PROPOSED REMEDIAL ACTION PLAN

East Central Phoenix
48th Street and Indian School Road
Water Quality Assurance Revolving Fund Site

PHOENIX, ARIZONA

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Prepared by:

ADEQ Arizona Department of Environmental Quality

Clean Air, Safe Water, Healthy Land for Everyone

Waste Programs Division
Remedial Projects Unit
1110 West Washington Street
Phoenix, Arizona 85007

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Acronyms

A.A.C	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AWQS	Aquifer Water Quality Standard
A.R.S.	Arizona Revised Statute
c-1,2-DCE	cis-1,2-Dichloroethene
COC	Contaminant(s) of Concern
bgs	Below Ground Surface
DO	Dissolved Oxygen
ECP	East Central Phoenix
ERD	Enhanced Reductive Dechlorination
FS	Feasibility Study
ft/ft	Feet per Foot
ft/day	Feet per Day
GWET	Groundwater Extraction and Treatment
IAQ	Indoor Air Quality
IRA	Interim Remedial Action(s)
ISCO	In-Situ Chemical Oxidation
ISCR	In-Situ Chemical Reduction
LAU	Lower Alluvial Unit
LGAC	Liquid Phase Granular Activated Carbon
µg/L	Micrograms per Liter
µg/m3	Micrograms per Cubic Meter
mg/kg	Milligrams per Kilogram
MAU	Middle Alluvial Unit
mg/L	Milligrams per Liter
MNA	Monitored Natural Attenuation
ORP	Oxidation-Reduction Potential
PCE	Tetrachloroethene
PRAP	Proposed Remedial Action Plan
RSL	Regional Screening Level
RO	Remedial Objective(s)
ROD	Record of Decision
RSRL	Residential Soil Remediation Level(s)
SRP	Salt River Project
SVE	Soil Vapor Extraction
TCE	Trichloroethene
UAU	Upper Alluvial Unit
VOC	Volatile Organic Compound(s)
WQARF	Water Quality Assurance Revolving Fund

1.0 INTRODUCTION

The Arizona Department of Environmental Quality (ADEQ) prepared this Proposed Remedial Action Plan (PRAP) for the East Central Phoenix (ECP) 48th Street and Indian School Road Water Quality Assurance Revolving Fund (WQARF) Site (Site), located in Phoenix, Arizona (Figure 1). This PRAP was prepared in accordance with Arizona Revised Statute (A.R.S.) Section (§) 49-287.04 and Arizona Administrative Code (A.A.C.) R18-16-408. The PRAP is based on information contained in the following documents:

- *Remedial Investigation Report, East Central Phoenix 48th Street and Indian School WQARF Registry Site, Phoenix, Arizona (Wood, 2019); and*
- *Feasibility Study Report, East Central Phoenix 48th Street and Indian School WQARF Site, Phoenix, Arizona (Wood, 2020).*

The information presented in the PRAP was taken directly from the above-referenced reports without attribution other than that noted in this document. The detailed history of environmental investigations, Interim Response Actions (IRAs), and preliminary screening of remedial alternatives completed for the Site is presented in the referenced documents and is not reiterated in detail in this document.

The purpose of the PRAP is to inform the public on the remedy proposed from the alternatives evaluation presented in the Feasibility Study (FS), which addressed the site-specific Remedial Objectives (ROs). The PRAP is part of the remedy selection process under the WQARF program where public input is solicited on the Proposed Remedy and on the rationale for proposing the remedy. ADEQ will review the public comments and prepare a responsiveness summary to address the public comments. The responsiveness summary will be part of the Record of Decision (ROD). The remedy for the Site will be selected by ADEQ in the ROD.

This PRAP, in accordance with A.R.S. §49-287.04, describes the following:

- The boundaries of the Site that is the subject of the remedial action;
- The results of the Remedial Investigation and the FS;
- The Proposed Remedy and estimated cost; and
- How the remediation goals and selection factors in A.R.S. §49-282.06 and rules adopted by the ADEQ Director have been considered.

2.0 SITE BOUNDARIES

The boundaries subject to remedial action include the area approximately bounded by Devonshire Avenue to the north, Weldon Avenue to the south, 48th Street to the east, and 42nd Street to the west (Figure 1 and Figure 2). The Site includes the geographical area of the current groundwater plume impacted with volatile organic compounds (VOCs). The Site abuts the 40th Street and Osborn WQARF Site immediately to the west. These sites are hydrogeologically continuous but with geographically separate plumes. Both sites are shown on the figures for clarity and context.

3.0 REMEDIAL INVESTIGATION RESULTS

This section presents a summary of the remedial investigations conducted at the Site. The source of the data presented in this section is the Remedial Investigation Report (Wood, 2019).

3.1 Site Description and History

The Site is located within a mixed commercial and residential area that includes small to medium-sized businesses, single family and multi-family residences, and Arcadia High School. The City of Phoenix indicated there are no current foreseeable plans to alter current zoning districts within the Site boundaries.

The Site is adjacent to and upgradient of the 40th Street and Osborn Road WQARF Site. The contaminant plumes for both sites are along a similar flow path but are separated by approximately 400 feet and the dividing line between these two Sites is 42nd Street (Figure 2).

Development of commercial activities began in 1966 and included dry-cleaning operations. Groundwater contamination was discovered in 1983 when the Salt River Project (SRP) collected groundwater samples from several wells that they were pumping in the Salt River Valley. This included SRP Well 17.9E-7.5N, located at the 40th Street and Osborn Road WQARF site (Figure 2) which had tetrachloroethene (PCE) concentrations above the Aquifer Water Quality Standard (AWQS) of 5.0 micrograms per liter (µg/L). Subsequent investigations identified dry cleaning facilities that operated at the northeast corner of 48th Street and Indian School Road as the source area of the PCE (Figure 2).

Area production wells include SRP wells 19 E-8.1N, 19 E-7.6N, 18.6 E-7.6N, and 17.9 E-7.5N as shown in Figure 2. SRP wells 19 E-7.6N and 18.6 E-7.6 N are located approximately 1,800 and 3,100 feet to the south-southwest of the source property, respectively. SRP well 19 E-8.1 N is located approximately 600 feet upgradient of the source property. The nearest drinking water well is an inactive City of Scottsdale well (Well #55-626544) located approximately 2.3 miles upgradient. Currently, there are no City of Phoenix wells located within five miles.

3.1.1 Site Geology

A detailed description of the physiography is provided in the RI Report (Wood, 2019). In summary, the Site is located within the eastern portion of West Salt River Valley sub-basin of the Phoenix Active Management Area, a broad, relatively level alluvial valley filled with layers of unconsolidated sand, gravel, silt, clay. The Arizona Department of Water Resources (ADWR) defined three hydrogeologic units in the basin-fill by differences in grain size that occur throughout most of the Phoenix Basin and are generally correlative with the hydrostratigraphic units defined by the United States Bureau of Reclamation in 1976. These include from the shallowest to deepest: the Upper Alluvial Unit (UAU), the Middle Alluvial Unit (MAU), and the Lower Alluvial Unit (LAU). The MAU and LAU are not present due to shallow bedrock.

The UAU consists predominantly of silt, clay, sand mixed with silt and/or clay, and gravel. Bedrock, identified as the Camels Head Formation, was encountered at a depth of 214 feet below ground surface (bgs) at SMW-16B and at a depth of 256 feet bgs at SMW-14B. The UAU/Camels Head Formation contact drops approximately 75 feet in a southwesterly direction across the area, which is a slope of approximately 0.02 feet per foot (ft/ft). The depth to groundwater is approximately 46 feet bgs. Groundwater elevations have generally declined since early 1994 when the depth to groundwater was approximately 20 feet bgs. The current and historical direction of groundwater flow has been to the west-southwest with a current gradient of approximately 0.0089 ft/ft (Figure 3).

3.2 Source of Contamination

Data collected during the remedial investigation indicated that contaminant releases occurred to soil and groundwater from releases related to dry cleaning operations. The identified sources of contamination are One Hour Martinizing and Sandy's Magic Tough Cleaners (Sandy's Cleaners) located at the Arcadia Towne Center (a multi-tenant shopping center). One Hour Martinizing operated from 1966 to 1987. Sandy's Cleaners began operation in 1987 and continues as a commercial dry cleaner and laundry service.

3.3 Contaminants of Concern

The Contaminant of Concern (COC) is PCE in groundwater. The only COC present above the AWQS is PCE. Other compounds that have historically been detected above regulatory levels in groundwater include trichloroethene (TCE) and cis-1,2-dichloroethene (c-1,2-DCE). None of these compounds are considered COCs.

3.3.1 Groundwater

Historically, the maximum PCE concentration was 6,200 µg/L from a groundwater sample collected from SMW-01 in March 1997. The current PCE concentrations (March 2024) range from non-detect to a maximum of 32 µg/L in monitor well BMW-05B (Figure 4). The PCE plume is approximately 2,400 feet long and 425 feet wide with a vertical thickness that ranges from approximately 10 feet to 100 feet (Figure 5) (WSP, 2024).

Historically, TCE and c-1,2-DCE have been detected above their respective AWQS. TCE was detected above the AWQS of 5.0 µg/L in only two samples since 1992; a sample in April 1992 (6.0 µg/L) in well SMW-01 and a sample in October 2011 in well SMW-03-60 (5.5 µg/L). TCE has been detected in groundwater samples in March 2024 in wells SMW-19A (0.44 µg/L), SMW-19B (0.26 µg/L), and BMW-05B (0.42 µg/L). C-1,2-DCE was detected above the AWQS of 70 µg/L in only five samples collected from well SMW-03-60 in October 2013 and May 2014, ranging from 74 µg/L to 120 µg/L. C-1,2-DCE has not been detected in a groundwater samples since September 2022 in wells SMW-03-60 (0.22 µg/L) and SMW-03-138 (1.1 µg/L). Concentrations of PCE along the groundwater plume flow path, downgradient of the source area, are decreasing in monitoring wells SMW-03-60, SMW-18, SMW-19A, SMW-19B, and BMW-05B. These decreasing trends were determined utilizing Mann-Kendall trend analyses (WSP, 2024).

3.3.2 Soil

Soil investigations were conducted at Sandy's Cleaners in 1992 and 1996. Soil samples were collected at depths ranging from five to 17 feet bgs. PCE was detected in these samples at concentrations below the Arizona Residential Soil Remediation Levels (RSRLs) of 0.51 milligrams per kilogram (mg/kg). Additional soil sampling was conducted in 2012 during the installation of monitoring wells at depths ranging from five to 40 feet bgs. PCE was detected above the RSRLs in one sample at a concentration of 2.4 mg/kg at a depth of 25 feet bgs. However, since PCE was not detected in the other soil samples during the 2012 investigation, the PCE detected in this single soil sample was considered to be a laboratory error.

ADEQ and SRP entered into an agreement to conduct a source control Interim Remedial Action (IRA) in 2000. As part of the IRA, SRP constructed a soil vapor extraction (SVE) system to remediate the source of PCE in soil. The SVE system operated from April 2006 until December 2011. SRP decommissioned their SVE system in April 2012 pending design and construction of an enhanced system. However, PCE concentrations in groundwater samples collected from source area wells, SMW-01 and ECP-01, decreased during SVE system operation and did not exceed 5.0 µg/L from 2013 through the December 2018 sampling event. Therefore, ADEQ decided to not continue the IRA SVE system operation at Sandy's Cleaners. The SVE system removed 319 pounds of PCE and remediated PCE concentrations in soil to levels that are no longer a threat to groundwater or human health.

3.3.3 Soil Vapor

Soil vapor investigations began in May 1996 and concluded in November 2015. These investigations were conducted at Sandy's Cleaners, Arcadia Towne Center, Arcadia High School, the neighborhood north of Indian School Road, and the neighborhood west of Arcadia High School as follows:

- At Sandy's Cleaners, PCE concentrations in soil vapor samples ranged from non-detect to 5,600,000 micrograms per cubic meter (µg/m^3) and were collected at depths ranging from five to 25 feet bgs;
- Soil vapor samples were collected at Arcadia Towne Center from six locations at the northern and eastern sides of the property at a depth of 15 feet bgs. PCE was not detected above the laboratory reporting limit of 20 µg/m^3 in any of the samples;
- In June 2012, soil vapor samples collected at Arcadia High School had PCE concentrations ranging from 90 to 4,300 µg/m^3 and were collected at depths ranging from seven to 15 feet bgs;
- Soil vapor samples collected from the neighborhood north of Indian School Road had PCE concentrations ranging from non-detect to 57,000 µg/m^3 and were collected at depths ranging from five to 25 feet bgs; and
- Soil vapor samples collected from the neighborhood west of Arcadia High School had PCE concentrations ranging from non-detect to 8,100 µg/m^3 and were collected at depths ranging from five to 25 feet bgs.

Based on the results of the soil vapor sampling, an indoor air sampling program was conducted in August 2013 to evaluate the vapor intrusion risk to nearby residences and Arcadia High School as follows:

- Seven indoor air quality (IAQ) samples were collected from seven residences in the neighborhood north of Indian School Road. PCE concentrations in these samples ranged from non-detect to 11 µg/m^3; all at or below the Residential Indoor Air Regional Screening Level (RSL) of 11 µg/$m^{3;}$
- Six IAQ samples were collected from six residences in the neighborhood west of Arcadia High School. PCE concentrations in these samples ranged from non-detect to 6.6 µg/m^3; all below or at the RSL of 11 µg/$m^{3;}$and
- At Arcadia High School, IAQ samples were collected from 30 classrooms. PCE concentrations in these samples ranged from non-detect to 34 µg/m^3. PCE concentrations in the five samples detected above the RSL of 11 µg/m^3 were attributed to chemicals used and stored in the classrooms.

A comparison of IAQ sample results to associated sub-slab soil vapor sample results was used in the RI Report to evaluate that soil vapor concentrations are protective of residential indoor air. Based on the assessment performed in the RI Report, the maximum sub-slab soil vapor PCE concentrations are protective of residential indoor air in the residential area north of Indian School Road, the neighborhood west of Arcadia High School, and Arcadia High School. The RI Report concluded that the five IAQ samples collected from classrooms in Arcadia High School with PCE concentrations above the RSL of 11 µg/m^3, when compared to the relative sub-slab soil vapor samples, were the result of ambient air sources and not soil vapor.

3.4 Nature and Extent of Contamination

Samples from soil, soil vapor, indoor air, and groundwater collected during the RI were compared to screening levels to identify which media have been impacted by COCs. The RI Report concluded that the groundwater was the only media with COC concentrations that exceeded a screening level or a regulatory standard. The current extent of PCE in groundwater at concentrations exceeding the AWQS is presented on Figures 4 and 5.

3.5 Risk Evaluation Summary

Multiple investigations have been conducted since VOCs were initially detected in the groundwater in 1983. The data from these investigations were used to evaluate the risks that the soil, soil vapor, and groundwater pose to the public and the environment. The risk evaluations indicate there is no current human health risk from soil, soil vapor, or groundwater contamination.

3.6 Remedial Objectives

3.6.1 Soil

The RO Report (ADEQ, 2019) identified the current and future land use as mixed residential and commercial. An IRA, as discussed in Section 3.3.2 of this PRAP, reduced the concentrations of PCE in soil to below the RSRLs. In addition, soil vapor and indoor air samples collected have confirmed that no properties are impacted with soil or soil vapor contamination above regulatory levels. Thus, a RO for soil is not needed.

3.6.2 Groundwater

The RO Report (ADEQ, 2019) identified current and future groundwater uses at the Site. These included the current and future use of groundwater for irrigation and drinking water by SRP well 19E-8.1N. Based on these groundwater uses, ADEQ established the following ROs for the Site:

- ***Irrigation Use*:** Protect against the loss or impairment of irrigation water threatened by the COC at the 48th and Indian School Road WQARF Site. Where protection cannot be achieved in a reasonable, necessary, or cost-effective manner, then restore, replace, or otherwise provide for irrigation water that is lost or impaired by the COCs at the 48th and Indian School Road WQARF Site. Action is needed for as long as necessary to ensure that, while the water exists and the resource remains available, the contamination associated with the 48th and Indian School Road WQARF Site does not prohibit or limit the designated use of groundwater; and
- ***Potable Use*:** Protect against the loss or impairment of potable water threatened by the COC at the 48th and Indian School Road WQARF Site. Where protection cannot be achieved in a reasonable, necessary, or cost-effective manner, then restore, replace, or otherwise provide for potable water that is lost or impaired by the COCs at the 48th and Indian School Road WQARF Site. Action is needed for as long as necessary to ensure that, while the water exists and the resource remains available, the contamination associated with the 48th and Indian School Road WQARF Site does not prohibit or limit the designated use of groundwater.

3.6.3 Surface Water

Current surface water use includes irrigation water from the SRP Arizona Canal. The SRP Arizona Canal is located at the northeastern boundary and is a concrete lined canal. The water in the Arizona Canal is supplemented with groundwater pumped from SRP wells near the Site. There are currently no impacted supply wells within the plume and monitoring suggests the plume will attenuate over time. Since there is no discharge to canal proposed, and hypothetical pumping would likely meet irrigation standards, a RO for surface water use is not needed. The ROs for groundwater use for the water pumped into the Arizona Canal are potentially applicable.

4.0 FEASIBILITY STUDY RESULTS

This section presents a summary of the FS conducted for the Site. The source of the data presented in this section is the FS Report (Wood, 2020).

4.1 Identification and Screening of Remedial Technologies

Soil impacts were remediated utilizing SVE as presented in Section 3. Thus, the FS focused on technologies to address the groundwater contamination. The FS identified several remedial technologies for remediating the impacted groundwater including: Monitored Natural Attenuation (MNA), Enhanced Reductive Dechlorination (ERD), injected liquid phase granular activated carbon (LGAC), in-situ Chemical Oxidation (ISCO), in-situ chemical reduction (ISCR), and groundwater extraction and treatment (GWET).

These remedial technologies were screened based on the anticipated ability of the technology to address the ROs and reduce the contaminant concentration, mass, and/or toxicity. Each technology was screened for effectiveness, implementability, health and safety concerns, flexibility, expandability, and cost. Based on the screening results, MNA, GWET, and ISCO were retained for use at the Site.

4.2 Development of the Reference Remedy and Alternative Remedies

The retained remedial technologies were used to develop a reference remedy and two alternative remedies (a less aggressive remedy and a more aggressive remedy). The development of the reference remedy and alternative remedies considered the following:

- The data obtained from the remedial investigations;
- Ability to achieve the ROs;
- Consistent with current and future land and water use;
- The best available engineering and scientific information concerning available remedial technologies; and
- Preliminary analysis of the comparison criteria and the ability of the remedies to comply with A.R.S. §49-282.06.

4.2.1 Reference Remedy

The Reference Remedy proposed the following remedial technologies for the remediation of impacted groundwater:

- **GWET** – GWET included pumping contaminated groundwater from the plume and treating the groundwater ex-situ before discharge. The GWET would be implemented when PCE concentrations did not demonstrate a decreasing trend and would be in operation for seven years;
- **MNA** – MNA included groundwater monitoring and sampling on a semi-annual basis of up to 24 monitoring wells for a period of up to 10 years; and

- **Increased GWET Operation Period (Contingency)** – This alternative included a contingency to operate the GWET and conduct MNA for an additional three years.

4.2.2 Less Aggressive Remedy

The Less Aggressive Remedy proposed the following remedial technologies for the remediation of impacted groundwater:

- **MNA** – MNA included groundwater monitoring and sampling on a semi-annual basis of up to 24 monitoring wells for a period of up to 15 years;
- **Additional Monitoring Well (Contingency)** – This alternative includes a contingency for a deeper monitoring well if the PCE groundwater plume continued to migrate down gradient; and
- **Increased Monitoring Period (Contingency)** – This alternative included a contingency to conduct MNA for an additional three years.

4.2.3 More Aggressive Remedy

The More Aggressive Remedy proposed the following remedial technologies for the remediation of impacted groundwater at the Site:

- **MNA** – MNA included groundwater monitoring and sampling on a semi-annual basis of up to 24 monitoring wells for a period of up to 11 years;
- **ISCO (Contingency)** – This alternative includes a contingency for ISCO. The ISCO system included injecting a chemical oxidant into groundwater via a network of injection wells to destroy or degrade organic compounds. ISCO would be implemented as two injection networks; one for the shallow upgradient portion of the plume and one for the deeper downgradient part of the plume. The system would be operated for up to three years;
- **Additional ISCO Injection Wells and Piping (Contingency)** – This alternative included a contingency for additional ISCO system wells and conveyance piping; and
- **Additional ISCO Operation Time Period (Contingency)** – This alternative includes a contingency to operate the ISCO system for additional two years.

4.3 Evaluation and Comparison of the Remedies

A comparative evaluation was conducted for the Reference, Less Aggressive, and More Aggressive Remedies to demonstrate that each remedial alternative would achieve the ROs in accordance with A.A.C. R18-16-407(H). The criteria used to evaluate each remedial alternative included practicability, risk, cost, and benefit. A summary of the evaluation for each remedial alternative is presented in Table 1.

Table 1 - Summary of Remedial Alternatives				
Alternative	**Practicability**	**Risk**	**Cost***	**Benefit**
Reference Remedy	• Highly Feasible • Moderately Implementable • Potentially Effective • Clean-Up Duration of 10 Years and 3 additional years with contingency	• Some Potential Risk	$3.22M	• Protects Water Supply and Achieves ROs
Less Aggressive Remedy	• Highly Feasible • Highly Implementable • Potentially Effective • Clean-Up Duration of 15 Years	• Some Potential Risk	$1.1M	• Protects Water Supply and Achieves ROs
More Aggressive Remedy	• Moderately Feasible • Least Implementable • Likely Effective • Clean-Up Duration of 11 Years	• Some Potential Risk	$6.13M	• Protects Water Supply and Achieves ROs
Notes: *The source of the costs presented in this table is Table 4 of the FS Report (Wood, 2020) Abbreviations: M - million				

4.3.1 Determination of Monitoring Period

The data collected during the remedial investigation indicate that PCE concentrations are expected to decrease via physical processes that include advection and dispersion. The FS Report used a pore water volume flushing analysis to estimate the time for PCE concentrations in the groundwater to decrease to levels below water quality standards.

The ambient groundwater flow velocity for the UAU aquifer at the Site is 0.8 to 1.4 feet per day (ft/day). An exchange of four pore volumes of water was used to estimate the time required to remove sufficient dissolved and sorbed VOC mass to achieve the cleanup goals. The cross-sectional area for the PCE plume is about 3,500 square feet. Assuming an average flow velocity of 1.0 ft/day, approximately 26,000 gallons of water flows into and out of the PCE remediation area each day which equals approximately 9,490,000 gallons per year. At an estimated porosity of 30 percent, the volume of water within the PCE plume is 26,289,440 gallons. Four times this amount is 105,157,760 gallons. Therefore, the estimated amount of time for four pore volumes of water to move through the remediation area is 11 years. Four additional

years was added to the pore volume estimate as a safety factor to the Less Aggressive Remedy to confirm achievement of the remedial goal.

4.4 Recommended Remedy

The remedy recommended by the FS was the More Aggressive Remedy.

5.0 PROPOSED REMEDY

The Proposed Remedy is based on the data presented in the FS Report. The FS Report evaluated remedial alternatives for COCs in groundwater (Wood, 2020). The remedial alternatives presented in the FS were developed to meet the ROs (ADEQ, 2019). As previously mentioned, a remedial alternative for soil is not warranted because no soil contamination is present. The Proposed Remedy for the groundwater consists of the Less Aggressive Remedy presented in the FS Report.

5.1 Proposed Remedy Summary

5.1.1 MNA

MNA is a remedial measure that involves routine groundwater sampling and analysis to monitor the results of one or more naturally occurring physical, chemical, or biological processes that reduce the mass, toxicity, volume, or concentration of chemicals in groundwater. MNA is a mechanism by which COCs are reduced by natural means without other control, removal, treatment, or aquifer-modifying activities. These in-situ processes may include dilution, adsorption, volatilization, precipitation, and biological degradation of the contaminants in the groundwater.

During the August 2016 groundwater sampling event, groundwater samples were analyzed for alkalinity, chloride, nitrate, and sulfate. Alkalinity ranged in concentration from 170 to 720 milligrams per liter (mg/L), chloride ranged from 160 to 330 mg/L, nitrate ranged in concentration from 0.43 to 21 mg/L, and sulfate ranged in concentration from 72 to 200 mg/L. Dissolved oxygen (DO) and oxidation-reduction potential (ORP) were measured in the groundwater samples collected in December 2018. The data indicated aerobic (DO greater than 1.0 mg/L) and strong oxidizing conditions (ORP ranged from 220-371 millivolts). The groundwater has historically been characterized by aerobic conditions.

The aforementioned data in conjunction with low to non-detect concentrations of PCE daughter products (TCE and c-1,2-DCE) indicate that biodegradation by reductive dechlorination is not contributing to the natural attenuation of PCE at the Site. However, PCE concentrations are still trending downwards as mentioned in Section 3.3.1. This is the result of dispersion of the plume over time whereby the concentrations decrease without a reduction in contaminant mass (i.e. spreading laterally and longitudinally). Dispersion is a recognized mechanism in MNA guidance by EPA and others. Dispersion is distinct from dilution whereby water is added (by some mechanism) to the plume to reduce concentrations. The FS concluded that PCE groundwater concentrations are expected to decrease via the non-destructive physical processes of advection and dispersion (Wood, 2020).

For the dispersion mechanism, MNA monitoring will comprise of the ongoing assessment of COC concentration trends using statistical methods. Water levels will be monitored to determine if the plume is shifting because of flow direction changes. In addition, wells will be periodically sampled for biological natural attenuation parameters. While biological MNA is not expected, it is prudent and relatively inexpensive to monitor these parameters to observe changes in aquifer geochemistry that may contribute to attenuation.

The groundwater samples will be analyzed for VOCs on a regular basis and MNA parameters less frequently. The VOC monitoring data will be used to evaluate plume migration, plume stability, and the natural attenuation (dispersion) of the plume. MNA will continue until the concentrations of the COCs drop below the AWQS in all site monitor wells.

Biological MNA parameters will be collected in year one and two to establish a baseline geochemistry and then years five, 10, and 15 to monitor geochemical changes. The MNA parameters that will be analyzed include alkalinity, chloride, total organic carbon, DO, ORP, pH, iron, manganese, nitrate, sulfate, methane, ethene, and ethane.

Based on Mann-Kendall trend analysis, MNA will be conducted for a period of up to 15 years as presented in Section 4.3.1. The groundwater monitoring well network shall consist of compliance wells, performance wells, and sentinel wells. Monitoring wells located outside the PCE plume boundaries have multiple groundwater sample results where PCE concentrations have been non-detect and below the AWQS of 5.0 µg/L. Therefore, groundwater samples are not required to be collected from these wells to monitor the remedy. These wells include ECP-01, ECP-02, ECP-03, SMW-01, SMW-02, SMW-04, SMW-05, SMW-07, SMW-08, SMW-16B, SMW-17, BMW-06A, and BMW-06B. The program will include semi-annual water level monitoring of all wells and annual reporting. The program will also include groundwater sampling of up to 13 wells for VOCs semi-annually and for MNA parameters for the first two years and then every five years, as shown in Table 2. After the completion of the baseline sampling events, the MNA performance parameters may be reevaluated to determine if a specific frequency may decrease for a specific MNA performance parameter or if a specific MNA performance parameter may be removed from the sampling program. The number of wells to be monitored and the frequency of monitoring will be adjusted over time in response to changing groundwater conditions. At a minimum, the number of wells and the frequency of monitoring will be evaluated and updated every three years.

MNA monitoring will continue for a period of two years after remediation objectives have been achieved in all site monitoring wells to ensure concentration levels are stable and remain below AWQS. If after eight years MNA is not performing in accordance with the objectives set forth, a contingency of an additional three years of MNA performance monitoring will be required.

Table 2 – MNA Monitoring Summary

Well Name	Screen Interval (feet bgs)	Sample Interval (feet bgs)	Monitored Parameters
SMW-03-060	13-60	49, 55	Water levels, VOCs & Natural Attenuation Parameters MNA parameters will be collected semi-annually in years one, two, five, 10, & 15
SMW-03-138	100-140	102	
SMW-06	20-60	55	
SMW-11	50-70	60	
SMW-12	144.9-164.9	150, 160	
BMW-05A	29.6-64.6	53, 55	
BMW-05B	75.1-115.1	77.5, 100, 111.7	
BMW-12B	120-170	125, 145, 165	
SMW-18	40-80	48, 55, 65, 75	
SMW-19A	40-70	53, 55, 65	
SMW-19B	80-120	80, 95, 105, 115	
Proposed New Well A	75-125	80, 100, 120	
Proposed New Well B	150-275	160, 220, 270	

Notes:
bgs = below ground surface
VOCs = volatile organic compounds
MNA = monitored natural attenuation

5.1.2 Additional Monitoring Well Contingency

As a contingency, an additional dual nested monitoring well is proposed to monitor the downgradient lateral and vertical delineation of the groundwater plume. The proposed well will be installed in the vicinity of soil boring BMW-15D (Figure 2). The proposed well will be completed to an approximate depth of 300 feet bgs. The proposed well screens will be completed at approximate depths of 75 to 125 and 150 to 275 feet. During well drilling, vertical profile VOC samples (e.g., hydro-punch) will be collected from the depth of first groundwater to total depth to confirm well screen depths. The well will be installed in accordance with applicable ADWR requirements.

5.1.3 Increased Monitoring Period Contingency

As a contingency, additional monitoring time may be required until the concentrations of PCE in groundwater attenuate to below the AWQS in all site monitor wells. The Proposed Remedy requires that progress of the remedy be evaluated every three years. If progress of the attenuation is not indicated after eight years, the contingency remedial measure of up to three additional years of monitoring may be implemented.

At the conclusion of MNA performance monitoring activities, the 26 monitoring wells associated with the Site will be abandoned in accordance with applicable ADWR requirements including A.A.C. R12-15-816. A list of the current monitoring wells to be abandoned is presented in Appendix A. After well abandonment, ADEQ will delist the Site in accordance with A.R.S. §49-287.01(K).

5.2 Periodic Reviews

Periodic reviews of remedial progress will be conducted as necessary to assess the effectiveness of the remedy in achieving the ROs. These reviews will be conducted, at a minimum, every three years.

5.3 Estimated Cost

The estimated cost of the Proposed Remedy is $2,766,000. This cost includes an annual three percent inflation rate. A summary of the costs associated with the remedy is presented in Table 3. The detailed costs are presented in Appendix B.

5.4 Duration

The estimated number of years required for the Proposed Remedy to achieve the ROs is 15 years.

Table 3 - Summary of Costs for Proposed Remedy	
Remedial Technology	**Cost**
Groundwater Sampling (up to 15 years)	$1,125,000
MNA Parameter Sampling (years 1, 2, 5, 10, 15)	$265,000
Periodic Site Reviews (every 3 years)	$165,000
Site Closure	$138,000
SUB-TOTAL	$1,693,000
Well Installation (Contingency)	$200,000
Additional 3 Years Sampling (Contingency)	$258,000
CONTINGENCY-TOTAL	*$458,000*
SUB-TOTAL WITH CONTIGENCY	***$2,151,000***
TOTAL WITH 3% YEARLY INFLATION	***$2,766,000***

6.0 CONSIDERATION OF REMEDIATION GOALS AND SELECTION FACTORS

This section presents how the remediation goals and selection factors outlined in A.R.S. §49-282.06 and A.C.C R18-16-408 were considered for the Proposed Remedy.

6.1 Rationale for Selection of the Remedy

The Proposed Remedy includes monitoring of the contamination and the installation of a dual nested downgradient monitoring well. The Proposed Remedy provides the best combination of remedial effectiveness, practicability, cost, and benefit for the restoration and use of the groundwater resource. There is a potential future human health risk associated with the contaminated groundwater at the Site and the components of the Proposed Remedy will be protective of public health and the environment. The risk to human health and the environment with these remedies is low and known exposure pathways have been addressed.

Each component of the Proposed Remedy is a proven, reliable remedial alternative that will be protective of the public health and the environment. The risk to human health and the environment with this remedy is low and all known exposure pathways have been addressed. Over time, the remedial actions will reduce the concentrations and the volume of contaminated groundwater at the Site. Groundwater monitoring and sampling will verify that the remedy is protective of public health and the environment during and after remedy implementation. The components of the Proposed Remedy are consistent and compatible with current and anticipated future land and resource use. Upon implementation, this remedy is considered to have a positive impact in terms of enhancement of future land uses and impacts on the local economy.

6.2 Achievement of Remedial Objectives

Per A.C.C. R18-16-408(B)(3), the Proposed Remedy must achieve each of the ROs established by ADEQ for the Site as presented in this PRAP. The Proposed Remedy for groundwater will achieve ROs for groundwater use by utilizing MNA. Groundwater monitoring and sampling will be used to confirm the groundwater ROs are being met.

6.3 Achievement of Remedial Action Criteria

A.R.S. § 49-282.06 requires that remedial actions shall:

- Assure the protection of public health and welfare and the environment;
- To the extent practicable, provide for the control, management, or cleanup of the hazardous substances in order to allow the maximum beneficial use of the waters of the state; and
- Be reasonable, necessary, cost-effective, and technically feasible.

As demonstrated in this PRAP, the Proposed Remedy meets the requirements of A.R.S. § 49-282.06. The Proposed Remedy is protective of human health and the environment, compliant with applicable laws,

and allows for the maximum beneficial use of the waters of the State at the lowest cost. The Proposed Remedy is the best combination of practicability, risk, cost, and benefit to achieve the ROs.

6.4 Consistency with Water Management Plans

The Proposed Remedy is consistent with the water management plans of local water providers. There are no active supply wells currently impacted by the plume. This remedy will allow for the maximum beneficial use of the waters of the State, protect the groundwater supply for future use, and ensure that wider areas are not impacted for future water development options.

6.5 Consistency with General Land Use Planning

The Proposed Remedy is consistent with the current land use and is not anticipated to negatively impact current or future land use at the Site.

6.6 Lead Agency Statement for Proposed Remedy

Based on the information currently available, the Proposed Remedy provides the best balance of tradeoffs among the other alternatives with respect to the comparison criteria. The Proposed Remedy will satisfy the remedial action criteria pursuant to A.R.S. § 49-282.06 and the ROs.

6.7 Uncertainties

Uncertainties associated with the Proposed Remedy include the duration of time required to remediate the groundwater at the Site. Pore-flushing calculations were used to estimate the duration of time required for the concentrations of COCs in the groundwater to reach the AWQS (Wood 2020). The assumptions used in the estimates may not fully represent all the conditions. Thus, the estimated duration required to remediate the groundwater could be more or less than the time frame estimated by the pore-flushing calculations.

6.8 Public Comment Period

The PRAP will be issued for a 90-day public comment period. A Community Advisory Board meeting may be held during the public comment period. ADEQ will accept written comments on this PRAP that are postmarked or emailed within the comment period and submitted to:

Arizona Department of Environmental Quality
Attention: Adam Nagle, Project Manager
Address: 1110 West Washington Street, Phoenix, Arizona 85007
Email: Nagle.Adam@azdeq.gov

7.0 REFERENCES

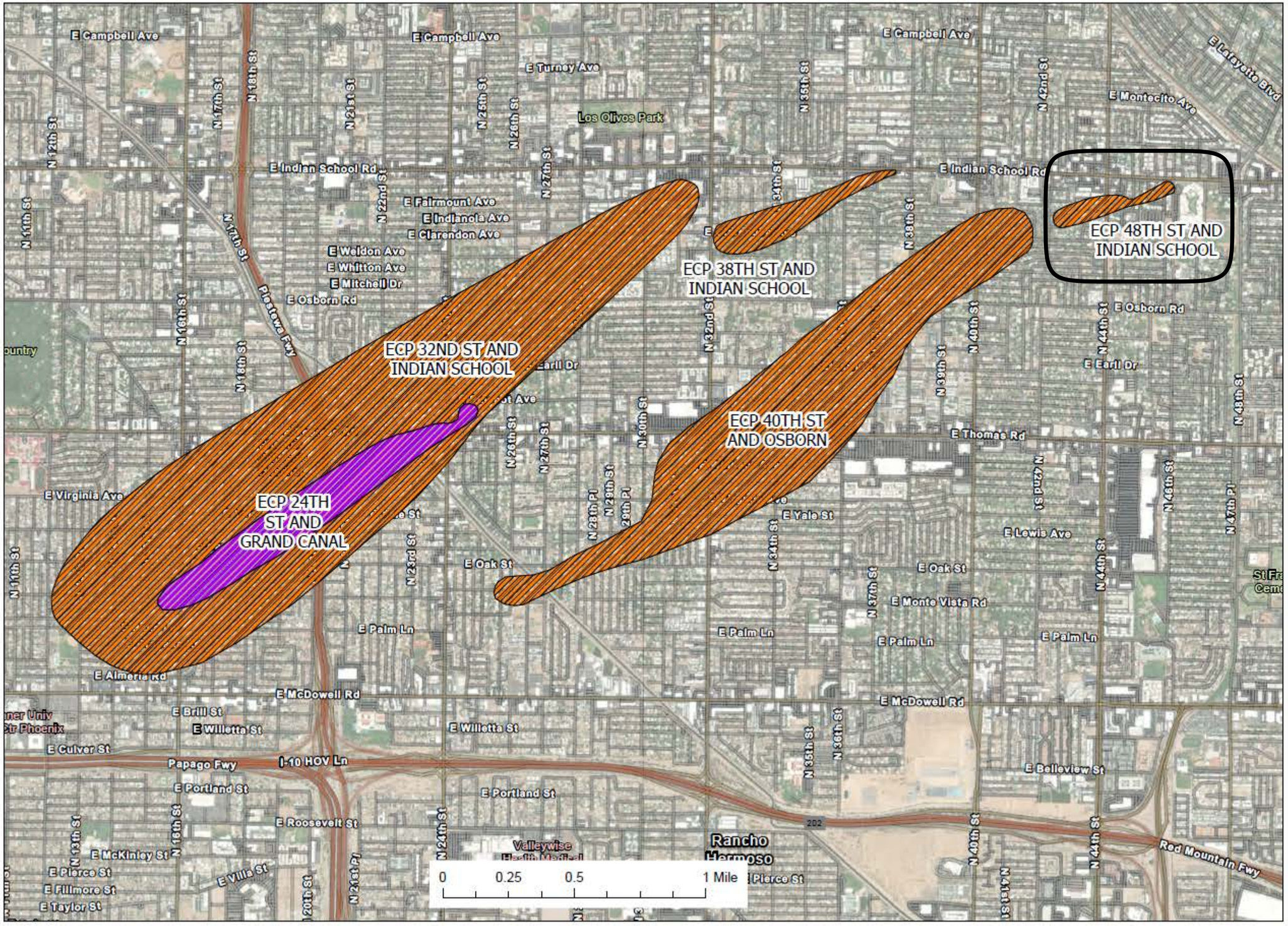
Arizona Department of Environmental Quality (ADEQ), 2019. Final Remedial Objectives Report, East Central Phoenix, 48th Street and Indian School Road WQARF Site, Phoenix, Arizona, October.

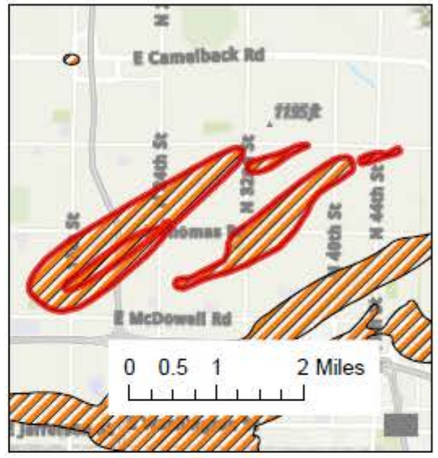
WSP Earth & Environmental, Inc. (WSP) formerly Wood Environment & Infrastructure Solutions, Inc. (Wood), 2019. Remedial Investigation Report, East Central Phoenix, 48th Street and Indian School Road WQARF Site, Phoenix, Arizona, November.

Wood, 2020. Feasibility Study Report, East Central Phoenix 48th Street and Indian School Road WQARF Site, Phoenix, Arizona, June.

WSP, 2024. Spring 2024 Groundwater Monitoring Technical Memo, East Central Phoenix 48th Street and Indian School Road WQARF Site, Phoenix, Arizona, April.

FIGURES





24th St Grand Canal Estimated Plume Boundary

ECP Estimated Plume Boundary

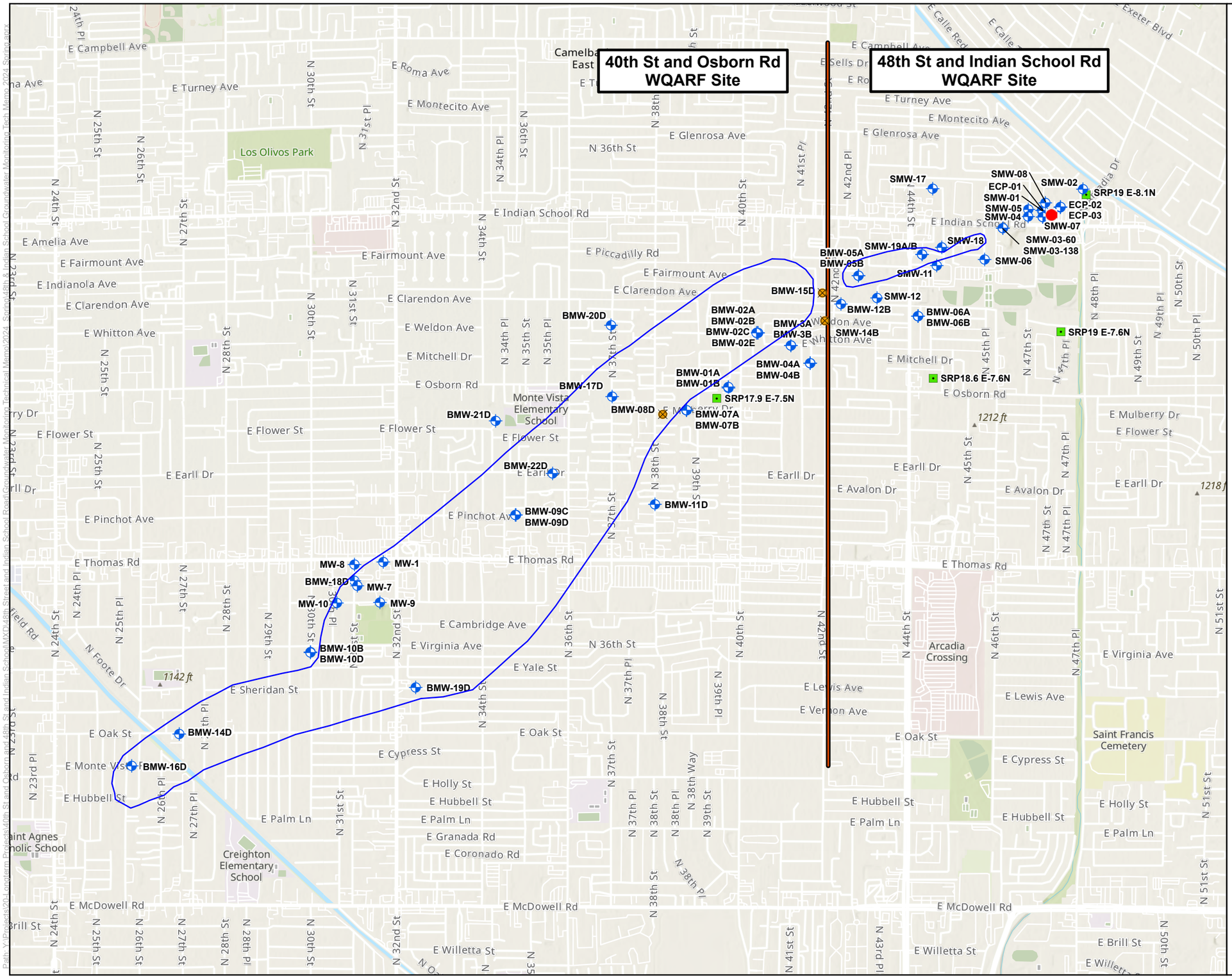
Counties

Figure 1 - Site Location Map

Plume boundaries depicted on the site map represent ADEQ's interpretation of data available at the time the map was constructed. The map is intended to provide the public with basic information as to the estimated geographic extent of known contamination as of the date of map production. The actual extent of contamination may be different. Therefore, the plume for this site may change in the future as new information becomes available.

ADEQ Arizona Department of Environmental Quality

2/16/2023



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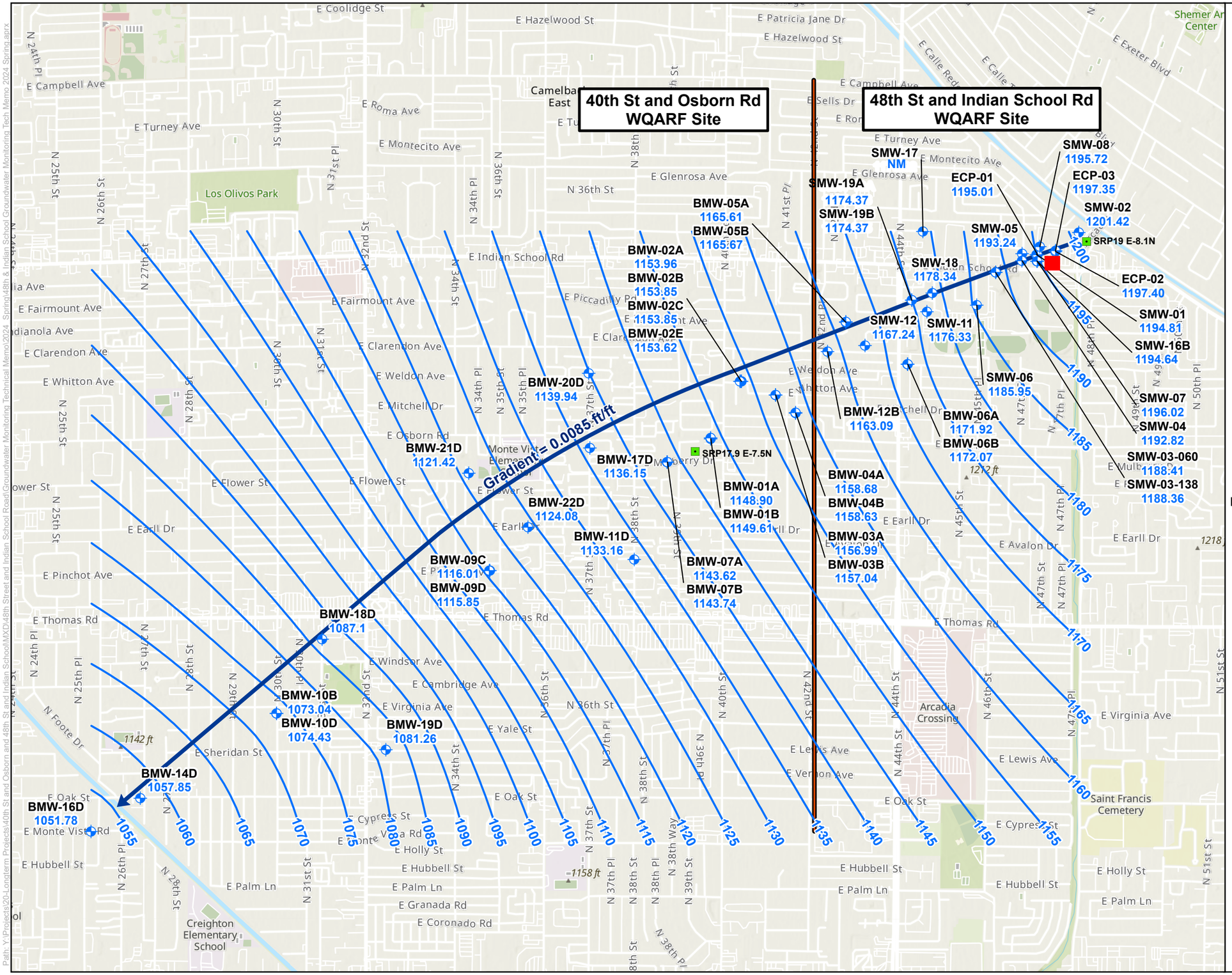


Legend

- Wells
- Groundwater Elevation Contour (ft amsl)
- Groundwater Flow Direction
- SRP Production Well
- Source Area: 1-Hour Martinizing & Sandy's Cleaners

Notes:

BMW-14D 1057.85	Groundwater Monitoring Well Identification Groundwater Elevation (ft amsl)
*	Groundwater elevation was not used in groundwater contouring
NM	Not Measured
ft amsl	Feet above mean sea level
WQARF	Water Quality Assurance Revolving Fund

0 750 1,500
Feet

N

Spring 2024 Groundwater Monitoring Technical Memorandum
ECP 48th St & Indian School Rd WQARF Site
Phoenix, Arizona

FIGURE 3

Groundwater Elevation Map March 2024

Job No.	14-2023-2031
PM:	JC
Date:	3/20/2024
Scale:	1"= 1500'

40th St and Osborn Rd WQARF Site

48th St and Indian School Rd WQARF Site

SMW-19A	
PCE (µg/L)	Depth (ft bgs)
3.3	***53***
14	***55***
22	***65***

SMW-19B	
PCE (µg/L)	Depth (ft bgs)
1.6	80
1.8	95
0.78	105
1.1	115

BMW-05A	
PCE (µg/L)	Depth (ft bgs)
<0.50	53
<0.50	55

BMW-05B	
PCE (µg/L)	Depth (ft bgs)
20	***77.5***
32	***100***
20	***111.7***

BMW-15D (5/2017)
All samples collected from 42 to 215 ft bgs were <0.25 µg/L for PCE

SMW-14B (12/2017)	
PCE (µg/L)	Depth (ft bgs)
<0.25	40
<0.25	65
7.36	***85***
<0.25	105
2.66	135
1.75	155
<0.25	175
<0.25	195
<0.25	214
0.74	240
<0.25	255

BMW-12B	
PCE (µg/L)	Depth (ft bgs)
<0.25	45
<0.25	65
<0.25	85
0.41	105
0.43	125
<0.50	145
<0.50	165
1.19	185

SMW-17	
PCE (µg/L)	Depth (ft bgs)
NS	48
<1.0	70
<1.0	85
<1.0	100
<1.0	115
<1.0	120

SMW-12	
PCE (µg/L)	Depth (ft bgs)
NS	60
NS	80
<0.5	100-140
<0.5	155
0.25	160
<0.5	180

BMW-06A	
PCE (µg/L)	Depth (ft bgs)
NS	43

BMW-06B	
PCE (µg/L)	Depth (ft bgs)
NS	77.9
NS	107.1

SMW-03-060	
PCE (µg/L)	Depth (ft bgs)
0.78	49
0.82	55

SMW-03-138	
PCE (µg/L)	Depth (ft bgs)
<0.50	102

SMW-05	
PCE (µg/L)	Depth (ft bgs)
NS	43

SMW-08	
PCE (µg/L)	Depth (ft bgs)
NS	43

ECP-01	
PCE (µg/L)	Depth (ft bgs)
NS	44

SMW-01	
PCE (µg/L)	Depth (ft bgs)
NS	43
NS	54

SMW-02	
PCE (µg/L)	Depth (ft bgs)
NS	46

ECP-02	
PCE (µg/L)	Depth (ft bgs)
NS	88

ECP-03	
PCE (µg/L)	Depth (ft bgs)
NS	43

SMW-07	
PCE (µg/L)	Depth (ft bgs)
NS	44
NS	48
NS	58

SMW-16B	
PCE (µg/L)	Depth (ft bgs)
NS	79
NS	100
NS	120
<0.25	140
<0.25	160
0.98	180
0.99	199

SMW-04	
PCE (µg/L)	Depth (ft bgs)
NS	42
NS	52

SMW-06	
PCE (µg/L)	Depth (ft bgs)
NS	40

SMW-18	
PCE (µg/L)	Depth (ft bgs)
1.5	48
1.2	55
1.3	65
1.1	75
<1.0	85
<1.0	100
<1.0	115
<1.0	120
<1.0	130

SMW-11	
PCE (µg/L)	Depth (ft bgs)
<0.50	60

SRP19 E-8.1N

SRP19 E-7.6N

SRP18.6 E-7.6N

Arcadia High School

Site Boundary

A

A'

20

5

Site Vicinity

Legend

- Groundwater Monitoring Well
- SRP Production Well
- Boring Location - Abandoned

Approximate Distribution of PCE

- Above 20 µg/L
- Above 5 µg/L
- Source Area: 1-Hour Martinizing & Sandy's Cleaners

Notes:

BMW-12B	Groundwater Monitoring Well Identification
1.19	Results that are black are vertical profile sample results
0.43	Results that are blue are from Spring 2024
20	Results that are ***bolded and italicized*** exceed the Aquifer Water Quality Standard of 5 µg/L
NS	Not Sampled
µg/L	Microgram per liter
ft bgs	Feet Below Ground Surface
PCE	Tetrachloroethene
WQARF	Water Quality Assurance Revolving Fund

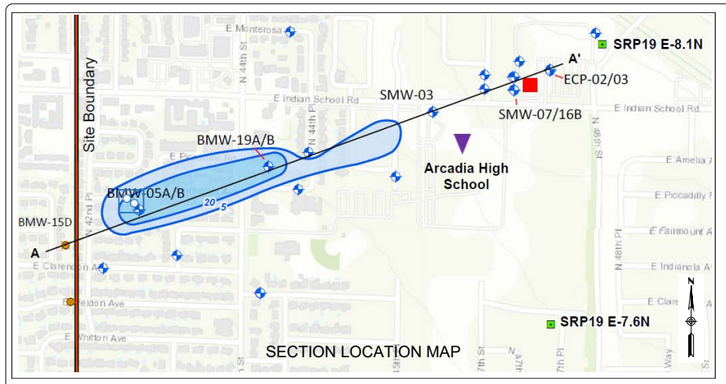
0 350 700 Feet

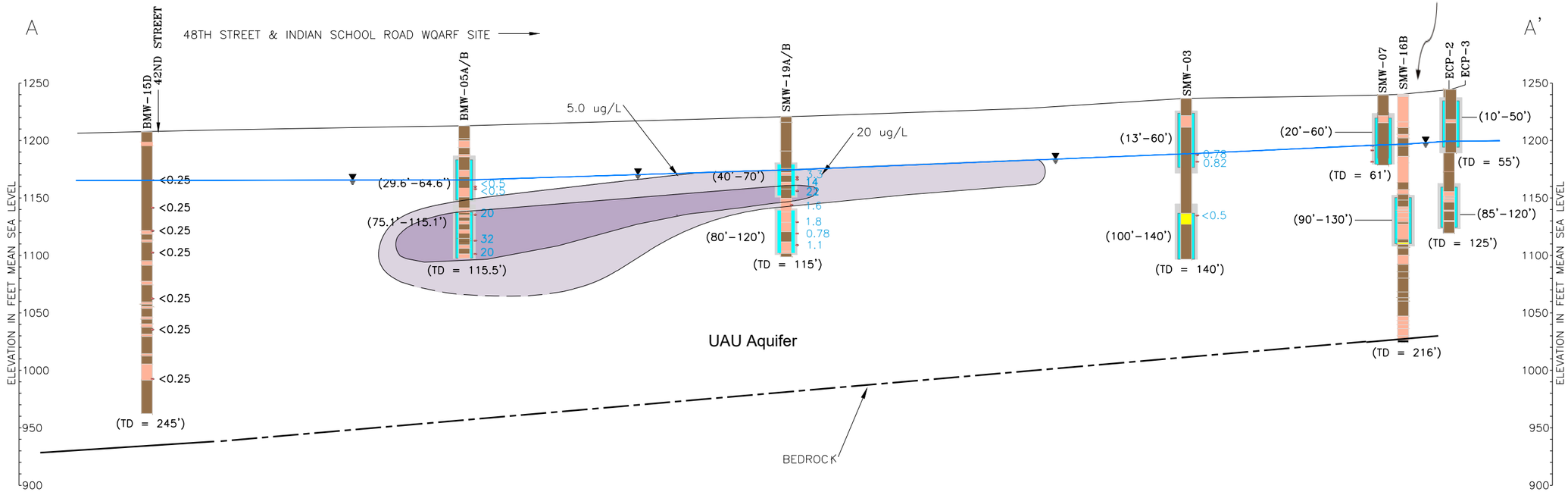
N

Spring 2024 Groundwater Monitoring Technical Memorandum
ECP 48th St & Indian School Rd WQARF Site
Phoenix, Arizona

FIGURE 4 **Site PCE Plume Map March 2024**

Job No.	14-2023-2031
PM:	JC
Date:	3/22/2024
Scale:	1"= 700'



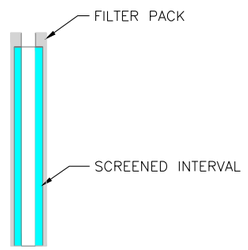


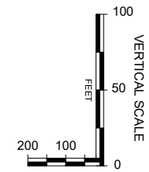
EXPLANATION

- BORING LOCATION
- GROUNDWATER WELL LOCATION
- DEPTH-DISCRETE GROUNDWATER SAMPLE
- 3.6 — CONCENTRATION OF TETRACHLOROETHYLENE (PCE) DETECTED IN VERTICAL PROFILE GROUNDWATER SAMPLE IN MICROGRAMS PER LITER (ug/l), BOLD IF EXCEEDS 5.0 ug/l, BMW-15D (MAY 2017)
- 3.6 — MARCH 2024 CONCENTRATION OF TETRACHLOROETHYLENE (PCE) DETECTED IN COMPLIANCE GROUNDWATER IN MICROGRAMS PER LITER (ug/l), BOLD IF EXCEEDS 5.0 ug/l
- WATER LEVEL ELEVATION MEASURED ON MARCH 2024
- — ? — ? — WHERE INFERRED
- (TD = XX) TOTAL DEPTH
- (XX-XX) DEPTH OF SCREEN INTERVAL

BOREHOLE LITHOLOGY

- SILTY OR CLAYEY SAND AND GRAVEL; AND SAND MIXTURES
- PREDOMINANTLY SAND OR GRAVEL
- PREDOMINANTLY SILT AND CLAY
- SITE PCE PLUME >20 ug/L
- SITE PCE PLUME >5.0 ug/L





REVISIONS:

Environment & Infrastructure
4600 E. WASHINGTON STREET, SUITE 600
PHOENIX, ARIZONA 85034
PHONE: 602-733-6000
FAX: 602-733-6100

Cross-Section
March 2024

PROJECT
48th Street and Indian School Road WQARF Site
Phoenix, Arizona

DESIGNED BY: JNC
DRAWN BY: DET
CHECKED BY: JNC

PROJECT NO.
EI-US-1420232031

Figure
5

SHEET NO. 1

File: G:\Environmental-Development\2023 Projects\14-2023-2031 ADEQ FY 2024 48th & Indian School TO#1\14 CAD\DWG\1420232031_Figure 4.dwg

APPENDIX A

Summary of Monitoring Wells

Appendix A - Summary of Monitoring Wells

Well Name	ADWR Number	LATITUDE (DEG)	LONGITUDE (DEG)	TOC (ft amsl)	Screened Interval (ft btoc)
ECP-01	587191	33.4953	-111.9802	1241.28	10 - 70
ECP-02	587192	33.7287	-111.9793	1244.49	85 - 120
ECP-03	587193	33.4954	-111.9793	1244.35	10 - 50
SMW-01	533298	33.4953	-111.9802	1241.21	15 - 55
SMW-02	535795	33.4961	-111.9782	1248.61	15 - 55
SMW-03-060*	543424	33.6779	-111.9822	1236.71	13 - 60
SMW-03-138*	543424	33.6779	-111.9822	1236.66	100 - 140
SMW-04	907363	33.4950	-111.9809	1238.4	20 - 60
SMW-05	908628	33.4953	-111.9809	1239.5	20 - 60
SMW-06	914016	33.4932	-111.9831	1227.84	20 - 60
SMW-07	913979	33.4950	-111.9802	1240.43	20 - 60
SMW-08	913980	33.4956	-111.9801	1243.65	20 - 60
SMW-11	918939	33.4929	-111.9856	1221.38	50.2 - 70.2
SMW-12	919290	33.4915	-111.9886	1212.19	144.9 - 164.9
SMW-16B	921439	33.4950	-111.9802	1240.24	90.7 - 130.7
SMW-17	923913	33.4962	-111.9858	1230.34	30 - 60
SMW-18	924613	33.4937	-111.9853	1223.99	40 - 80
SMW-19A*	924614	33.4934	-111.9863	1221.19	40 - 70
SMW-19B*	924614	33.4934	-111.9863	1221.19	80 - 120
BMW-05A	916202	33.4925	-111.9895	1212.81	29.6 - 64.6
BMW-05B	916203	33.4925	-111.9895	1212.87	75.1 - 115.1
BMW-06A	916204	33.4908	-111.9865	1214.27	30.3 - 60.3
BMW-06B	916205	33.4908	-111.9865	1214.5	75.4 - 110.4
BMW-12B	922019	33.4746	-111.9904	1209.13	120 - 170
Proposed New Well A*	NA	NA	NA	NA	75 - 125
Proposed New Well B*	NA	NA	NA	NA	150 - 275

* well installed within same borehole

ADWR - Arizona Department of Water Recources

deg - degrees

ft - feet

ft amsl - feet above mean sea level

ft btoc - feet below top of casing

NA - not applicable

APPENDIX B

Detailed Cost Summary

Appendix B
Table B-1 - Summary of Costs

Year	Well Installation	Groundwater Monitoring	MNA	Periodic Site Review	Site Closure	Subtotal Cost	IF	Subtotal Cost with Inflation
1	$ 200,000	$ 75,000	$ 53,000			$ 328,000	1.00	$ 328,000.00
2		$ 75,000	$ 53,000			$ 128,000	1.03	$ 131,840.00
3		$ 75,000		$ 33,000		$ 108,000	1.06	$ 114,577.20
4		$ 75,000				$ 75,000	1.09	$ 81,954.53
5		$ 75,000	$ 53,000			$ 128,000	1.13	$ 144,065.13
6		$ 75,000		$ 33,000		$ 108,000	1.16	$ 125,201.60
7		$ 75,000				$ 75,000	1.19	$ 89,553.92
8		$ 75,000				$ 75,000	1.23	$ 92,240.54
9		$ 75,000		$ 33,000		$ 108,000	1.27	$ 136,811.17
10		$ 75,000	$ 53,000			$ 128,000	1.30	$ 167,010.97
11		$ 75,000				$ 75,000	1.34	$ 100,793.73
12		$ 75,000		$ 33,000		$ 108,000	1.38	$ 149,497.26
13		$ 75,000				$ 75,000	1.43	$ 106,932.07
14		$ 75,000				$ 75,000	1.47	$ 110,140.03
15		$ 75,000	$ 53,000	$ 33,000		$ 161,000	1.51	$ 243,526.95
16*		$ 75,000				$ 75,000	1.56	$ 116,847.56
17*		$ 75,000				$ 75,000	1.60	$ 120,352.98
18*		$ 75,000		$ 33,000	$ 138,000	$ 246,000	1.65	$ 406,600.52
TOTAL	**$ 200,000**	**$ 1,350,000**	**$ 265,000**	**$ 198,000**	**$ 138,000**	**$ 2,151,000**		**$ 2,766,000**

Notes:
Final Remedy Cost is rounded up to the nearest $1,000
*Years 16, 17, and 18 are contingency
Abbreviations:
MNA - Monitored Natural Attenuation
IF - Inflation factor of 3% per year

Appendix B
Table B-2 Detailed Costs

Well Installation (Year 1)

Item	*Description*	*Unit*	*Unit Cost*	*Quantity*	*Total (Rounded)*
1	Well Permitting / Traffic Control	Lump	$ 2,000	1	$ 2,000
2	Monitoring Well Installation	Feet	$ 525	300	$ 157,500
3	Monitoring Well Development	Well	$ 2,000	2	$ 4,000
4	IDW Management	Lump	$ 6,000	1	$ 6,000
5	Site Survey	Lump	$ 6,000	1	$ 6,000
6	Reporting	Lump	$ 6,000	1	$ 6,000
7	Project Management	Percent	10%	1	$ 18,150
Subtotal (Cost per year)					**$ 200,000**

Groundwater Monitoring of VOCs (Year 1 to 15)

Item	*Description*	*Unit*	*Unit Cost*	*Quantity*	*Total (Rounded)*
1	Semi Annual Well Monitoring & Sampling (32 samples from 13 wells)	Sample	$ 750	64	$ 48,000
2	Annual Evaluation & Reporting	Lump	$ 20,000	1	$ 20,000
3	Project Management	Percent	10%		$ 6,800
Subtotal (Cost per year)					**$ 75,000**

Monitored Natural Attenuation Sampling (Year 1, 2, 5, 10, and 15)

Item	*Description*	*Unit*	*Unit Cost*	*Quantity*	*Total (Rounded)*
1	Annual Well Monitoring & Sampling (32 samples from 13 wells)	Sample	$ 1,500	32	$ 48,000
2	Project Management	Percent	10%		$ 4,800
Subtotal (Cost per year)					**$ 53,000**

Periodic Site Reviews (Year 3, 6, 9, 12, and 15)

Item	*Description*	*Unit*	*Unit Cost*	*Quantity*	*Total (Rounded)*
1	Site Evaluation & Reporting	Lump	$ 30,000	1	$ 30,000
2	Project Management	Percent	10%		$ 3,000
Subtotal (Cost per year)					**$ 33,000**

Site Closure (Year 15)

Item	*Description*	*Unit*	*Unit Cost*	*Quantity*	*Total (Rounded)*
1	Well Abandonment of all Site Wells (up to 23 wells)	Feet	$ 40	2466	$ 98,640
2	ADWR Reporting (NOI to abandon a well)	Well	$ 150	23	$ 3,450
3	Mobilization for Abandonment (two wells per day)	Day	$ 200	12	$ 2,400
4	Resurfacing / Well Vault Removal	Well	$ 300	23	$ 6,900
5	Site Closure Report	Lump	$ 15,000	1	$ 15,000
6	Project Management	Percent	10%	1	$ 11,139
Subtotal (Cost per year)					**$ 138,000**