA Investigation

Sample Number	Sample Date	Analysis Date	Sample Depth (ft bgs)	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)
LAY-SG-001-011	1/11/02	1/11/02	11	<1.0	<1.0	<1.0
LAY-SG-001-031	1/11/02	1/11/02	31	<1.0	<1.0	<1.0
LAY-SG-001-051	1/11/02	1/11/02	51	<1.0	<1.0	<1.0
LAY-SG-001-071	1/11/02	1/11/02	71	<1.0	<1.0	<1.0
LAY-SG-001-091	1/11/02	1/11/02	91	<1.0	<1.0	<1.0
LAY-SG-001-111	1/14/02	1/14/02	111	<1.0	<1.0	<1.0
LAY-SG-001-126	1/14/02	1/14/02	126	<1.0	<1.0	<1.0
LAY-SG-002-011	1/8/02	1/9/02	11	<1.0	<1.0	<1.0
LAY-SG-002-031	1/8/02	1/9/02	31	<1.0	<1.0	<1.0
LAY-SG-002-051	1/8/02	1/9/02	51	<1.0	<1.0	<1.0
LAY-SG-002-071	1/8/02	1/9/02	71	<1.0	<1.0	<1.0
LAY-SG-002-071A*	1/8/02	1/8/02	71	<1.0	<1.0	<1.0
LAY-SG-002-091	1/8/02	1/9/02	91	**1.2**	<1.0	<1.0
LAY-SG-002-111	1/8/02	1/9/02	111	<1.0	<1.0	<1.0
LAY-SG-002-126	1/8/02	1/9/02	126	<1.0	<1.0	<1.0
LAY-SG-003-011	1/10/02	1/10/02	11	<1.0	<1.0	<1.0
LAY-SG-003-031	1/10/02	1/10/02	31	<1.0	<1.0	<1.0
LAY-SG-003-051	1/10/02	1/10/02	51	<1.0	<1.0	<1.0
LAY-SG-003-071	1/10/02	1/10/02	71	<1.0	<1.0	<1.0
LAY-SG-003-091	1/10/02	1/10/02	91	<1.0	<1.0	<1.0
LAY-SG-003-111	1/11/02	1/11/02	111	<1.0	<1.0	<1.0
LAY-SG-003-126	1/11/02	1/11/02	126	<1.0	<1.0	<1.0
LAY-SG-004-011	12/26/01	12/27/01	11	<0.5	<1.0	<1.0
LAY-SG-004-031	12/26/01	12/27/01	31	<1.0	<1.0	<1.0
LAY-SG-004-051	12/26/01	12/27/01	51	<0.5	<1.0	<1.0
LAY-SG-004-071	12/26/01	12/27/01	71	**2.5**	<1.0	<1.0
LAY-SG-004-091	12/26/01	12/27/01	91	**2.0**	<1.0	<1.0
LAY-SG-004-111	12/27/01	12/27/01	111	**2.1**	<1.0	<1.0
LAY-SG-004-111B*	12/27/01	12/27/01	111	**2.2**	<1.0	<1.0
LAY-SG-005-011	1/9/02	1/10/02	11	<1.0	<1.0	<1.0
LAY-SG-005-031	1/9/02	1/10/02	31	<1.0	<1.0	<1.0
LAY-SG-005-051	1/9/02	1/10/02	51	<1.0	<1.0	<1.0
LAY-SG-005-071	1/9/02	1/10/02	71	<1.0	<1.0	<1.0
LAY-SG-005-091	1/9/02	1/10/02	91	<1.0	<1.0	<1.0
LAY-SG-005-111	1/9/02	1/10/02	111	**1.3**	<1.0	<1.0
LAY-SG-005-126	1/9/02	1/10/02	126	**6.1**	<1.0	<1.0

Table 2-15 (Continued)
Soil Analytical Results
2001-2002 Layke NFA Investigation

Sample Number	Sample Date	Analysis Date	Sample Depth (ft bgs)	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)
LAY-SG-006-011	1/3/02	1/4/02	11	<1.0	<1.0	<1.0
LAY-SG-006-031	1/3/02	1/4/02	31	<1.0	<1.0	<1.0
LAY-SG-006-051	1/3/02	1/4/02	51	<1.0	<1.0	<1.0
LAY-SG-006-071	1/3/02	1/4/02	71	<1.0	<1.0	<1.0
LAY-SG-006-091	1/3/02	1/4/02	91	<1.0	<1.0	<1.0
LAY-SG-006-111	1/3/02	1/4/02	111	<1.0	<1.0	<1.0
LAY-SG-006-126	1/3/02	1/4/02	126	<1.0	**1.8**	<1.0
LAY-SG-007-011	1/2/02	1/2/02	11	<1.0	<1.0	<1.0
LAY-SG-007-031	1/2/02	1/2/02	31	<1.0	<1.0	<1.0
LAY-SG-007-051	1/2/02	1/2/02	51	<0.5	<1.0	<1.0
LAY-SG-007-071	1/2/02	1/2/02	71	<0.5	<1.0	<1.0
LAY-SG-007-091	1/2/02	1/2/02	91	<0.5	<1.0	<1.0
LAY-SG-007-111	1/2/02	1/2/02	111	<1.0	<1.0	<1.0
LAY-SG-007-126	1/2/02	1/2/02	126	<1.0	<1.0	<1.0
LAY-SG-008-011	1/7/02	1/8/02	11	<0.5	<1.0	<1.0
LAY-SG-008-031	1/7/02	1/8/02	31	<1.0	**1.1**	<1.0
LAY-SG-008-051	1/7/02	1/8/02	51	<0.5	<1.0	<1.0
LAY-SG-008-071	1/7/02	1/8/02	71	<0.5	<1.0	<1.0
LAY-SG-008-091	1/7/02	1/8/02	91	<0.5	<1.0	<1.0
LAY-SG-008-111	1/7/02	1/8/02	111	<0.5	<1.0	<1.0
LAY-SG-008-126	1/7/02	1/8/02	126	<0.5	<1.0	<1.0
LAY-SG-009-011	12/28/01	12/29/01	11	<1.0	<1.0	<1.0
LAY-SG-009-031	12/28/01	12/29/01	31	<1.0	<1.0	<1.0
LAY-SG-009-051	12/28/01	12/29/01	51	<1.0	<1.0	<1.0
LAY-SG-009-071	12/28/01	12/29/01	71	<1.0	<1.0	<1.0
LAY-SG-009-091	12/28/01	12/29/01	91	<1.0	<1.0	<1.0
LAY-SG-009-111	12/31/01	1/2/02	111	<1.0	<1.0	<1.0
LAY-SG-009-126	12/31/01	1/2/02	126	<1.0	<1.0	<1.0

Notes:

* Additional samples taken and analyzed onsite in the mobile laboratory to evaluate potential for vapor loss when soil-gas samples are analyzed at a fixed-based laboratory the day following collection.

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
ft bgs = feet below ground surface
µg/L = micrograms per liter

Samples were analyzed using EPA Method 8021B, Modified.

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL).

Table 2-16
Hydropunch® Groundwater Analytical Results
2001-2002 Layke NFA Groundwater Sampling

Monitor Well	Sample Date	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)
LAY-HP-001-136	1/14/02	<0.5	<0.5	<0.5
LAY-HP-002-136	1/8/02	<0.5	<0.5	<0.5
LAY-HP-003-136	1/11/02	<0.5	<0.5	<0.5
LAY-HP-004-136	12/28/02	<0.5	<0.5	<0.5
LAY-HP-005-136	1/10/02	<0.5	<0.5	<0.5
LAY-HP-006-136	1/4/02	<0.5	<0.5	<0.5
LAY-HP-007-136	1/2/02	<0.5	<0.5	<0.5
LAY-HP-008-136	1/7/02	<0.5	<0.5	<0.5
LAY-HP-009-136	12/31/01	<0.5	<0.5	<0.5
LAY-HP-103-136	1/11/02	<0.5	<0.5	<0.5
Arizona AWQS (µg/L)		5	7	5

Notes:

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
µg/L = micrograms per liter
MCL = Maximum Contaminant Level
AWQS = Aquifer Water Quality Standard

Samples were analyzed using EPA Method 8260B.

Table 4-1
Groundwater Elevations For Wells in and around the WCP WGA Site
(ft amsl)

Monitor Well	Apr-99	May-99	Jun-99	Jul-99	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99	Jan-00	Feb-00	Mar-00
ARCO #5290 MW-2	985.91	985.40	984.64	984.01	983.29	982.53	982.09	981.68	981.76	981.72	981.69	982.00
ARCO #5290 MW-3	985.99	985.44	984.63	984.01	983.27	982.52	982.11	981.75	981.84	981.81	981.77	982.07
ARCO #5290 MW-4	986.19	985.67	984.83	984.23	983.52	982.78	982.34	981.90	981.93	981.88	981.86	982.12
Southwest Roofing MWB-2	985.81	987.53	988.17	988.02	987.53	987.21	987.19	987.08	987.11	987.38	987.45	987.64
Southwest Roofing MWB-3	985.78	987.44	988.02	987.87	987.40	987.06	986.63	986.95	986.97	987.26	987.32	987.51
Southwest Roofing MWB-4	985.66	987.62	988.36	988.20	987.71	987.43	987.39	987.32	987.36	987.61	987.75	987.93
WCP-4	983.75	986.64	987.41	987.48	987.07	986.95	986.80	986.79	986.91	987.04	987.12	987.20
WCP-8	986.03	988.93	989.40	989.49	989.10	989.23	989.16	989.18	989.29	989.33	989.31	989.12
WCP-10	986.53	986.77	986.80	986.62	986.14	985.80	985.46	985.23	985.32	985.43	985.57	985.78
WCP-11	985.71	987.10	987.54	987.55	987.19	987.07	986.92	986.85	986.87	986.95	986.94	986.91
WCP-89	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WCP-94	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WCP-204	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WOC MW-1S	986.58	987.54	987.96	988.01	987.63	987.54	987.43	987.35	987.39	987.43	987.38	987.31
WOC MW-4S	990.83	991.82	991.70	991.53	991.08	991.00	990.91	990.86	990.74	990.69	990.49	990.23
WOC MW-5S	987.34	988.21	988.15	988.07	987.66	987.57	987.49	987.47	987.48	987.47	987.31	987.09
WOC MW-6S	981.25	982.14	981.39	980.85	980.07	979.87	979.72	979.75	979.96	980.02	980.00	979.59
WOC MW-102S	987.25	986.97	986.98	986.90	986.59	986.36	986.15	985.99	985.99	985.99	985.96	985.96
WOC MW-103S	986.26	985.83	985.40	985.03	984.42	983.99	983.59	983.35	983.46	983.55	983.65	983.86
WOC MW-104S	985.96	985.43	984.84	984.42	983.78	983.36	982.93	982.65	982.70	982.71	982.76	982.81
WOC MW-201S	984.41	983.80	982.95	982.35	981.61	981.00	980.45	980.16	980.31	980.37	980.44	980.66

Table 4-1 (Continued)
Groundwater Elevations For Wells in and around the WCP WGA Site
(ft amsl)

Monitor Well	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Sep-00	Oct-00	Nov-00	Dec-00	Jan-01	Feb-01	Mar-01
ARCO #5290 MW-2	981.65	981.40	981.00	980.63	980.05	979.55	978.99	978.70	978.48	978.57	978.81	979.15
ARCO #5290 MW-3	981.84	981.43	981.09	980.63	980.03	979.47	978.87	978.52	978.26	978.31	978.59	979.01
ARCO #5290 MW-4	981.90	981.57	981.25	980.84	980.28	979.76	979.20	978.83	978.56	978.54	978.78	979.11
Southwest Roofing MWB-2	987.70	987.08	986.47	NM	NM	984.64	984.03	983.89	NM	985.28	986.11	984.70
Southwest Roofing MWB-3	987.56	986.93	986.33	985.65	985.06	984.50	983.88	NM	NM	987.22	985.59	984.46
Southwest Roofing MWB-4	987.95	987.33	986.71	986.01	985.39	984.82	984.25	984.09	983.87	984.31	985.36	984.99
WCP-4	986.98	986.50	986.06	985.50	984.81	984.59	983.82	983.69	983.54	983.70	984.04	984.32
WCP-8	988.80	988.31	987.93	987.32	986.70	986.25	985.98	985.91	985.85	985.76	DRY	DRY
WCP-10	985.68	985.29	984.86	984.35	983.66	983.04	982.45	982.06	981.83	981.90	982.26	982.67
WCP-11	986.71	986.33	985.97	985.53	984.95	984.36	DRY	DRY	DRY	DRY	DRY	DRY
WCP-89	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WCP-94	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WCP-204	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WOC MW-1S	987.07	986.69	986.34	985.91	985.28	984.80	984.33	984.01	983.85	983.79	983.89	984.04
WOC MW-4S	989.87	989.36	989.00	988.49	987.84	987.30	986.94	NM	986.60	986.52	986.53	986.52
WOC MW-5S	987.52	987.00	986.63	986.05	985.30	984.78	984.34	984.19	984.01	984.00	984.11	984.22
WOC MW-6S	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
WOC MW-102S	985.81	985.49	985.17	984.75	984.11	983.51	982.93	982.56	982.21	982.11	982.22	982.44
WOC MW-103S	983.70	983.26	982.86	982.36	981.69	981.02	980.44	980.05	979.80	979.90	980.20	980.63
WOC MW-104S	982.66	982.34	981.99	981.50	980.84	980.25	979.66	979.22	978.91	978.86	979.23	979.43
WOC MW-201S	980.53	980.10	979.68	979.20	978.53	977.98	977.42	977.11	976.83	976.97	977.25	977.75

Table 4-1 (Continued)
Groundwater Elevations For Wells in and around the WCP WGA Site
(ft amsl)

Monitor Well	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	Nov-01	Dec-01	Jan-02	Apr-02	Sep-02
ARCO #5290 MW-2	979.51	979.50	978.77	DRY	DRY	DRY	DRY	DRY	975.57	DRY	975.37	973.49
ARCO #5290 MW-3	979.44	979.42	978.81	978.13	977.41	976.82	976.22	975.87	975.43	DRY	DRY	DRY
ARCO #5290 MW-4	979.51	979.54	979.02	978.40	977.82	NM	DRY	DRY	DRY	DRY	DRY	DRY
Southwest Roofing MWB-2	984.90	984.81	NM	983.10	981.33	980.96	980.96	980.44	980.52	980.43	980.33	DRY
Southwest Roofing MWB-3	984.84	984.99	983.80	983.98	979.88	981.42	NM	NM	NM	NM	NM	NM
Southwest Roofing MWB-4	985.28	985.00	984.18	983.60	982.11	981.20	981.21	980.79	980.88	980.76	980.61	DRY
WCP-4	982.83	984.05	983.29	982.29	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
WCP-8	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
WCP-10	981.55	983.01	982.37	981.55	980.74	980.00	979.39	978.99	978.69	978.56	978.52	DRY
WCP-11	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
WCP-89	984.13	984.16	983.18	982.39	981.50	980.60	980.12	NM	979.94	979.88	979.62	975.60
WCP-94	N/A	N/A	N/A	N/A	980.69	979.84	979.24	978.78	978.65	978.27	978.15	975.32
WCP-204	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	978.26	977.81	977.63	975.24
WOC MW-1S	983.99	983.62	983.16	NM	981.51	NM	DRY	DRY	DRY	DRY	DRY	DRY
WOC MW-4S	986.19	985.56	984.91	983.91	NM	NM	DRY	DRY	DRY	DRY	DRY	DRY
WOC MW-5S	983.22	982.71	982.07	981.08	980.27	NM	979.37	979.07	979.09	978.98	--	974.83
WOC MW-6S	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
WOC MW-102S	982.52	982.10	981.71	980.80	979.96	NM	978.83	978.55	978.44	978.05	--	974.03
WOC MW-103S	981.09	980.84	980.35	979.45	978.66	NM	977.24	976.79	976.55	976.43	--	972.71
WOC MW-104S	979.75	979.54	979.09	978.34	977.59	NM	976.25	975.81	975.56	975.35	--	971.66
WOC MW-201S	978.25	978.04	977.59	976.64	975.96	NM	974.78	974.40	974.34	974.06	--	971.34

Table 4-1 (Continued)
Groundwater Elevations For Wells
in and around the WCP WGA Site
(ft amsl)

Notes:

ft amsl	=	feet above mean sea level
NM	=	not measured (unable to obtain access)
N/A	=	not applicable (well had not been installed yet)
DRY	=	well is dry
--	=	no data submitted by reporting party

Table 4-2
Well Elevations For Wells in and around the WCP WGA Site
(ft amsl)

Monitor Well	ADEQ ID	ADWR Number	Well Elevation
ARCO #5290 MW-2	57125	55-536034	1095.81
ARCO #5290 MW-3	57126	55-536033	1096.30
ARCO #5290 MW-4	57127	55-545742	1096.09
Southwest Roofing MWB-2	57182	55-538226	1106.29
Southwest Roofing MWB-3	57183	55-538227	1106.33
Southwest Roofing MWB-4	57189	55-538228	1105.81
WCP-4	57115	55-535334	1109.25
WCP-8	57263	55-537381	1109.92
WCP-10	57422	55-547462	1102.50
WCP-11	57421	55-547461	1107.66
WCP-89	59427	55-585116	1105.53
WCP-94	59431	55-586979	1101.57
WCP-204	60383	55-589528	1097.47
WOC MW-1S	57149	55-532636	1109.45
WOC MW-4S	57156	55-534122	1107.64
WOC MW-5S	57157	55-534123	1107.28
WOC MW-6S	57160	55-558699	1098.35
WOC MW-102S	58079	55-564733	1106.02
WOC MW-103S	58080	55-564982	1100.81
WOC MW-104S	58081	55-564984	1100.36
WOC MW-201S	58082	55-571594	1095.26

Notes:

ft ams = feet above mean sea level

Table 5-1
Physical Properties of Chemicals of Concern at the WCP WGA Site

Chemical	Specific Gravity (g/cm^3)	Aqueous Solubility @ 25°C (mg/L)	Vapor Pressure @ 25°C (mm Hg)	Henry's Law Constant @ 25°C ($atm\text{-}m^3/mol$)	Vapor Density	Boiling Point (°C)	K_{oc} (mL/g)	K_{ow}
TCE	1.46	1,280	69	9.85E-03	4.53	87.2	101	407
PCE	1.62	150	18.5	1.77E-02	5.7	121.3	200-237	2,512
1,1-DCE	1.21	2,500	600	2.61E-02	3.25	31.7	64	135

Notes:

All physical parameters obtained from: Toxicology Data Network, National Library of Medicine (Toxnet), Hazardous Substance Database, http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB, July 2, 2003.

Henry's Law Constant (K_H): Compounds with constants greater than 1E-03 readily volatilize from water; compounds with constants less than 1E-05 are not as volatile.

Specific Gravity: Compounds with a density of greater than 1 have a tendency to sink in water (i.e., DNAPLs); compounds with a density of less than 1 have a tendency to float on water (i.e., LNAPLs).

Water Solubility: Highly soluble chemicals can be rapidly leached from wastes and soils and are mobile in groundwater; the higher the value, the higher the solubility.

Boiling Point: Useful in determining how quickly a chemical will produce a vapor or whether the chemical is in its gaseous state.

Octanol-Water Partition Coefficient (K_{ow}): Used in estimating the sorption of organic compounds on soils (high K_{ow} tends to adsorb more easily).

Organic Carbon Partition Coefficient (K_{oc}): Indication of the capacity for an organic chemical to adsorb to soil because organic carbon is responsible for nearly all adsorption in most soils (the higher the value, the more it adsorbs).

Vapor Pressure: Relative measure of volatility of a substance in pure state. The higher the vapor pressure, the more volatile.

Vapor Density: Compounds with a density of greater than 1 have a tendency to migrate downhill and accumulate in low lying areas. Chemicals that have a vapor density which is the same or less than the vapor density of air will disperse readily into the surrounding environment.

Table 5-2
1992-2001 Summary of Groundwater Analytical Results
WCP West Grand Avenue and West Osborn Complex Sites

Monitor Well	Sample Date	Sampler	Well Elev. ft amsl	GW Elev. ft amsl	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)
WCP-4	5/29/92	ETC	1109.25	1011.45	**420**	<1.0	<1.0
WCP-4	7/10/92	ETC	1109.25	1013.55	**340**	**2.0**	<0.5
WCP-4 (D)	7/10/92	ETC	1109.25	1013.55	**290**	**1.5**	<0.5
WCP-4	12/4/92	ETC	1109.25	1012.15	**370**	**1.6**	<0.5
WCP-4	1/24/94	ETC	1109.25	1010.27	**380**	<5.0	<5.0
WCP-4	3/28/95	ETC	1109.25	1014.83	**140**	<0.5	<0.5
WCP-4	2/7/96	ETC	1109.25	1010.00	**190**	<0.5	<0.5
WCP-4	11/25/96	Geotrans	1109.25	1008.87	**2.0**	<0.5	<0.5
WCP-4	11/25/96	GZA	1109.25	1008.87	**3.1**	<0.5	<0.5
WCP-4	5/6/97	Geotrans	1109.25	998.67	<0.5	<0.5	<0.5
WCP-4	8/9/97	Geotrans	1109.25	994.25	**0.58**	<0.5	<0.5
WCP-4	11/14/97	Geotrans	1109.25	996.92	**0.76**	<0.5	<0.5
WCP-4	2/10/98	Geotrans	1109.25	996.94	**1.4**	<0.5	<0.5
WCP-4	5/26/98	Geotrans	1109.25	995.92	<0.5	<0.5	<0.5
WCP-4	8/28/98	Geotrans	1109.25	994.65	**2.7**	<0.5	<0.5
WCP-4	11/9/98	Geotrans	1109.25	992.50	**0.85**	<0.5	<0.5
WCP-4	2/11/99	Geotrans	1109.25	991.89	<0.5	<0.5	<0.5
WCP-4	3/5/01	Weston	1109.25	984.30	<0.3	<0.3	<0.3
WCP-4 (D)	3/5/01	Weston	1109.25	984.30	<0.3	<0.3	<0.3
WCP-4	6/6/01	Weston	1109.25	983.60	<0.2	<0.2	<0.2
WCP-8	12/4/92	ETC	1109.92	1013.24	<0.5	<0.5	<0.5
WCP-8	2/18/93	ETC	1109.92	1011.55	<0.5	<0.5	<0.5
WCP-8	1/20/94	ETC	1109.92	1011.64	<0.5	<0.5	<0.5
WCP-8	2/8/96	ETC	1109.92	1012.27	<0.5	<0.5	<0.5
WCP-8	11/25/96	Geotrans	1109.92	1006.79	<0.5	<0.5	<0.5
WCP-8	11/25/96	GZA	1109.92	1006.79	<0.5	<0.5	<0.5
WCP-8	5/9/97	Geotrans	1109.92	1001.27	<0.5	<0.5	<0.5
WCP-8	8/9/97	Geotrans	1109.92	995.68	<0.5	<0.5	<0.5
WCP-8	11/13/97	Geotrans	1109.92	1001.01	<0.5	<0.5	<0.5
WCP-8	2/12/98	Geotrans	1109.92	1000.27	<0.5	<0.5	<0.5
WCP-8	5/20/98	Geotrans	1109.92	998.61	<0.5	<0.5	<0.5
WCP-8	8/21/98	Geotrans	1109.92	997.45	<0.5	<0.5	<0.5
WCP-8	11/6/98	Geotrans	1109.92	995.34	<0.5	<0.5	<0.5
WCP-8	2/19/99	Geotrans	1109.92	994.79	<0.5	<0.5	<0.5
WCP-8	6/01	Weston	DRY	DRY	DRY	DRY	DRY

Table 5-2 (Continued)
1992-2001 Summary of Groundwater Analytical Results
WCP West Grand Avenue and West Osborn Complex Sites

Monitor Well	Sample Date	Sampler	Well Elev. ft amsl	GW Elev. ft amsl	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)
WCP-10	2/28/95	ETC	1102.50	1009.60	**37**	**1.0**	<0.5
WCP-10	3/28/95	ETC	1102.50	1010.54	**45**	**0.9**	<0.5
WCP-10 (D)	3/28/95	ETC	1102.50	1010.54	**37**	**1.0**	<0.5
WCP-10	2/6/96	ETC	1102.50	1008.18	**33**	<0.5	<0.5
WCP-10	11/22/96	Geotrans	1102.50	1002.61	**16**	<0.5	<0.5
WCP-10	11/22/96	GZA	1102.50	1002.61	**20**	<0.5	<0.5
WCP-10	5/8/97	Geotrans	1102.50	998.80	**20**	<0.5	<0.5
WCP-10	8/4/97	Geotrans	1102.50	993.53	**19**	<0.5	<0.5
WCP-10	11/14/97	Geotrans	1102.50	994.67	**29**	<1.0	<1.0
WCP-10	2/10/98	Geotrans	1102.50	995.05	**11**	<0.5	<0.5
WCP-10	5/18/98	Geotrans	1102.50	994.41	**3.9**	<0.5	<0.5
WCP-10	8/20/98	Geotrans	1102.50	993.21	**5.9**	<0.5	<0.5
WCP-10	11/5/98	Geotrans	1102.50	991.00	**11**	<0.5	<0.5
WCP-10	2/8/99	Geotrans	1102.50	990.36	**13**	<0.5	<0.5
WCP-10	3/5/01	Weston	1102.50	982.57	**8**	<0.3	<0.3
WCP-10	6/7/01	Weston	1102.50	982.62	**5**	<0.2	<0.2
WCP-11	2/28/95	ETC	1107.66	1013.46	<0.5	<0.5	<0.5
WCP-11 (D)	2/28/95	ETC	1107.66	1013.46	<0.5	<0.5	<0.5
WCP-11	3/28/95	ETC	1107.66	1014.20	<0.5	<0.5	<0.5
WCP-11	2/7/96	ETC	1107.66	1011.18	<0.5	<0.5	<0.5
WCP-11	11/22/96	Geotrans	1107.66	1006.62	<0.5	<0.5	<0.5
WCP-11	11/22/96	GZA	1107.66	1006.62	**0.6**	<0.5	<0.5
WCP-11	5/6/97	Geotrans	1107.66	1001.35	<0.5	<0.5	<0.5
WCP-11	8/5/97	Geotrans	1107.66	996.37	**1.5**	<0.5	<0.5
WCP-11	11/14/97	Geotrans	1107.66	999.21	**2.1**	<0.5	<0.5
WCP-11	2/12/98	Geotrans	1107.66	998.25	**3.8**	<0.5	<0.5
WCP-11	5/18/98	Geotrans	1107.66	996.35	**2.7**	<0.5	<0.5
WCP-11	8/21/98	Geotrans	1107.66	995.19	**0.93**	<0.5	<0.5
WCP-11	11/9/98	Geotrans	1107.66	993.06	**0.70**	<0.5	<0.5
WCP-11	2/9/99	Geotrans	1107.66	992.21	**1.3**	<0.5	<0.5
WCP-11	6/01	Weston	DRY	DRY	DRY	DRY	DRY
MW-103S	2/9/98	Geotrans	1100.81	994.02	**59**	**2.0**	<1.3
MW-103S	5/18/98	Geotrans	1100.81	993.53	**29**	<1.0	<1.0
MW-103S	8/21/98	Geotrans	1100.81	991.64	**28**	**0.78**	<0.5
MW-103S	11/6/98	Geotrans	1100.81	989.38	**29**	<0.5	<0.5
MW-103S	2/9/99	Geotrans	1100.81	988.81	**40**	**1.2**	**0.60**
MW-103S	6/7/01	GZA	1100.81	980.62	**30**	**1**	**0.4**
Arizona AWQS (µg/L)					5	7	5

Table 5-2 (Continued)
1992-2001 Summary of Groundwater Analytical Results
WCP West Grand Avenue and West Osborn Complex Sites

Notes:

TCE	= Trichloroethylene
PCE	= Tetrachloroethylene
1,1-DCE	= 1,1-Dichloroethylene
µg/L	= micrograms per liter
Well Elev.	= well elevation
GW Elev.	= groundwater elevation
ft amsl	= feet above mean sea level
MCL	= Maximum Contaminant Level
AWQS	= Aquifer Water Quality Standard
D	= Duplicate Sample
ETC	= The Earth Technology Corporation for ADEQ
Geotrans	= Geotrans, Inc. for United Industrial Corporation
GZA	= GZA GeoEnvironmental, Inc. for ADEQ
Weston	= Weston Solutions, Inc. (formerly Roy F. Weston, Inc.)

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate groundwater sample exceeds AWQS.

Table 5-3
2001-2002 Groundwater Analytical Results
WCP East Grand Avenue RI Investigation

Monitor Well	Sample Date	Well Elev. ft amsl	GW Elev. ft amsl[3]	TCE (µg/L)	1,1-DCE (µg/L)	PCE (µg/L)
WCP-89[1]	2/23/01	1105.53	982.63[4]	**1**	<0.3	<0.3
WCP-89[1]	4/24/01	1105.53	984.13	**1**	<0.3	<0.3
WCP-89[1]	6/6/01	1105.53	983.18	<0.2	<0.2	<0.2
WCP-89[2]	6/18/01	1105.53	983.18	**0.4**	<0.2	<0.2
WCP-89[1]	8/01/01	1105.53	981.50	<0.2	<0.2	<0.2
WCP-89[2]	10/31/01	1105.53	980.12	<0.2	<0.2	<0.2
WCP-89[2]	1/11/02	1105.53	979.88	<0.2	<0.2	<0.2
WCP-94[1]	8/9/01	1101.57	980.69	**12**	<0.2	<0.2
WCP-94[1]	9/20/01	1101.57	979.84	**11**	**0.4**	<0.2
WCP-94[2]	11/7/01	1101.57	978.78	**13**	**0.4**	<0.2
WCP-94[2]	1/23/02	1101.57	978.27	**11**	<0.2	<0.2
WCP-204[2]	12/18/01	1097.47	978.26	<0.2	<0.2	**0.3**
WCP-204[2]	1/21/02	1097.47	977.81	<0.2	<0.2	<0.2
Arizona AWQS (µg/L)				5	7	5

Notes:

Groundwater samples collected by ADEQ for the WCP East Grand Avenue RI Investigation. Samples were analyzed using EPA Method 8260B.

[1] Groundwater samples collected using the low-flow purge method and the pump discharge sample collection method.
[2] Groundwater samples collected using three casing volume purge method and the pump discharge sample collection method.
[3] Groundwater elevations taken within a month of sampling date.
[4] Final groundwater elevation at the time well is completed obtained from well construction log.

TCE = Trichloroethylene
PCE = Tetrachloroethylene
1,1-DCE = 1,1-Dichloroethylene
µg/L = micrograms per liter
Well Elev. = well elevation
GW Elev. = groundwater elevation
ft amsl = feet above mean sea level
MCL = Maximum Contaminant Level
AWQS = Aquifer Water Quality Standard

Bold areas indicate contaminant detections above the laboratory method detection limit (MDL). Shaded areas indicate groundwater sample exceeds AWQS.

Table 6-1
Physical Properties of Organic Contaminants that Affect Fate and Transport

Physical Property	Range	Qualitative Description
Sorption- Soil Adsorption Coefficient (K_{oc})	<10	Very weakly sorbed
	10 - 100	Weakly sorbed
	100 - 1,000	Moderately sorbed
	1,000 - 10,000	Moderately to strongly sorbed
	10,000 - 100,000	Strongly sorbed
	> 100,000	Very strongly sorbed
Mobility- Based on a combination of solubility (s) (mg/L) and K_{oc}	s > 3,500 and K_{oc} < 50	Very high mobility
	3,500 > s > 850 and 50 < K_{oc} < 150	High mobility
	850 > s > 150 and 150 < K_{oc} < 500	Moderate mobility
	150 > s > 15 and 500 < K_{oc} < 2,000	Low mobility
	15 > s > 0.2 and 2,000 < K_{oc} < 20,000	Slight mobility
	s < 0.2 and K_{oc} > 20,000	Immobile
Volatility- Henry's Constant (K_H) (atm m^3/mol)	$K_H < 3x10^{-7}$	Non-volatile
	$3x10^{-7} < K_H < 1x10^{-5}$	Low volatility
	$1x10^{-5} < K_H < 1x10^{-3}$	Moderate volatility
	$K_H > 10^{-3}$	High volatility

Sources: ATSDR Public Health Assessment Manual, http://www.atsdr.cdc.gov/HAC/HAGM/toc-html.htm, Chapter 6.

Fetter, C.W., 1988. Applied Hydrogeology, Second Edition, pp. 403-405.

WEST CENTRAL PHOENIX WEST GRAND AVENUE SITE
DRAFT REMEDIAL INVESTIGATION REPORT

LIST OF FIGURES

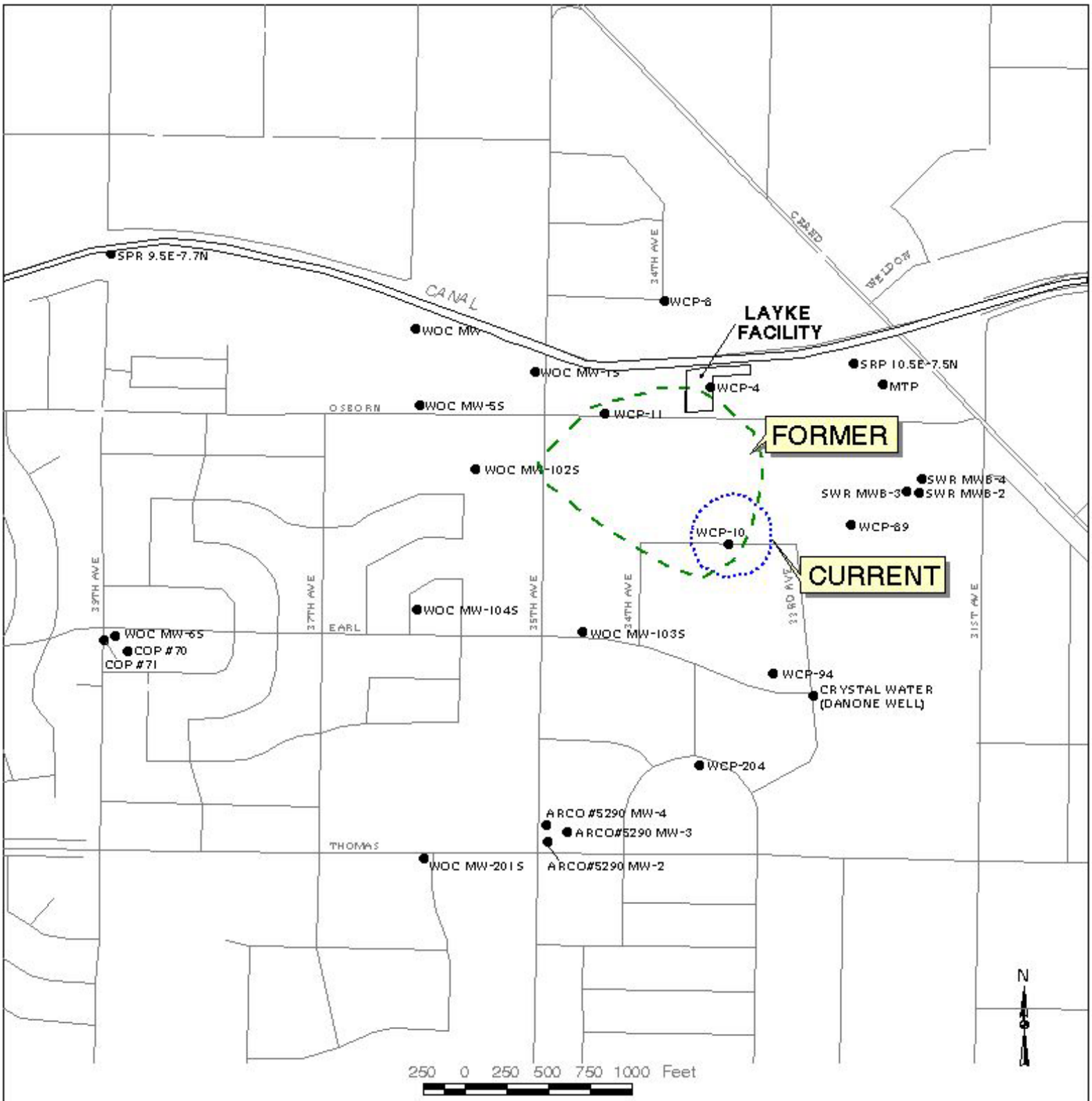

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Figure 1-1

Boundaries of the WCP WGA Site (Former and Current)

12/2003

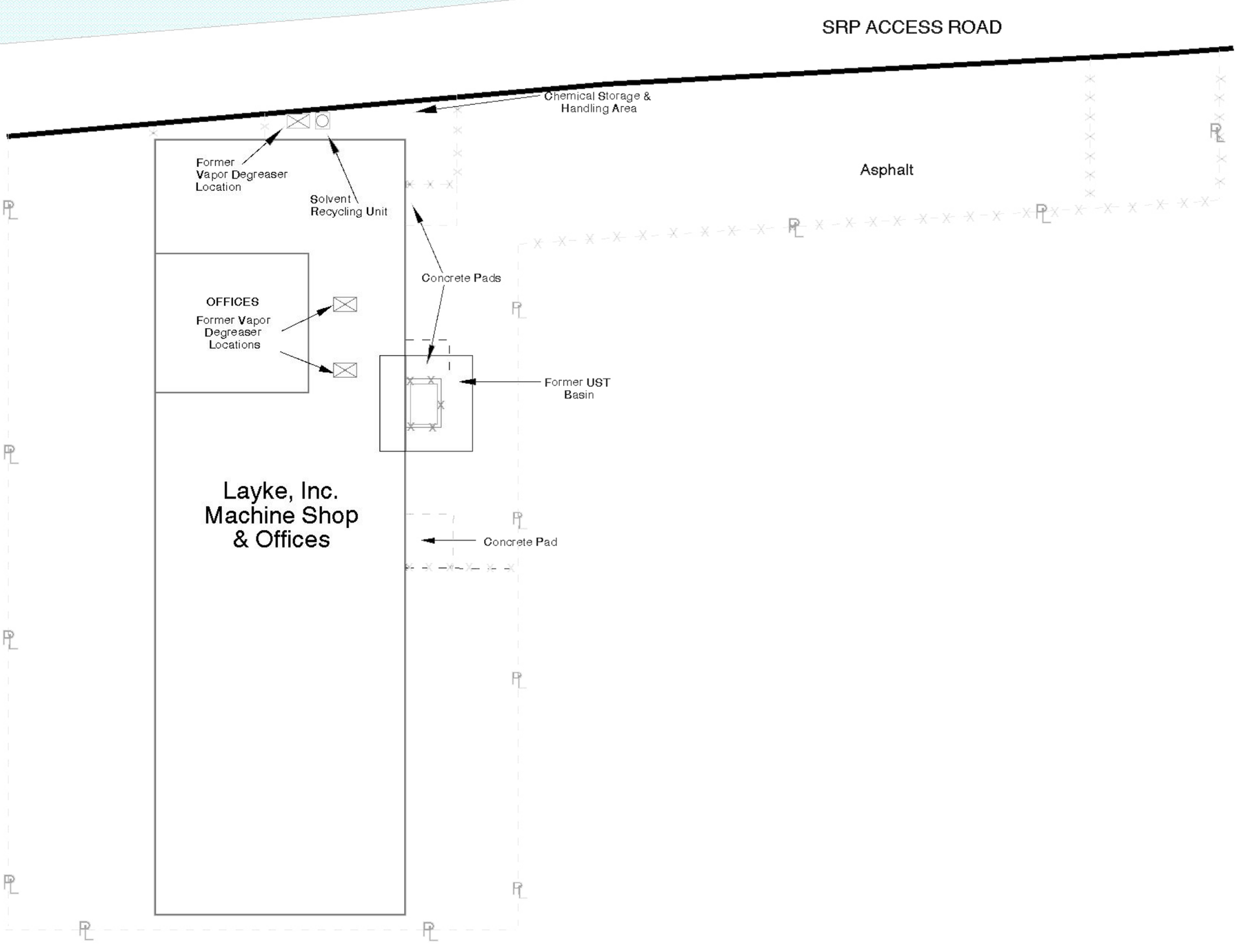

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Figure 1-2

Layke Facility Diagram

- Approx. Property Boundary
- Chain Link Fence
- Block Wall
- Vapor Degreaser
- Solvent Recycling Unit

N

0 20 40 60

12/2003

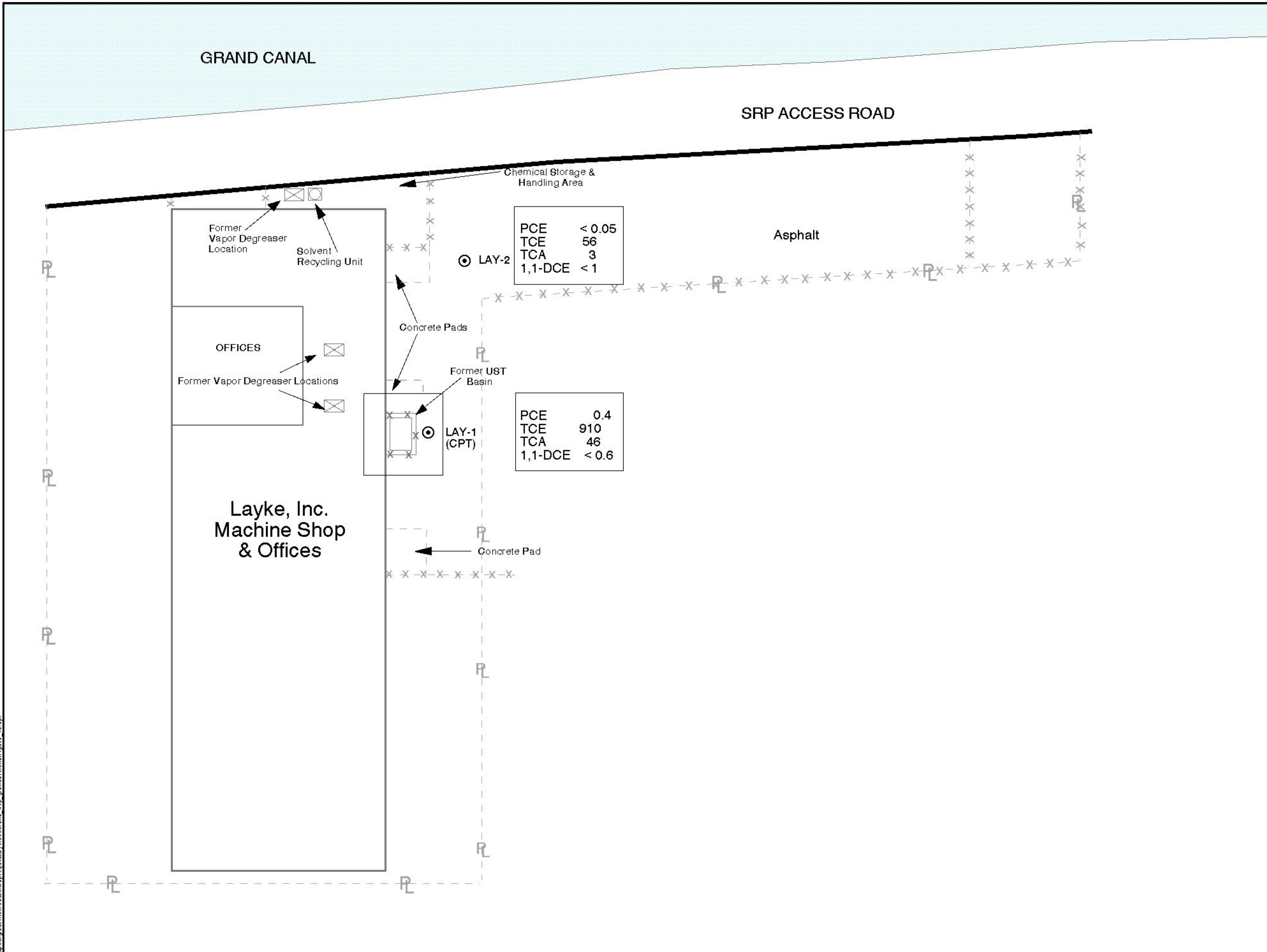

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Figure 2-1

1989 EPA PA/SI Investigation

Symbol	Description
PL	Approx. Property Boundary
X	Chain Link Fence
(solid line)	Block Wall
⊠	Vapor Degreaser
○	Solvent Recycling Unit
⊙ LAY-2	Soil-Gas Sample Location (SI, 1989)
CPT	Cone Penetrometer Test Location

Note: Concentrations of VOCs in soil-gas are reported in µg/L.

N

0 20 40 60

12/2003

GRAND CANAL

SRP ACCESS ROAD

Chemical Storage & Handling Area

SS-1

SS-2

SS-3

SB-1

SB-2

Former Vapor Degreaser Location

Solvent Recycling Unit

Asphalt

Concrete Pads

OFFICES

Former Vapor Degreaser Locations

UST-N

UST-P

Former UST Basin

UST-S

Layke, Inc.
Machine Shop
& Offices

Concrete Pad

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Figure 2-2

1990 Phase I Testing

- Approx. Property Boundary
- Chain Link Fence
- Block Wall
- Vapor Degreaser
- Solvent Recycling Unit
- ■ SS-1 Soil Sample Location from Excavation or Hand Auger (Phase I, 1990)
- ◆ SB-1 Soil Boring Location (Phase I, 1990)

N

0 20 40 60

12/2003

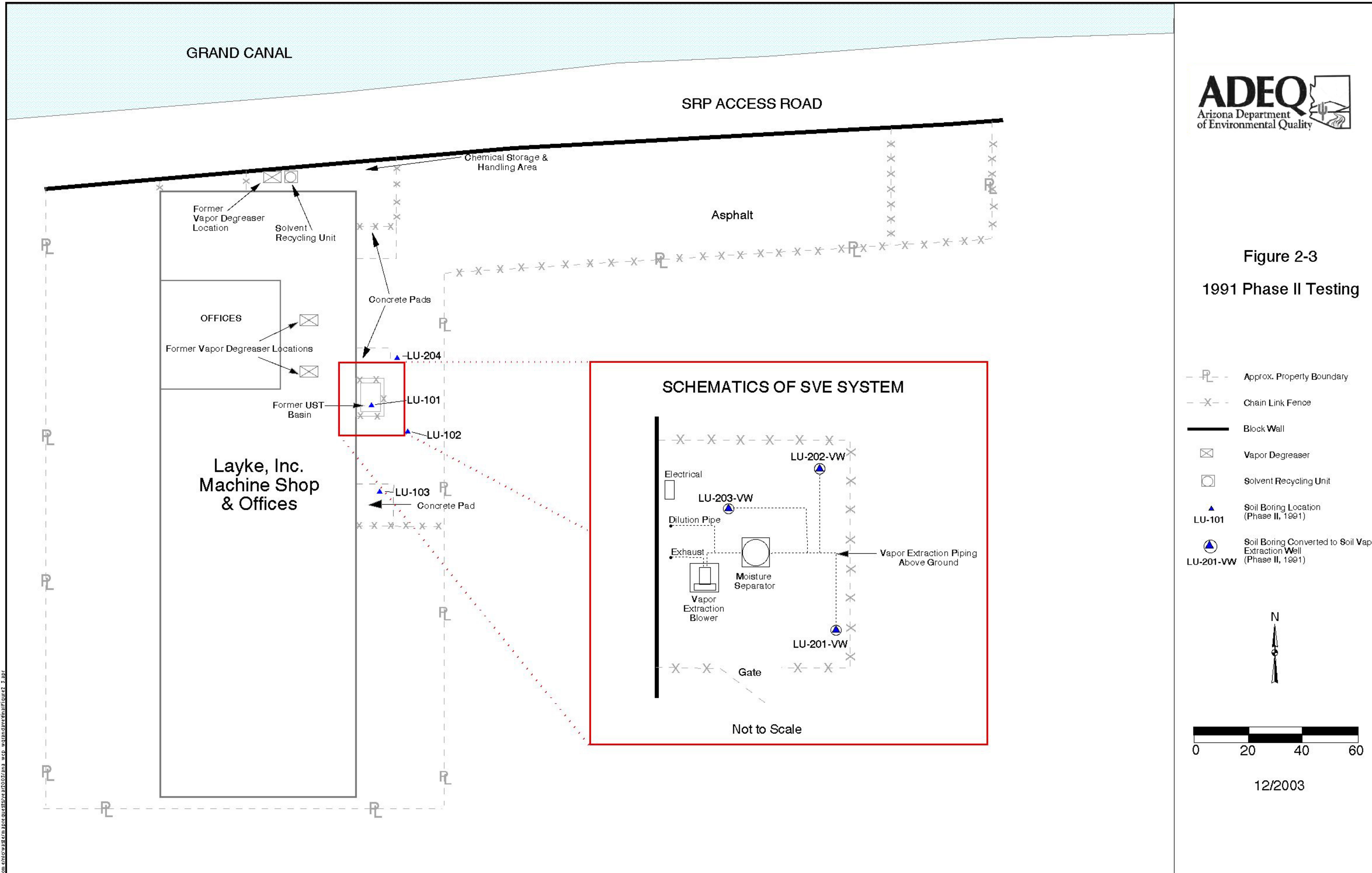

Figure 2-3

1991 Phase II Testing

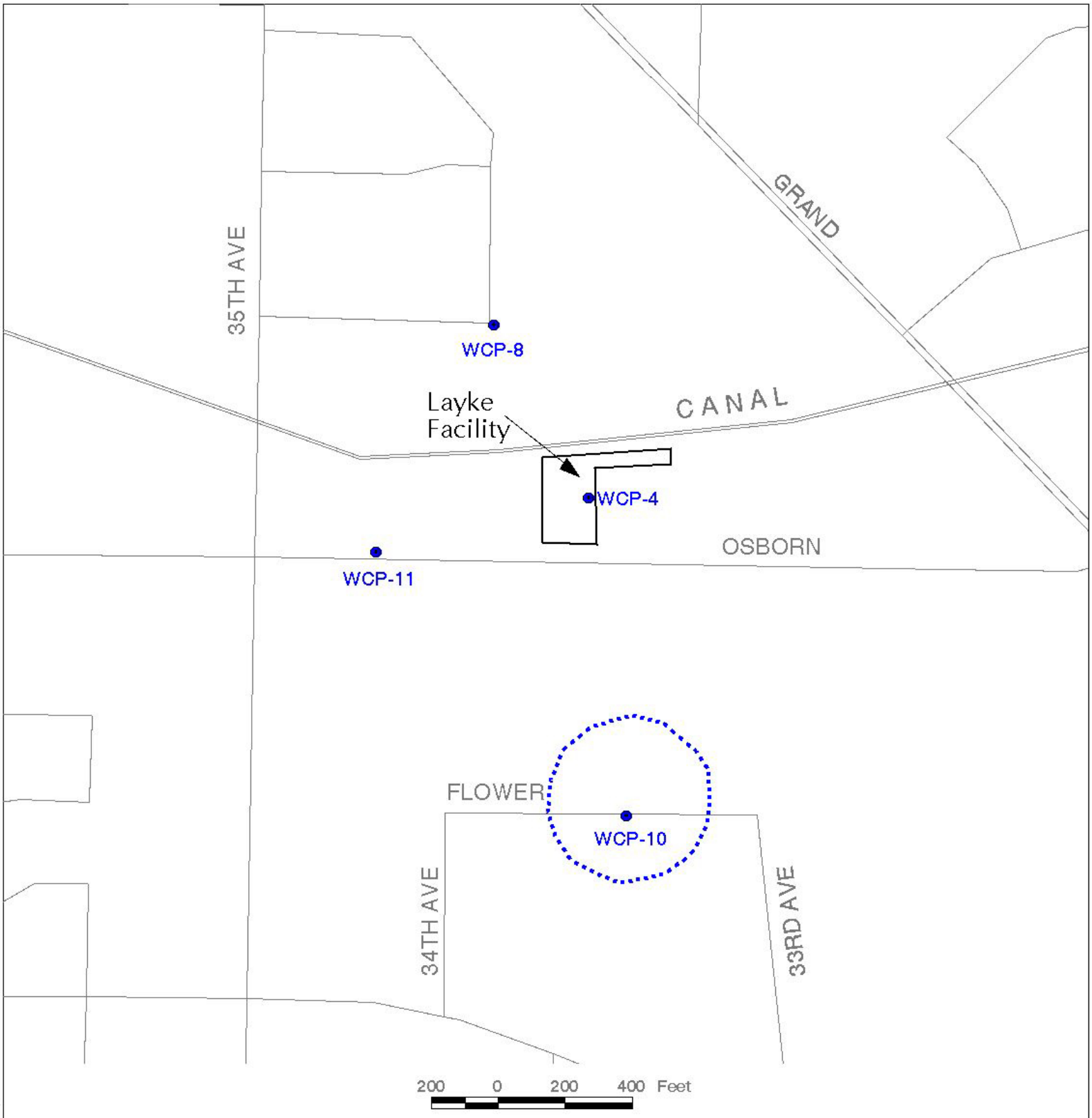

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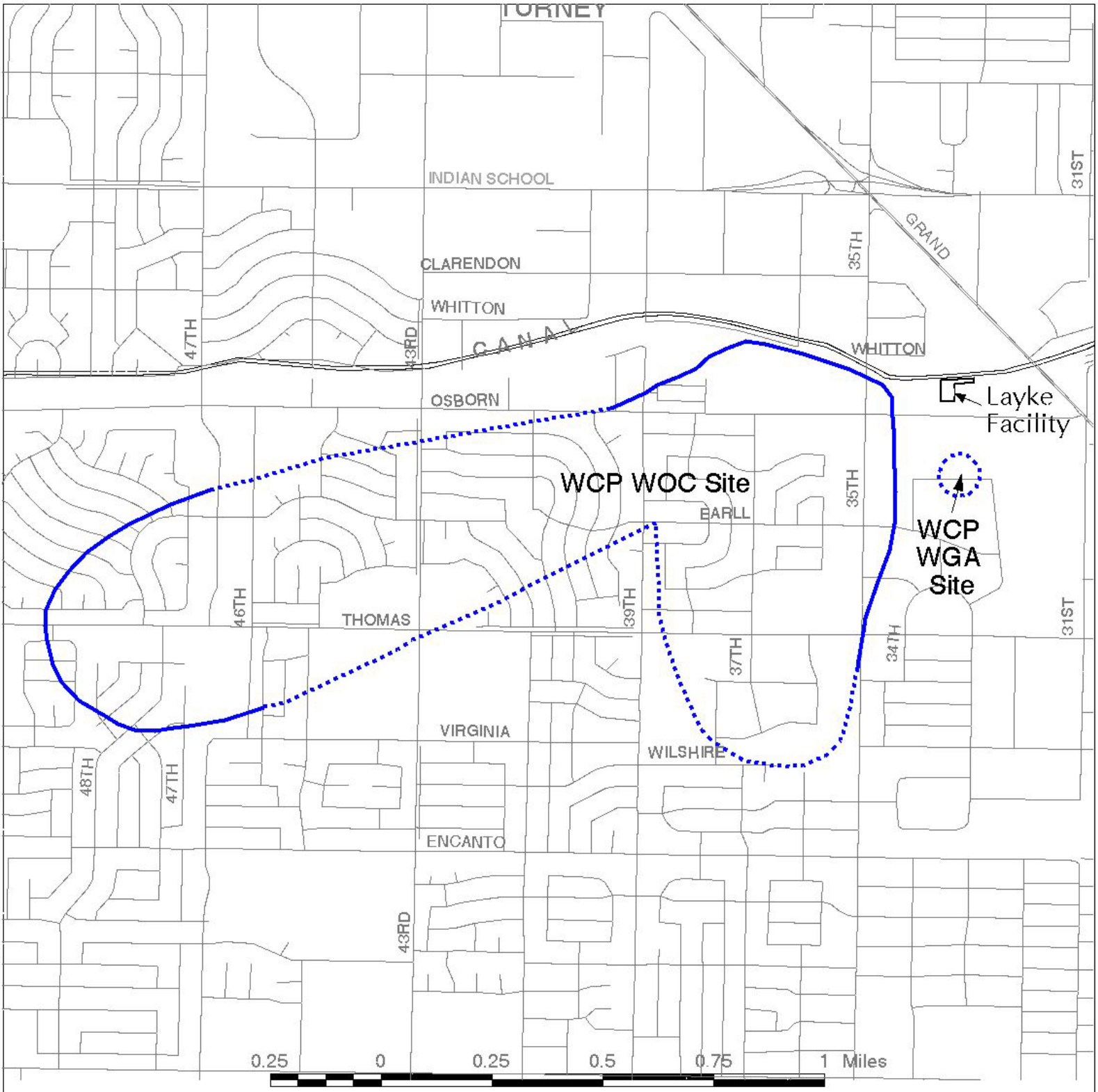
Figure 2-4

Locations of Wells
WCP-4, WCP-8,
WCP-10 & WCP-11

12/2003

/export/gisdevmlc/maprequests/year2003/ana_wcp_wgrandave/wcp2003fi.apr



Estimated site boundary - Contour represents area of TCE contamination in groundwater that exceeds the Aquifer Water Quality Standard of 5 µg/L.

Dashed line indicates inferred site boundary.

Roads

Railroads

Canals

N

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Figure 2-5

Locations of the WCP WOC and WCP WGA Sites

12/2003

/export/gisdev/hlcmaprequests/year2003/ana_wcp_wgrandave/figure2-5.apr

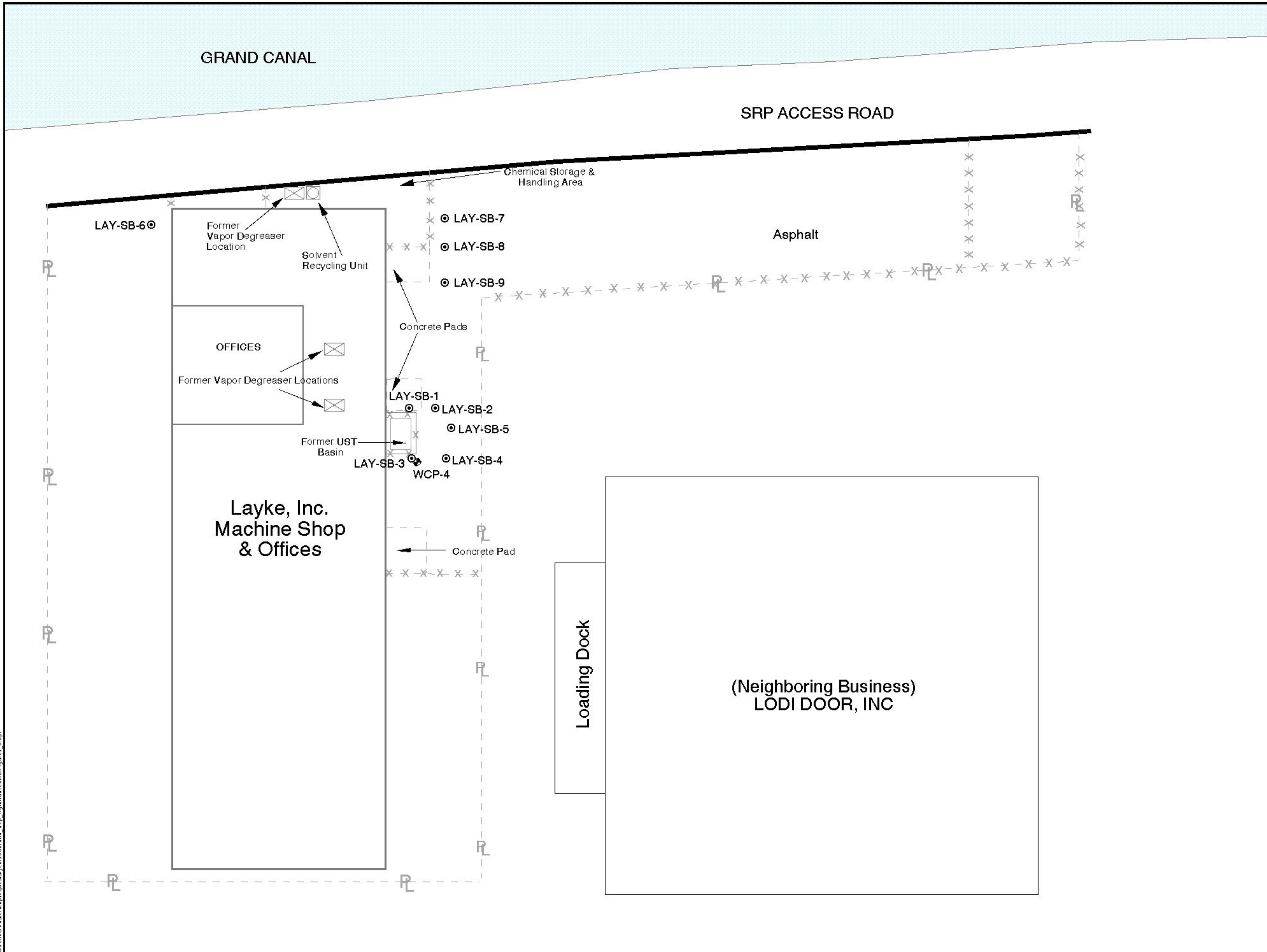

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Figure 2-6

2001-2002 Layke Facility NFA Soil & Soil-Gas Investigation

Approx. Property Boundary
Chain Link Fence
Block Wall
Vapor Degreaser
Solvent Recycling Unit
LAY-SB-2 Soil Boring Location (2001, 2002)
WCP-4 Monitor Well

N

0 20 40 60

12/2003

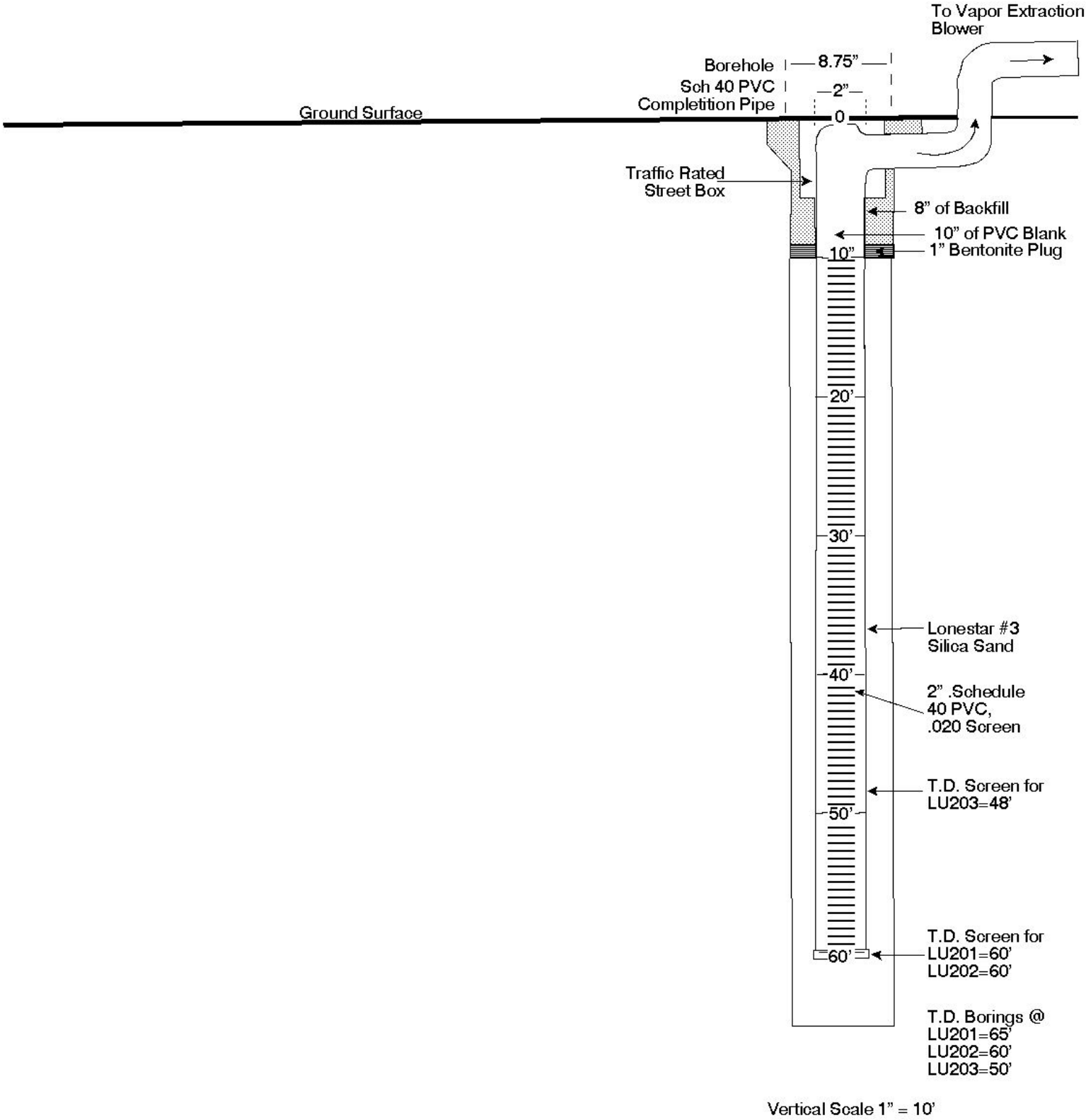

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Figure 3-1

Schematic for
Soil Vapor Extraction Wells
at the Layke Facility

12/2003

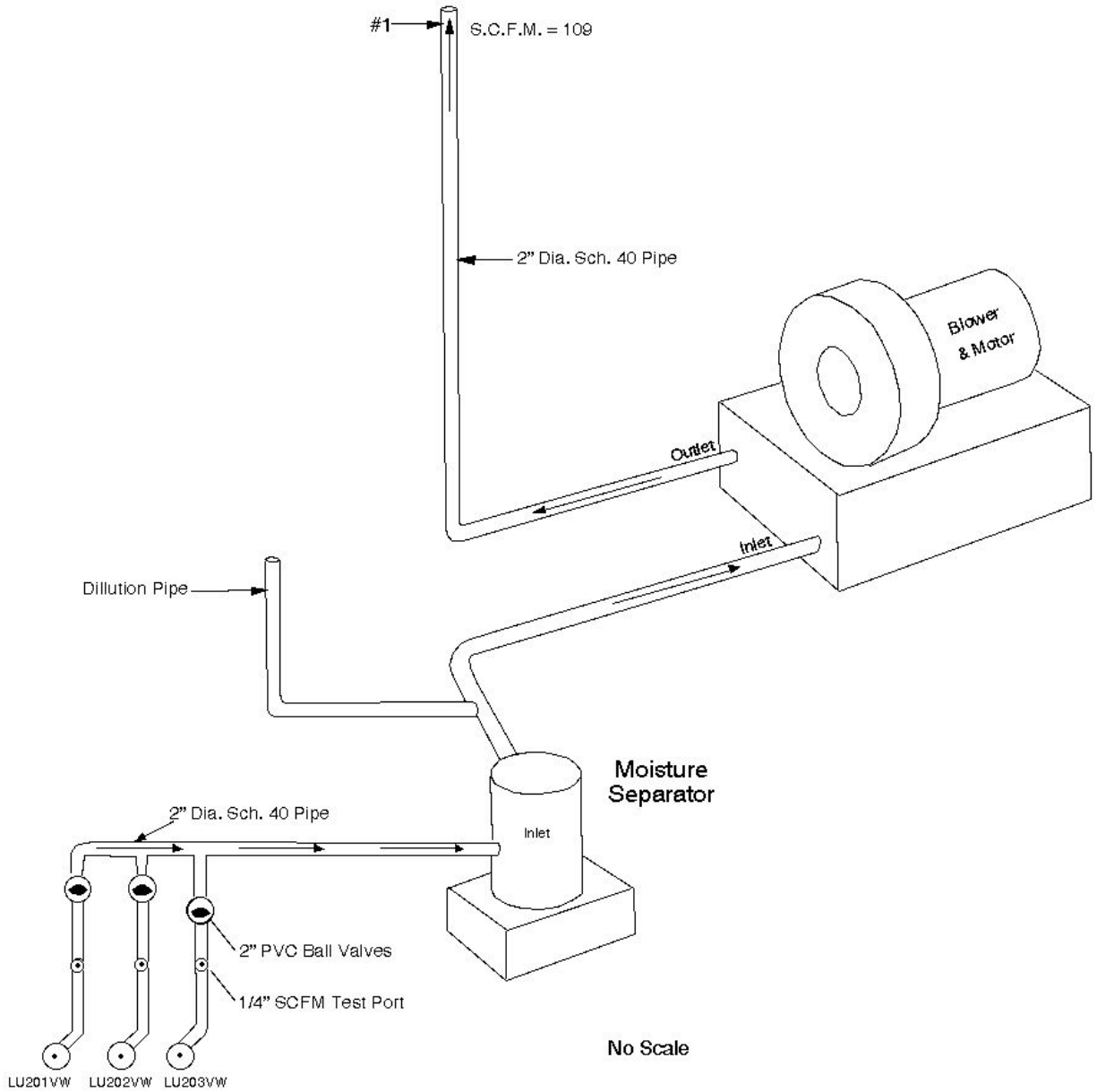

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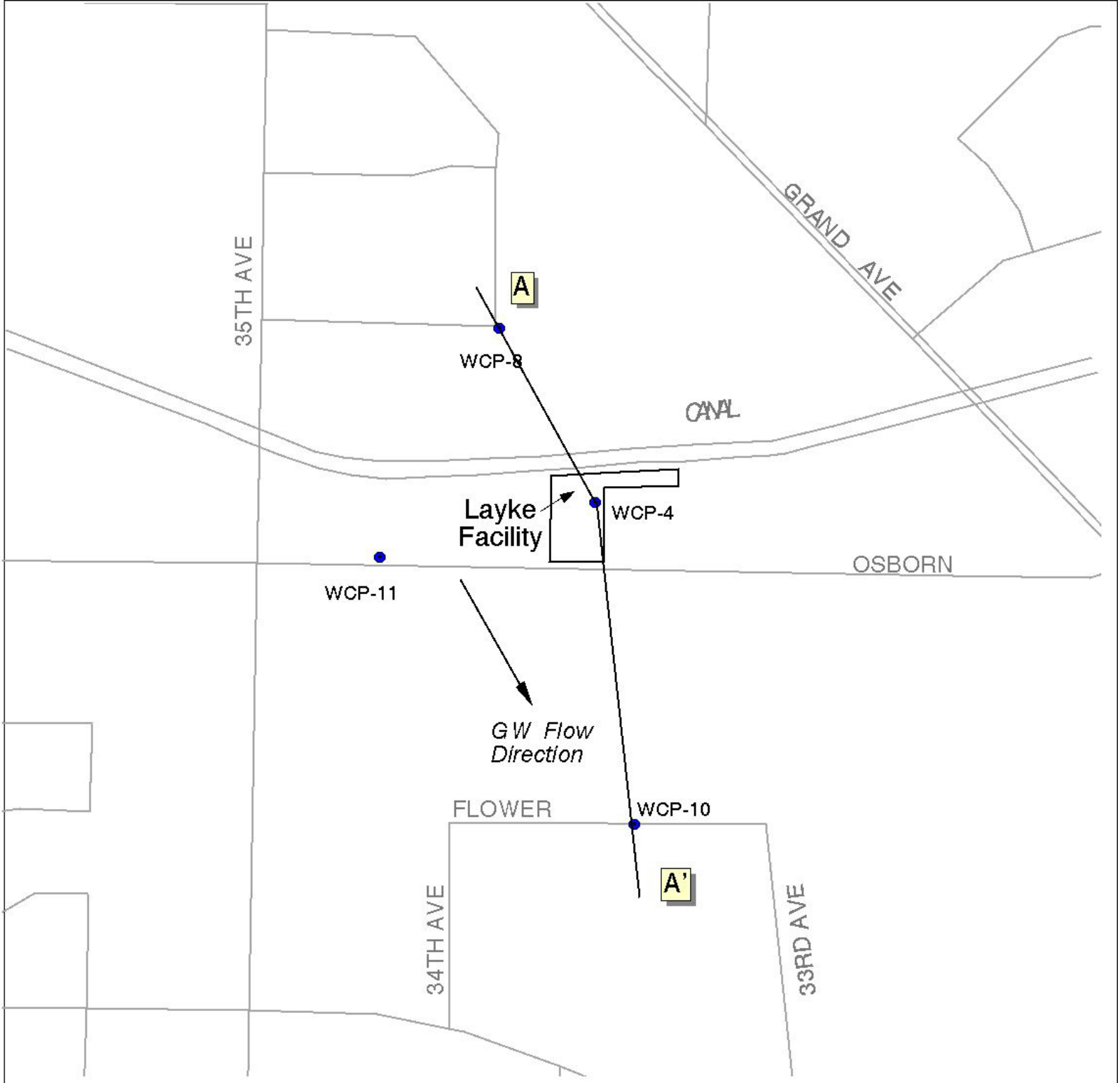
Figure 3-2

Soil Vapor Extraction
System Schematic
at the Layke Facility

12/2003

/export/gisdevmlc/waste/maprequests/year2003/ana_wpgwgrandavefinalFigure3_2.apr



200 0 200 400 Feet

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Figure 4-1

Line of Section at the Layke Facility

N

12/2003

/export/gisdev/nic/maprequests/year2003/ana_wcp_wgrandave/finalFigure 4_1.apr

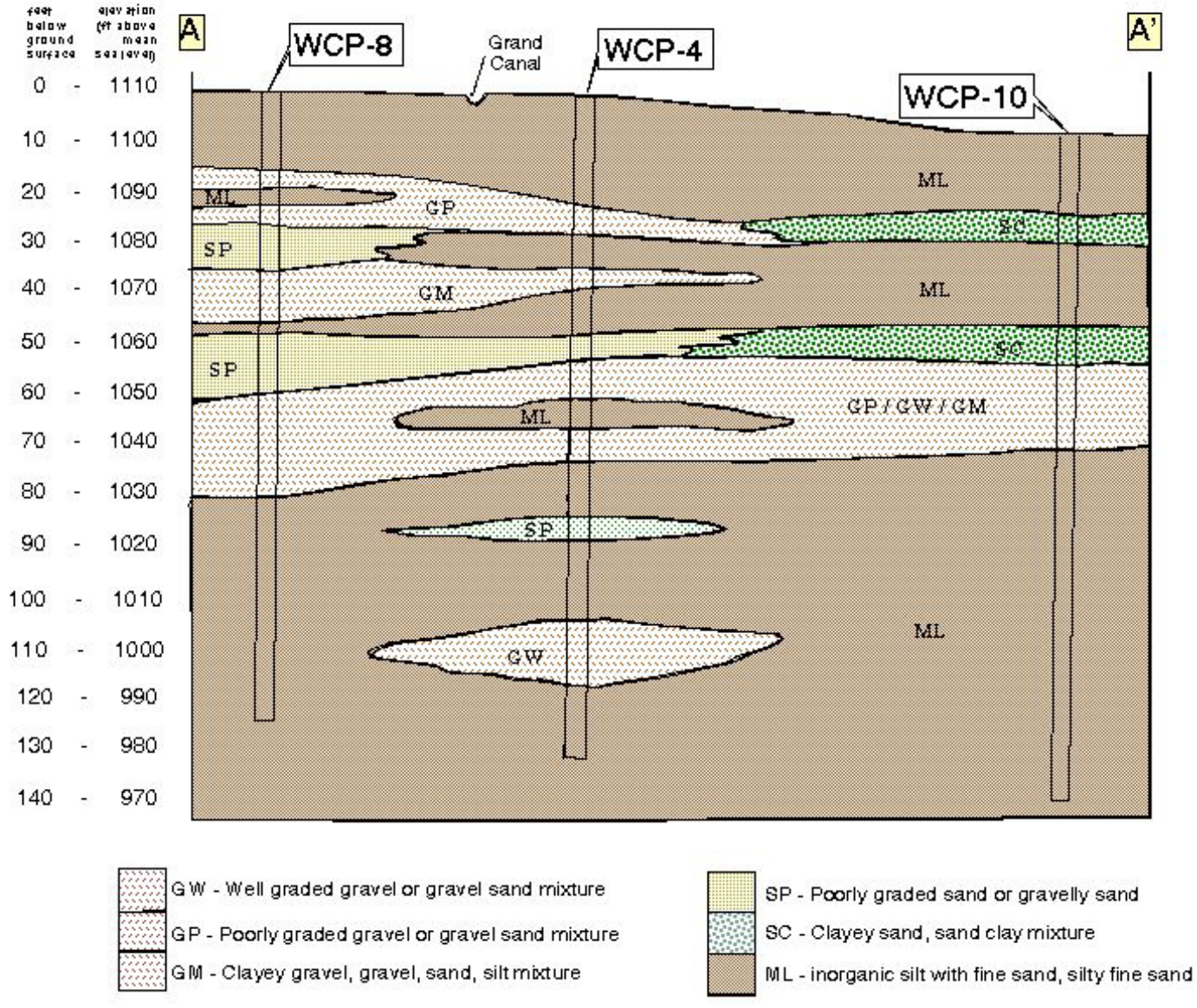

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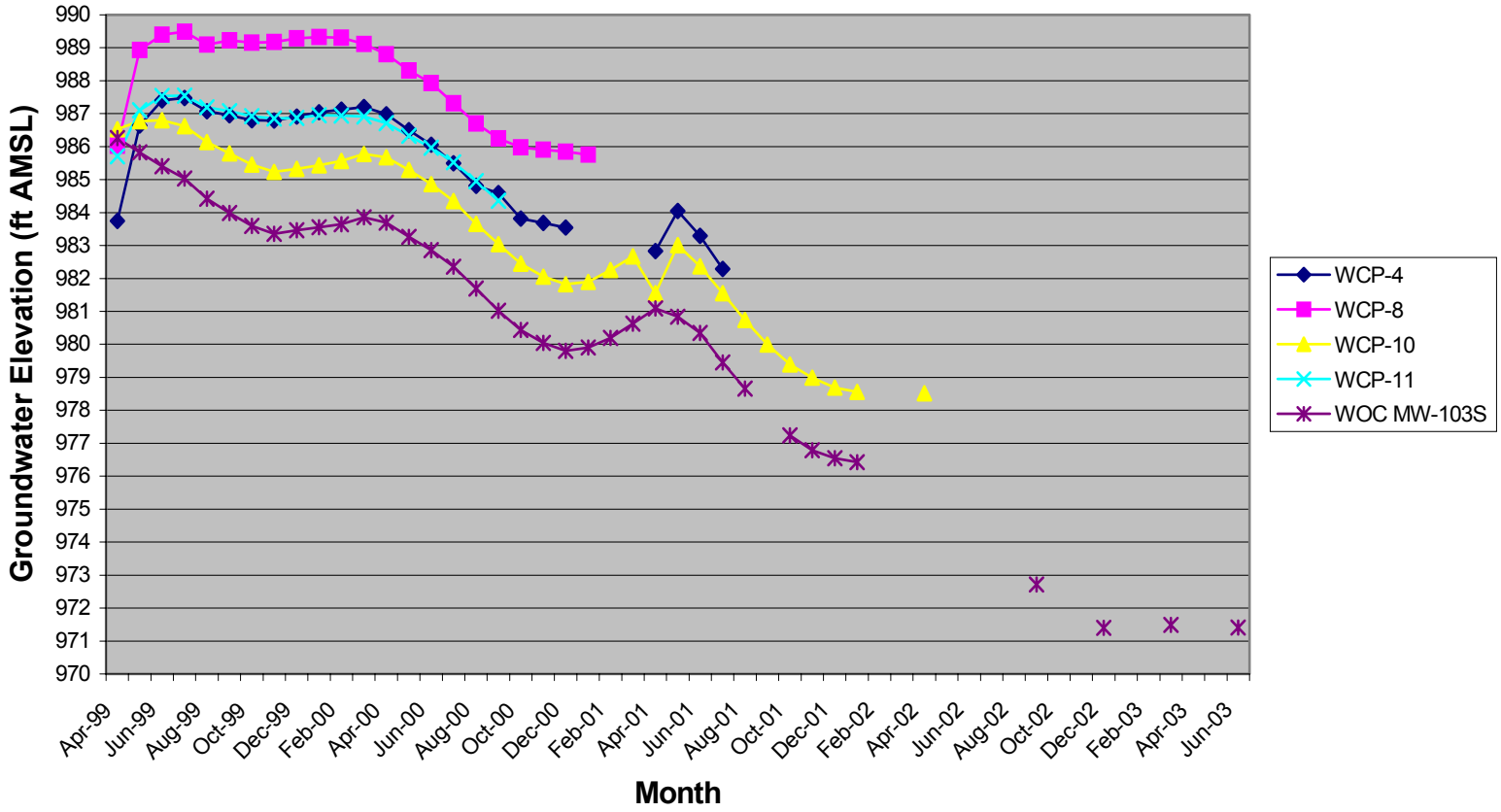
Figure 4-2

Cross Section A-A' at the Layke Facility

12/2003



Wells WCP-4, WCP-8, WCP-10 and WCP-11 are currently dry.

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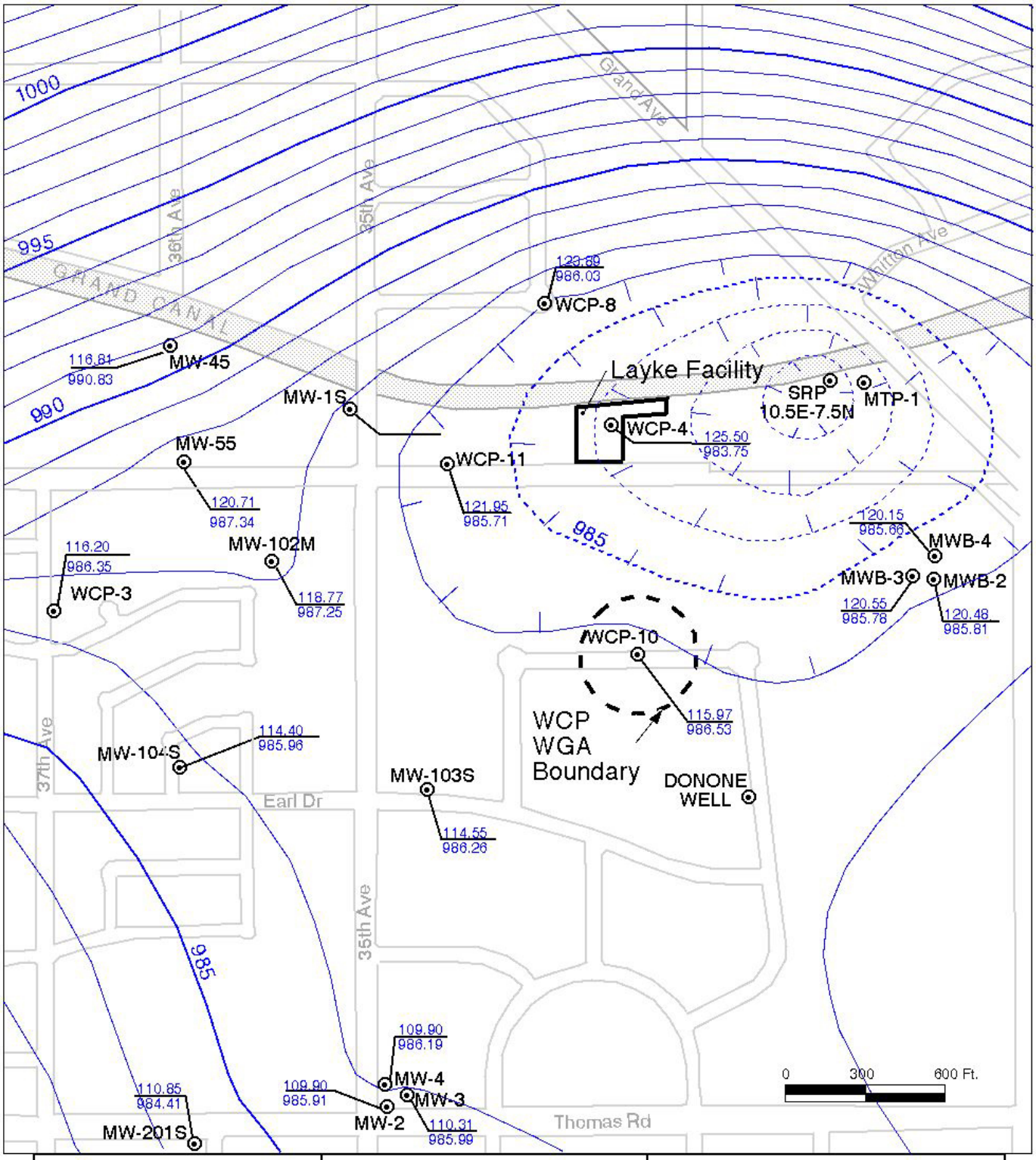
Figure 4-3

Hydrograph (April 1999 through June 2003)
WCP-4, WCP-8, WCP-10, WCP-11
& WOC MW-103S

12/2003

D:\AIV4500E\FACILITY\LAYKE\WCP WGA RI Report-Figure 4-3



Well

110.31 / 985.99 Depth to Groundwater / Groundwater Elevation

Canal

950 Groundwater Elevation Contour (1 Ft. Contour Interval)

Note:
All well locations are approximate.
Groundwater Elevations (feet above mean sea level), City of Phoenix Datum.
Contours are derived from a groundwater monitor well network that exceeds the area covered by this map.

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Figure 4-4
April 1999 Groundwater Elevations at the WCP WGA Site

N

12/2003

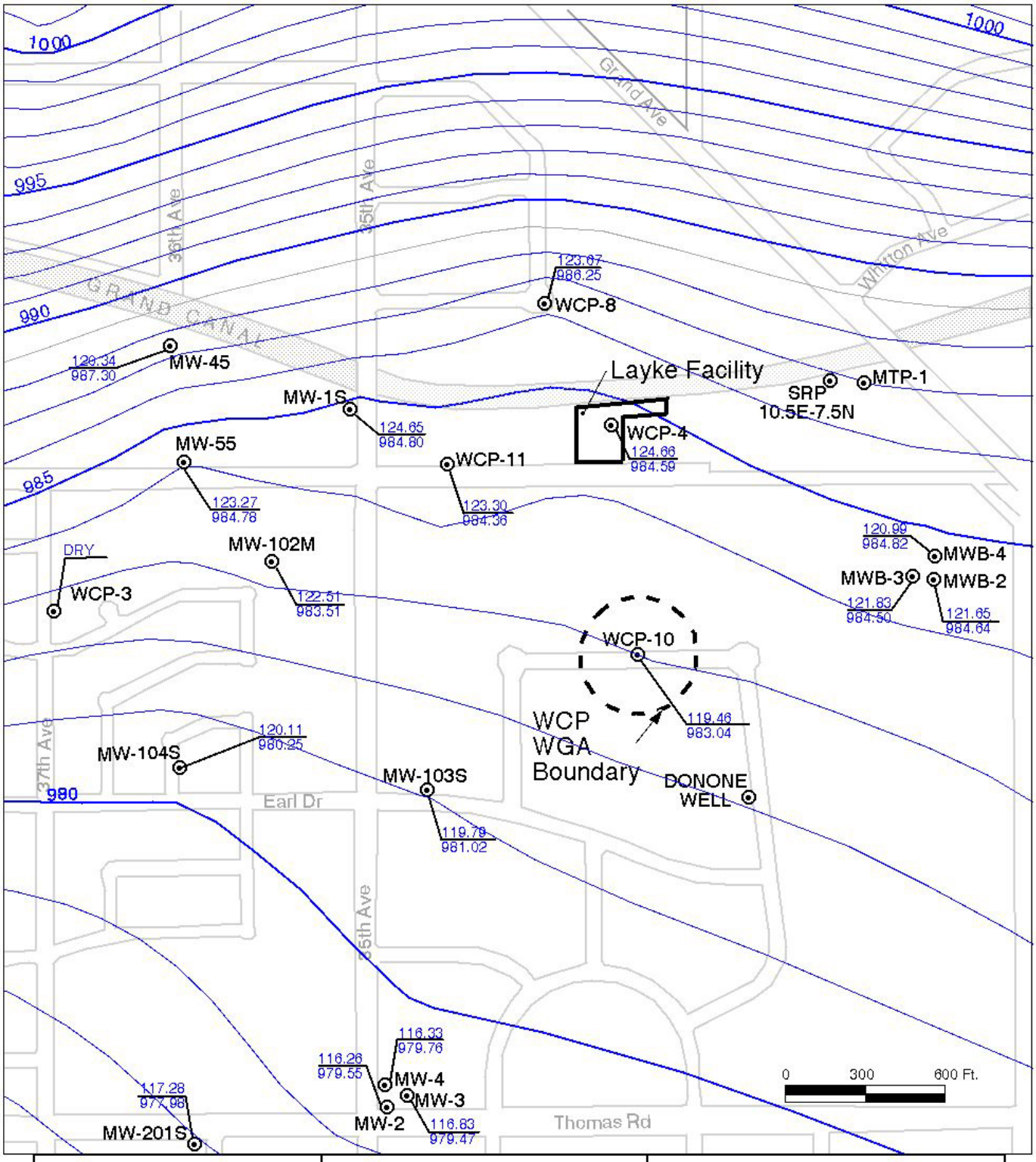

Figure 4-5
September 2000 Groundwater Elevations at the WCP WGA Site

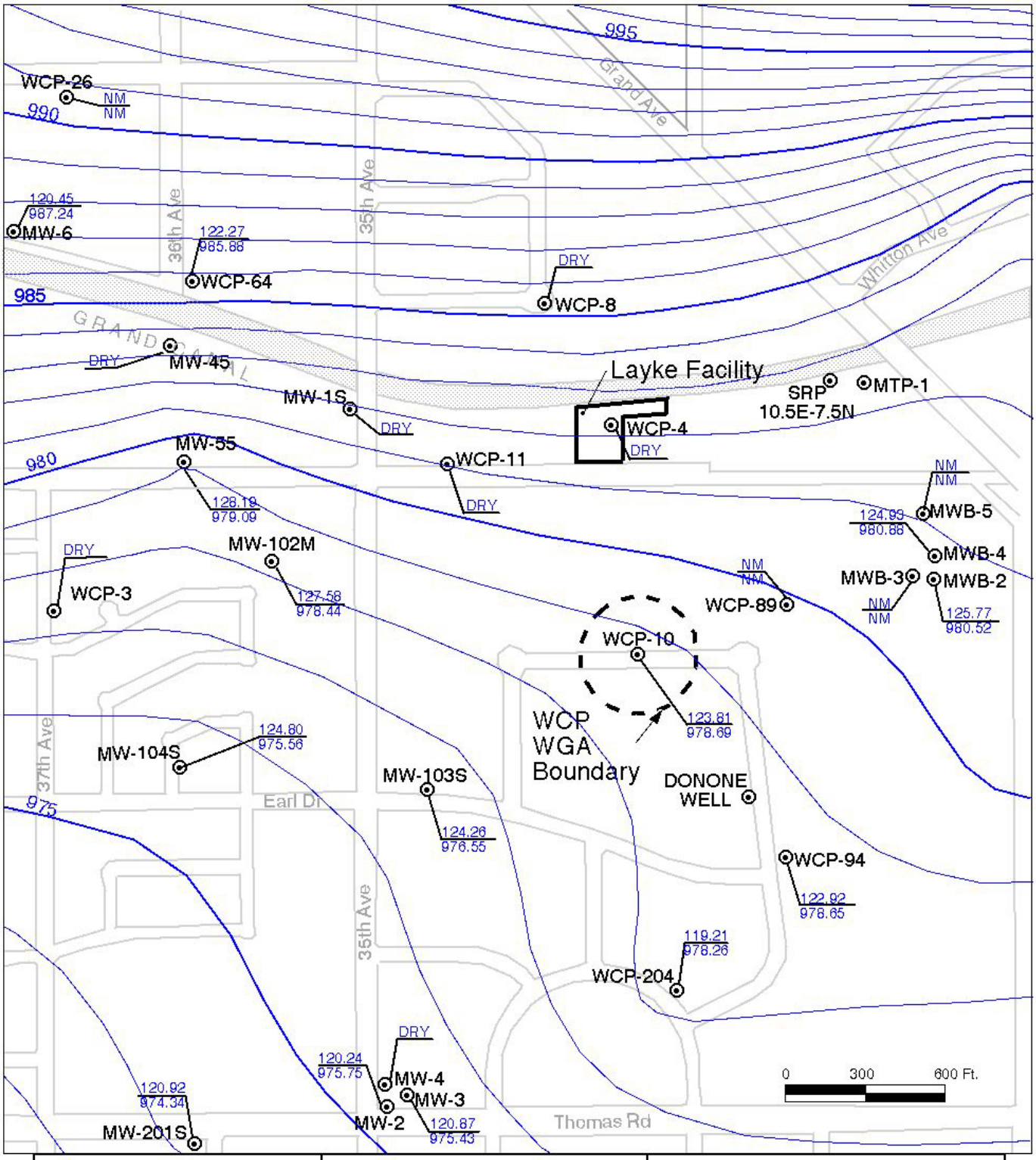

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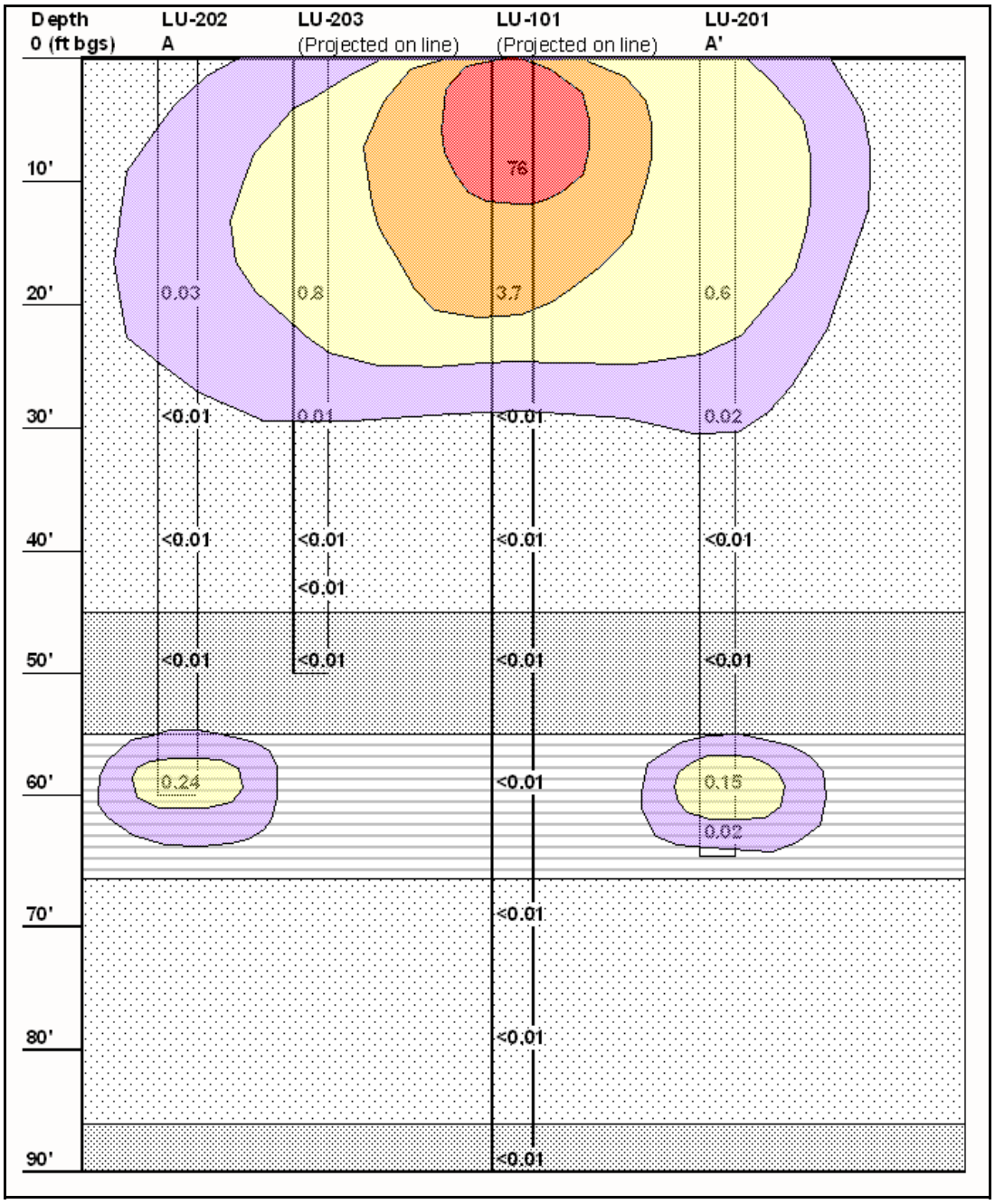
Figure 4-6
December 2001 Groundwater Elevations at the WCP WGA Site

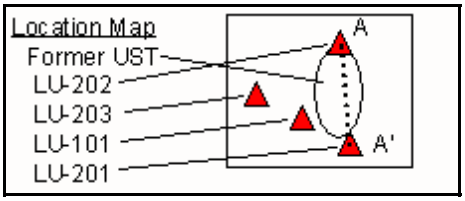
N

12/2003



TCE Concentration in mg/kg in soil solid samples

- 100-50
- 50-1
- 1-0.1
- 0.1-0.01



Lithology

- Silty Sand
- Poorly Graded Sand
- Clayey silt with fine sand

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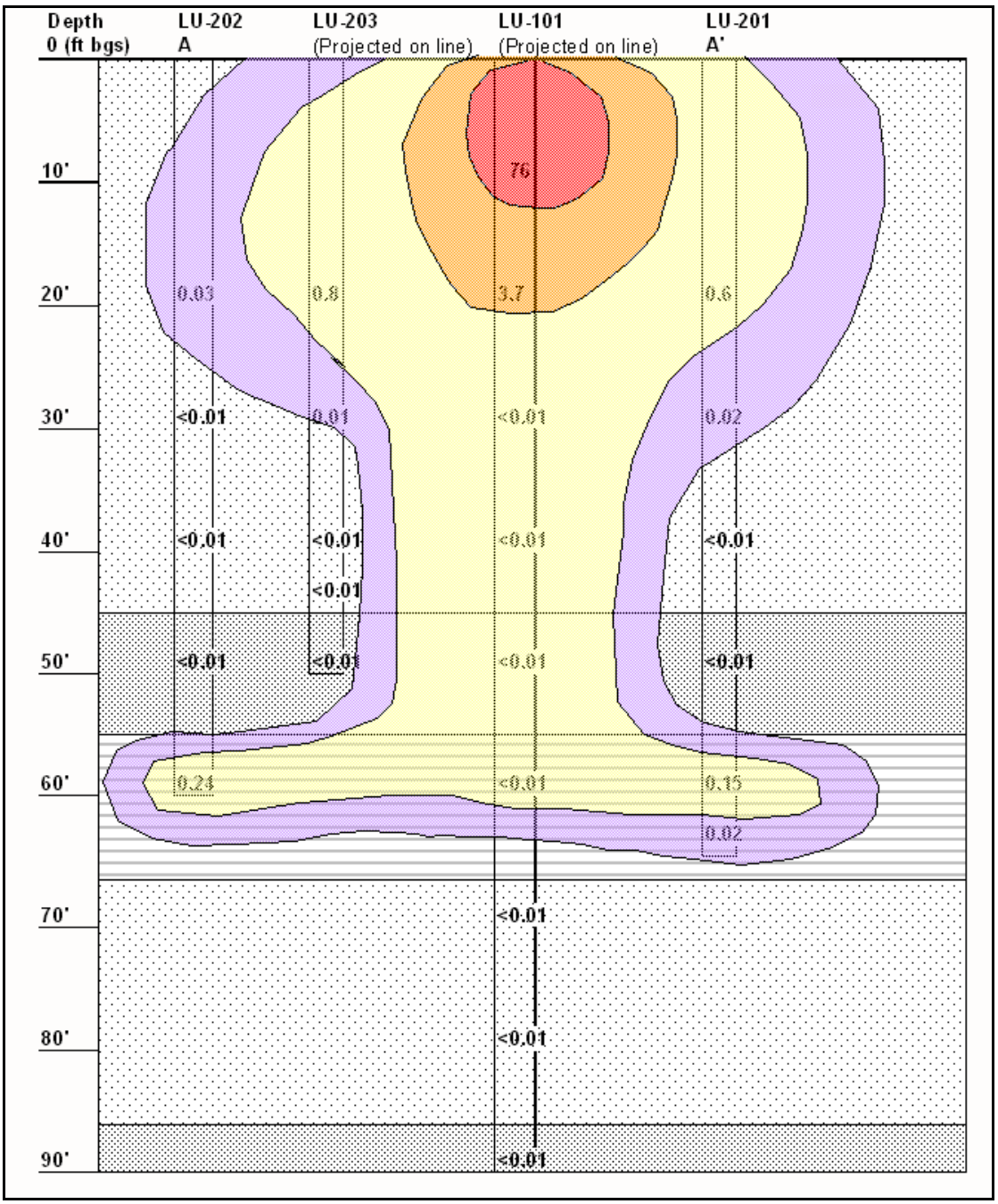
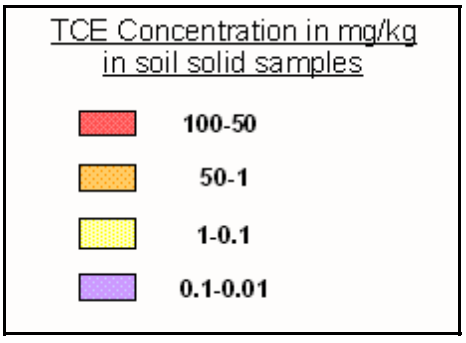
Figure 5-1

Previous Extent of Soil Contamination
at the Layke Facility Former UST Basin

12/2003

D:\AIV4500E\FACILITY\LAYKE\WCP WGA RI Report-Figure 5-1





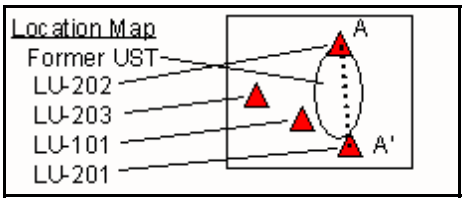


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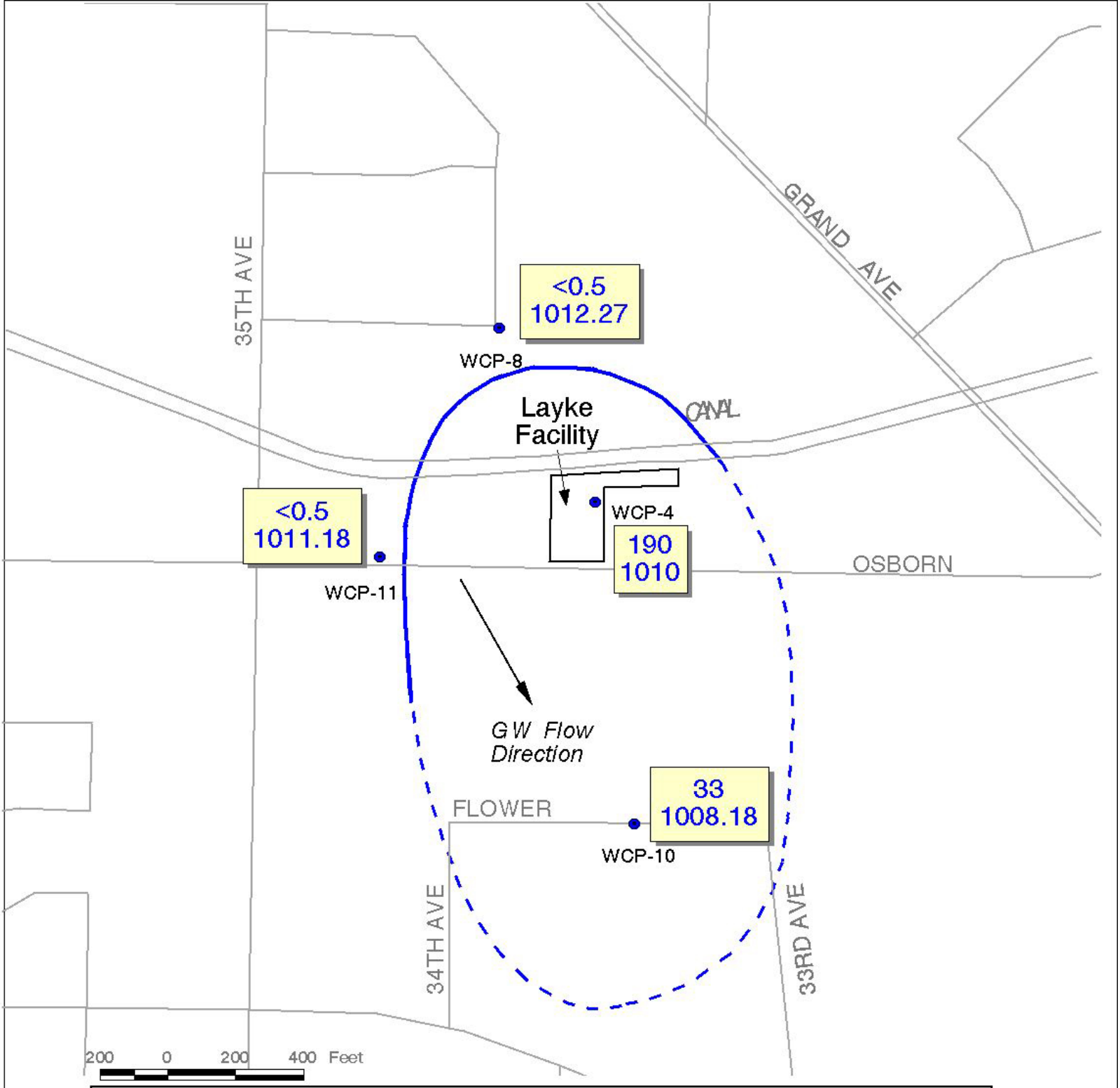
Figure 5-2
Cross Section Depicting
Potential Release Pathways at the
Layke Facility



Contour represents area of TCE contamination in groundwater that exceeds the Aquifer Water Quality Standard of 5 µg/L.

Dashed line indicates inferred extent of TCE contamination in groundwater that exceeds the Aquifer Water Quality Standard of 5 µg/L.

Roads

Canals

Well symbol & identifier

WCP-4
1.0
900.00

TCE concentration in µg/L & water level in feet amsl.

N

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Figure 5-3

TCE Concentration Contour Map
February 1996

12/2003

/export/gisdev/nic/maprequests/year2003/ana_wcp_wgrandave/finalFigure 5_3.apr

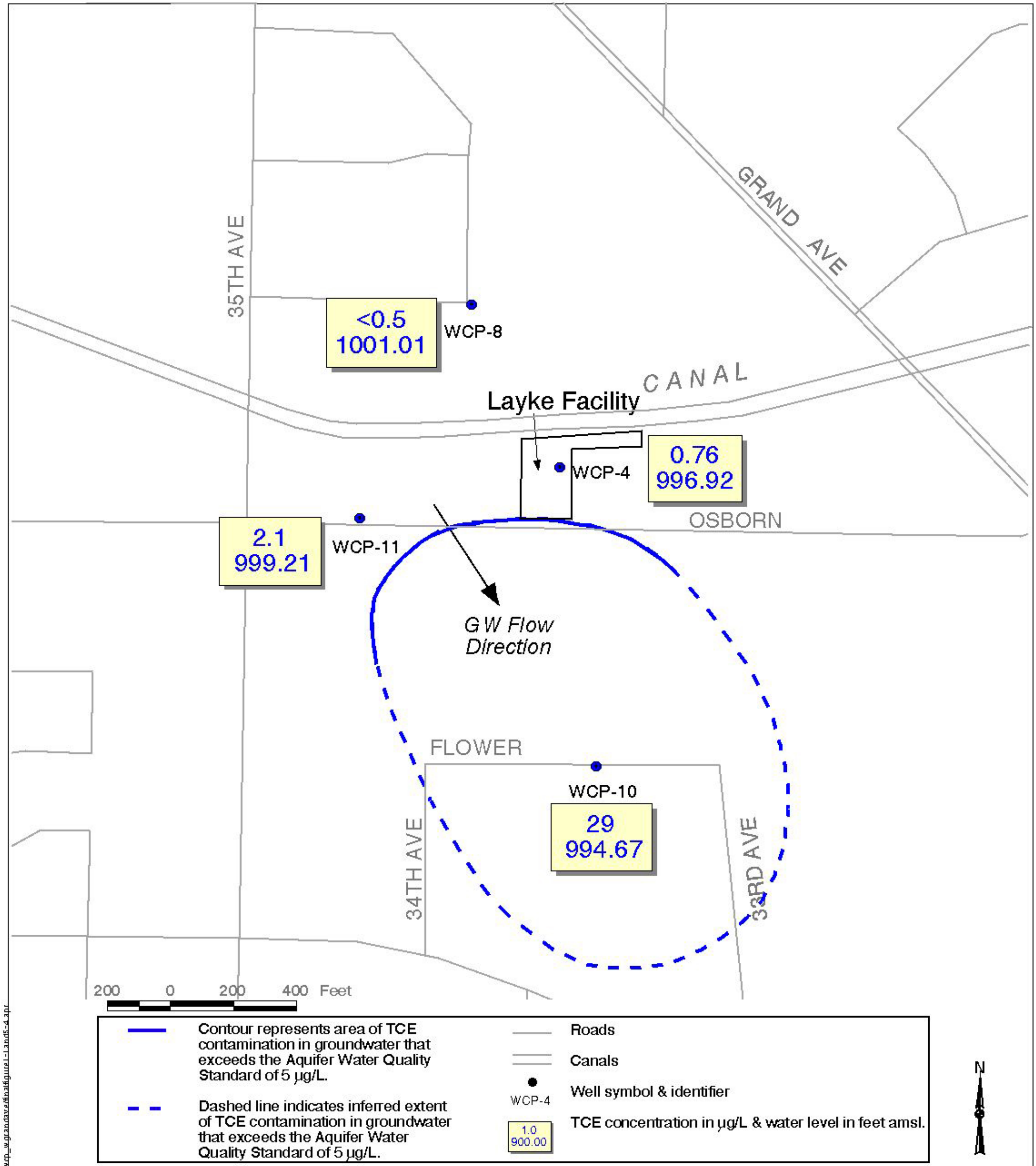

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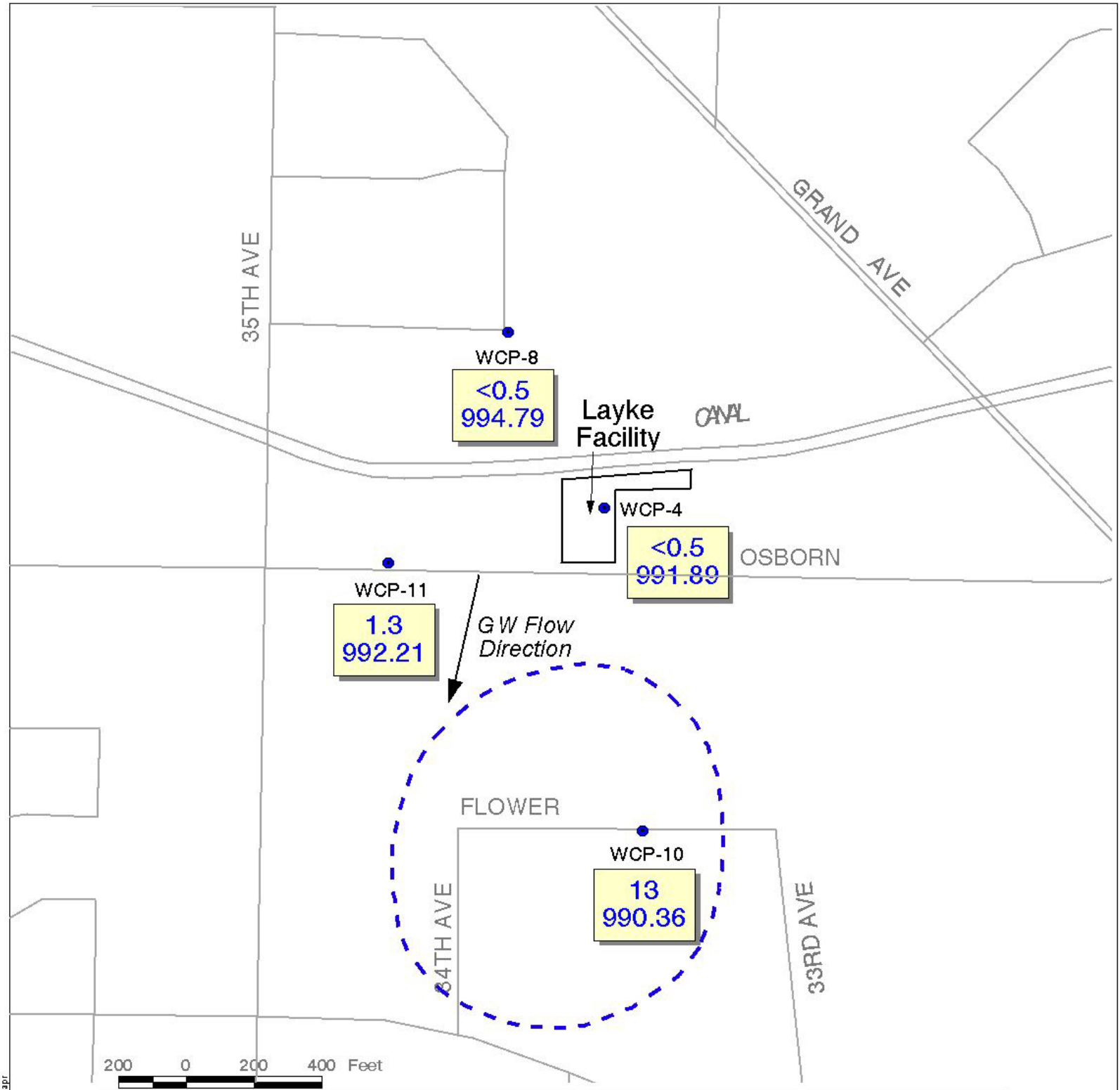
Figure 5-4

TCE Concentration Coutour Map
February 1997

12/2003



Contour represents area of TCE contamination in groundwater that exceeds the Aquifer Water Quality Standard of 5 µg/L.

Dashed line indicates inferred extent of TCE contamination in groundwater that exceeds the Aquifer Water Quality Standard of 5 µg/L.

Roads

Canals

Well symbol & identifier

WCP-4
1.0
900.00

TCE concentration in µg/L & water level in feet amsl.

N

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Figure 5-5

TCE Concentration Contour Map
February 1999

12/2003

/export/gisdevnic/maprequests/year2003/ana_wcp_wgrandave/finalFigure 5_4and5_5.apr