PROPOSED REMEDIAL ACTION PLAN

16th STREET & CAMELBACK WQARF SITE
PHOENIX, ARIZONA

July 2016

Prepared for:

ADEQ
Arizona Department of Environmental Quality
Waste Programs Division
Remedial Projects Unit
1110 West Washington Street
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EXPIRES 6/30/19

Matrix DESIGN GROUP

CALIBRE

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ACRONYMS

§	Section
A.A.C.	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
AWQS	Aquifer Water Quality Standard
A.R.S.	Arizona Revised Statute
COC	Contaminants of Concern
1,2-DCA	1,2-Dichloroethane
1,2-DCP	1,2-Dichloropane
ERD	Enhanced Reductive Dechlorination
FS	Feasibility Study
HGC	Hydro Geo Chem, Inc.
µg/L	Micrograms per liter
Law	Law Engineering, Inc.
MNA	Monitored Natural Attenuation
PCE	Tetrachloroethene
PRAP	Proposed Remedial Action Plan
RI	Remedial Investigation
RO	Remedial Objective(s)
SRL	Soil Remediation Levels
SRP	Salt River Project
VOC	Volatile Organic Compounds
WQARF	Water Quality Assurance Revolving Fund

1.0 INTRODUCTION

1.1 PURPOSE OF DOCUMENT

The Matrix-CALIBRE Team has been retained by the Arizona Department of Environmental Quality (ADEQ) to prepare this proposed remedial action plan (PRAP) for the 16th Street & Camelback Water Quality Assurance Revolving Fund (WQARF) Site (the Site), located in Phoenix, Arizona (see Figure 1-1). ADEQ is required under Arizona Revised Statute (A.R.S.) Section (§) 49-287.04 to issue a PRAP for the proposed remedy for the Site to the public for review and comment. This PRAP was prepared in accordance with Arizona Administrative Code (A.A.C.) R18-16-408 and is based on information contained in the following documents:

- *Remedial Investigation Report, 16th Street & Camelback, Phoenix , Arizona* (ADEQ/Brown and Caldwell, *2015)* (RI Report)
- *Final Feasibility Study, 16th Street & Camelback, Phoenix, Arizona* (ADEQ/Matrix-CALIBRE Team, *2015*) (FS)

The information contained in the PRAP is drawn from and, in many cases, quotes directly from the above-referenced reports without attribution other than that noted here. The detailed history of environmental investigations, early response actions, and preliminary screening of remedial alternatives completed for the Site are presented in the referenced documents and are not reiterated in detail here. The latest Site-related information, documents and notices can be found in electronic format at: http://www.azdeq.gov/environ/waste/sps/16th_Street_Camelback.html

The purpose of the PRAP is to inform the public on the remedy selected from the alternatives evaluation in the FS to address the site-specific remedial objectives (ROs) discussed in Appendix G of the RI Report and Section 4 of this PRAP. The PRAP is part of the final remedy selection process under WQARF where public input is solicited on the selected remedy and on the rationale for proposing the selected remedy. New information that ADEQ receives during the public comment period could result in the selection of a final remedy that differs from the selected remedy. Information on public participation activities associated with this PRAP is provided in Section 6.

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. In the Record of Decision, ADEQ will finalize its decision regarding the remedy for the Site.

1.2 SITE DESCRIPTION

The Site is located in a commercial area of East Central Phoenix in Maricopa County bounded by East Camelback Road to the north, North 17th Street to the east, East Highland Avenue to the south, and North 15th Street to the west (Figure 1-1). The boundaries of the Site are defined by the extent of two historical/current groundwater contaminant plumes on the property, referred to in this PRAP as the North Plume and the South Plume areas.

Historical occupants and/or operations at the Site included a landscape and tree nursery, a dry cleaning operation, an extermination business, a vehicle service station, and a plumbing shop. These businesses discontinued operations over 20 years ago. The Site is currently occupied by a number of retail and commercial businesses including a restaurant and public storage facility.

2.0 SITE CHARACTERISTICS

2.1 NATURE AND EXTENT OF CONTAMINATION

2.2.1 Source of Releases

Data collected during the RI indicates that contaminant releases occurred in soil and groundwater at the Site near the southeastern corner of 16th Street and Camelback Road (Figure 1-2). No other media of concern other than soil and groundwater have been identified for the Site. Contaminants of concern (COCs) which have been detected above regulatory or risk-based levels at the Site include tetrachloroethene (PCE), 1,2-dicholoroethane (1,2-DCA), and 1,2-dichloropropane (1,2-DCP). A former dry cleaning operation is the identified source of PCE and vehicle service station is the identified source of 1,2-DCA and 1,2-DCP at the Site. Currently PCE is the only COC present at the Site.

2.2.2 Soil/Soil Vapor

Concentrations of PCE in soil at the former dry cleaner and 1,2-DCA and 1,2-DCP in soil at the former vehicle service station are below Arizona soil cleanup standards, so soil remediation is not required. However, soil conditions resulting from COC releases at the Site are described in the following paragraphs for perspective and completeness.

North Plume Area. The distribution of PCE in the vadose zone has been defined by soil and soil gas samples collected from numerous soil borings drilled across the southeast corner of the 16th Street and Camelback Road properties between 1992 and 2003. Relatively minor concentrations of PCE have been detected in the vicinity of the former dry cleaner. The only known detections of PCE were found during a shallow soil gas investigation conducted by Hydro Geo Chem, Inc. (HGC) in 1995 and Kleinfelder in 2003. The area around the former dry cleaner has been the primary focus of various RI activities since the discovery of PCE in monitoring well MW-1 in 1992. Two initial soil gas surveys were conducted in 1992-93 and 1995 by Law Engineering, Inc. (Law) and HGC, respectively. Both surveys identified relatively low vapor concentrations of PCE at sampling points located in the general area of the former dry cleaner. Subsequent soil and soil gas sampling was conducted in 2003 by Kleinfelder. Soil vapor samples collected during the 2003 event also revealed relatively low concentrations of PCE, and soil samples collected at the same time were below the laboratory reporting limit for PCE. The observed distribution of PCE in the vadose zone is described in more detail in Section 2.2.3.

South Plume Area. The former service station in the southern end of the Site is the source of 1,2-DCA and 1,2-DCP groundwater contamination and other petroleum hydrocarbons that have been detected periodically in downgradient monitoring wells. The extent of contamination in the vadose zone on the south side of the Site is defined by soil and soil vapor samples collected during Phase II and Phase III environmental assessment activities performed by Law. Overall, only minor levels of contaminants associated with petroleum hydrocarbons were detected during these investigation activities. The extent of the petroleum hydrocarbon contamination appears to be limited to the upper 5 feet based on analytical results from the Phase II and Phase III environmental assessment.

2.2.3 Groundwater

Based on groundwater monitoring data collected at the Site since 2002, concentrations of 1,2-DCA and 1,2-DCP within groundwater monitoring wells located in the South Plume at the Site are currently below Arizona's Aquifer Water Quality Standards (AWQS) of 5 micrograms per liter (µg/L). Concentrations of PCE in groundwater located in the North Plume exceed the AWQS of 5 µg/L.

North Plume Area. The horizontal extent of PCE contamination in groundwater is defined by the network of Site groundwater monitoring wells as shown in Figure 2-1. PCE occurs below the northern portion of the Site near the former dry cleaner, and extends from the area around monitoring well OW-1D to the northwest past 16th Street as far as monitoring well MW-13 and as far west as 15th Street at monitoring well MW-14. The downgradient edge of the PCE plume in groundwater is defined by monitoring wells MW-13 and MW-14, where concentrations of PCE were below the AWQS of 5 µg/L during the February 2015 groundwater monitoring events. The southern extent of PCE is defined by monitoring well MW-2, and the northern extent is generally defined by MW-13. Overall, the concentrations of PCE in groundwater have decreased steadily since the original wells were installed in 1992.

South Plume Area. The horizontal extent of 1,2-DCA contamination in groundwater is defined by the network of Site groundwater monitoring wells as shown in Figure 2-1. The plume of 1,2-DCA and 1,2-DCP has reduced in size with concentrations below 0.5 µg/L at the Site monitoring wells based on the groundwater monitoring events conducted on Site through 2015.

2.2.4 Surface Water

Surface water was not identified as a media of concern for the Site in the RI or the FS. However, the following information regarding surface water as an environmental media is provided for perspective and completeness. The surface water use portion of the Land and

Water Use Report indicates that surface water is conveyed across the Site via lateral canals. The surface water contained in the canals can be used for agricultural and urban irrigation on Site and discharges into the Salt River Project (SRP) Grand Canal south of the site which is subsequently used for irrigation outside of the Site. The source for the surface water contained in the canals is groundwater pumped by SRP from outside the Site boundary and SRP does not extract groundwater from the Site. Future SRP plans for the Grand Canal include a possible drinking water treatment plant that may be constructed at the end of the Grand Canal.

3.0 NEED FOR REMEDIAL ACTION

The purpose of this section is to summarize the risks at the Site and the major goals of remedial action at the Site as determined from the Site RI and FS.

3.1 WASTE

There are no landfills or other uncontrolled wastes present on Site which require remedial action.

3.2. SOIL/SOIL VAPOR

COCs are not present in soil present on Site in concentrations greater than Arizona's remediation standards for soil. Therefore, no remedial action for soil is required.

3.3 GROUNDWATER

PCE concentrations in groundwater on Site currently exceed the AWQS. Although groundwater at the Site is not currently used, the regional aquifer is considered a drinking water source for the City of Phoenix and SRP. Therefore, the aquifer must be protected and a remedial action for groundwater is required.

3.4 SURFACE WATER

The only surface water present on the Site is obtained from a groundwater source located outside the Site and is conveyed across the Site via lateral, concrete-lined canals. Contaminated groundwater within the Site does not discharge to these canals. Therefore, no remedial action for surface water is required.

4.0 REMEDIAL OBJECTIVES

ADEQ prepared a Remedial Objectives (RO) Report (ADEQ, 2015) for the Site to meet requirements established under A.A.C. R18-16-406. The RO Report relied upon the Land and Water Use Report prepared by ADEQ for the Site and the comments received on the Proposed RO Report.

Remedial Objectives were established for the current and reasonably foreseeable uses of land and waters of the state that have been or are threatened to be affected by a release of a hazardous substance. The final remedy must be able to achieve the ROs.

4.1 REMEDIAL OBJECTIVES FOR LAND

Remedial Objectives for land use are established for those properties known to be contaminated with hazardous substances above a Soil Remediation Level (SRL) or a risk-based level. However, all soil investigations conducted in the southeast corner of 16th Street and Camelback Road indicate that COCs are no longer present in soils at the Site at concentrations greater than Arizona remediation standards. Therefore, no ROs are needed for land use or soil remediation.

4.2 REMEDIAL OBJECTIVES FOR GROUNDWATER

Groundwater is not currently used on Site, however, the regional aquifer is considered to be a drinking water source for the City of Phoenix and SRP which must be protected. The RO for regional groundwater at the Site is to protect this resource for use as a groundwater supply by the City of Phoenix and SRP. This action is currently not needed but may be needed if/when groundwater use changes to municipal/drinking water. This action will be needed for as long as the level of contamination in the groundwater threatens the use of the regional groundwater for municipal/drinking water uses.

4.3 REMEDIAL OBJECTIVES FOR SURFACE WATER

The only surface water present is conveyed across the Site via lateral, concrete-lined canals and is from a groundwater source located outside the Site. Contaminated groundwater within the Site does not discharge to these canals. The surface water conveyed across the Site can be used on Site for irrigation purposes, ultimately discharges into the SRP Grand Canal south of the Site, and is subsequently used for irrigation outside of the Site. Therefore, no ROs are needed for surface water.

4.4 REMEDIATION LEVELS AND BASIS FOR SELECTION

As previously noted in the beginning of Section 2.0, the COC identified at the Site is PCE. The groundwater standards for the COCs are shown in Table 4-1.

Table 4-1. Relevant Groundwater Standards for Primary Contaminants of Concern

Contaminant of Concern	Aquifer Water Quality Standard (µg/L)
PCE – Tetrachloroethene	5

5.0 EVALUATION OF REMEDIAL ALTERNATIVES

In accordance with the Remedy Selection Rule (A.A.C. R18-16-407), the FS must identify at least three alternative remedies capable of achieving the ROs. As documented in the FS, three alternatives were evaluated for remediation of the groundwater at the Site. These alternatives are as follows:

- Reference Remedy: Monitored Natural Attenuation (MNA)
- More Aggressive Remedy: MNA with Well-head Treatment
- Less Aggressive Remedy: No Action

5.1 SELECTED REMEDY

MNA (the Reference Remedy) is the selected remedy for the Site. 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 (often slowly) by natural means without other control, removal, treatment, or aquifer-modifying activities. These in-situ processes may include biodegradation, dispersion, dilution, sorption, and volatilization of contaminants. MNA is not typically implemented as a sole remediation method while source areas remain (i.e., remaining contaminant residues in soil) but is applicable at sites, such as the Site, where no ongoing contaminant sources remain. This remedial measure requires groundwater monitoring over a period of years to verify that attenuation is occurring and to ensure that progress is made in terms of meeting the ROs.

5.2 RATIONALE FOR SELECTION OF REFERENCE REMEDY

The Reference Remedy of MNA is the most feasible and practicable remedial approach for the Site given current and future use scenarios. MNA is a remedial alternative that is protective of public and ecological health because the current exposure pathway to Site groundwater is incomplete.

Groundwater monitoring data collected from the Site during the last 10+ years demonstrates that in down gradient portions of the plume attenuation is occurring, most likely dominated by advection and dispersion. There is an indication of slow dechlorination/degradation in some monitoring wells based on the presence of intermediate degradation products. MNA is a proven remedial alternative that provides both short and long-term effectiveness given that

PCE concentrations at the Site have decreased over the past 10 years. The residual risk to the aquifer after MNA is completed is anticipated to be low. MNA is consistent with potentially affected water providers and their long-term plans. The MNA remedy is considered to be reliable based on the relatively low concentrations in groundwater and the lack of a continuing/ongoing source of contamination in soil.

Presently, groundwater in the vicinity of the Site is not being used for drinking water; however, groundwater is designated as a potable resource for the future, if needed. Additionally, there are no ADWR registered water supply wells or known municipal wells within approximately one mile down gradient of the Site. Given the existing land use and COCs detected the exposure threat from contamination in the Site subsurface soils is minimal. Lastly, exposure to the COCs via air pathway is also considered incomplete due to the low concentrations of volatile organic compounds (VOC) in the upper 5 feet of soils.

MNA is a proven remedial technology that has been implemented at many sites and has been publicly accepted. The implementation of MNA at the Site would not impact the current and projected future use of the Site. The risk to human and ecological receptors associated with MNA is low. Additionally, both the concentrations and the volume of contaminated water will be reduced over time. Documenting Site cleanup with MNA will decrease liability associated with the Site. The aesthetics of the project are anticipated to be compatible with the existing and future land use. This remedy is considered to have a neutral impact in terms of enhancement of future land uses and impacts on local economies.

5.3 PERFORMANCE MONITORING RECOMMENDATIONS

Performance monitoring will be used to judge the effectiveness and adequacy of the MNA remedy selected for groundwater at the Site. A decision logic for the selection of groundwater monitoring wells to include in a performance monitoring program and for deciding when monitoring can be terminated at the Site or at a given well follows to provide a basis for these recommendations. The logic includes a distinction between the two groundwater contaminant plumes that exist at the Site (i.e., the South Plume and the North Plume) because of differing sources, COCs and Site conditions. A summary of information regarding the two plumes with information relevant to the performance monitoring recommendations follows.

5.3.1 South Plume Monitoring Recommendations

The COC in groundwater located at the South Plume was 1,2-DCA and 1,2-DCP. The highest initial concentrations of were observed in MW-3 in 2000 and 2001. Since mid 2007, the concentrations of 1,2-DCA and 1,2-DCP have been below the AWQS, of 5 µg/L in all of the

monitoring wells in the South Plume. The RO for groundwater at the Site has been met in the South Plume. Therefore, no further action is required in this area and no further monitoring is recommended in the South Plume monitoring wells.

5.3.2 North Plume Monitoring Recommendations

The North Plume emanated from former dry cleaner operations and the primary COC is PCE. Historically, the highest concentrations of PCE were observed in MW-1 in 2000. Over the last year or two, concentrations have declined in MW-1 and downgradient well MW-10 to between 10 and 25 µg/L. Table 5-1 provides information about each of the monitoring wells in and near the North Plume with respect to recommended performance monitoring to demonstrate remedy effectiveness.

Table 5-1. North Plume Performance Monitoring Recommendations

Well	Location	Decision Logic Notes
MW-9	Upgradient	PCE has never been detected. No further monitoring is recommended at this location.
MW-5	Upgradient	PCE has never been detected. No further monitoring is recommended at this location.
MW-2	Approximately 100 feet south of source area.	PCE has been less than the AWQS in four sampling events beginning in May 2013. No further monitoring is recommended at this location.
MW-1	At source area	PCE has been detected above the AWQS in the most recent sampling events. **Continued performance monitoring is recommended at this location.**
OW-1D	At source area	PCE has been less than the AWQS in three sampling events beginning in February 2014. Due to the proximity of this well to MW-1, **continued performance monitoring is recommended at this location.**
MW-10	Approximately 250 feet downgradient (west	PCE has been detected above the AWQS in the most recent sampling events. **Continued performance monitoring is recommended.**

Well	Location	Decision Logic Notes
	northwest) from MW-1	
MW-12	Approximately 350 feet downgradient (west northwest) from MW-10	PCE has been detected above the AWQS in the most recent sampling events**. Continued performance monitoring is recommended**
MW-14	Approximately 350 feet downgradient (west northwest) from MW-12	PCE concentrations are below the AWQS but on a slight upward trend. Because this well is in a "sentinel" location**, continued performance monitoring is recommended.**
MW-13	Approximately 300 feet north of the centerline of the plume.	PCE concentrations are below the AWQS but on a slight upward trend. Because of the upward trend and because this well is in a "sentinel" location**, continued performance monitoring is recommended.**

5.3.3 Monitoring Frequency, Duration and Termination

As previously indicated, on-going performance monitoring of select groundwater monitoring wells is recommended in the North Plume only. Three wells in the North Plume have been dropped from the proposed monitoring program (MW-2, MW-5, and MW-9) because they are located up gradient or cross gradient from the source area and the PCE concentrations in these wells are less than the AWQS. The six remaining monitoring wells (MW-1, OW-1D, MW-10, MW-12, MW-14, and MW-13) should be sampled annually until the PCE concentrations in all of the wells are below the AWQS. Up gradient well MW-9 may be sampled periodically, such as once every 5 years to verify that impacts from up-gradient plumes (if any) are identified.

During the preparation of this PRAP, a statistical evaluation of historical groundwater monitoring data was completed. Regression analysis was used to calculate the duration of monitoring that would likely be required to achieve the AWQS for PCE utilizing the recommended remedy of MNA. Based on this evaluation, which is presented in detail in Appendix A, the AWQS for PCE should be reached Site wide in approximately 12 years. This

timeframe is anticipated to be adequate for natural processes to reduce PCE concentrations to less than its AWQS and to confirm that PCE concentrations have not rebounded.

Monitoring may be terminated earlier in individual wells if results in two consecutive monitoring events are below the AWQS, with the exception of MW-12, MW-13, and MW-14, which are in sentinel locations, down gradient from the source area. It is anticipated that these wells may need to be monitored annually if any up-gradient wells remain above the AWQS. After each monitoring event, the data will be evaluated to see if trends are observed that suggest a change in sampling protocols is appropriate. Groundwater monitoring has been conducted in the North Plume wells since 1999. Concentrations of COCs have declined to relatively low values over the last several years. Accordingly, collecting one sample per year should be sufficient to monitor and evaluate the ongoing effectiveness of MNA as a groundwater remedy for the Site.

Termination of performance monitoring at a given monitoring well location can occur after the PCE concentration in a given well declines below the AWQS followed by one additional confirmation sample result at the given well in a subsequent period. An exception to this rule is for the wells down gradient of the source area, MW-12, MW-13, and MW-14, where because of their location as sentinel wells, concentrations may increase due to advective transport from the source area. Consequently, the trend at those wells should be considered before monitoring is terminated. Wells not recommended for groundwater sampling with the exception of up-gradient well MW-9 should be abandoned in accordance with ADWR requirements.

5.4 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. Following is a summary of the ROs established by ADEQ for the Site and a brief discussion regarding how the ROs either have already been met or will be met in the future.

5.4.1 Remedial Objectives for Groundwater

Groundwater is not currently used on Site, however, the regional aquifer is considered to be a drinking water source for the City of Phoenix and SRP which must be protected. The RO for regional groundwater at the Site is to protect this resource for use as a groundwater supply by the City of Phoenix and SRP. This action is currently not needed but may be needed if/when groundwater use changes to municipal/drinking water. This action will be needed for as long as the level of contamination in the groundwater threatens the use of the regional

groundwater for municipal/drinking water uses. Implementation of the proposed remedy of MNA will result in the reduction of COCs in groundwater to concentrations below the AWQS. The proposed remedy will protect the groundwater supply for future use and ensure that wider areas are not impacted for future water development options.

5.5 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.
- ✓ Be reasonable, necessary, cost-effective and technically feasible.
- ✓ Be consistent with the requirements of A.R.S., Title 45, Chapter 2, Groundwater Code.

As demonstrated in this PRAP, the proposed remedy of MNA for groundwater at the Site 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 with the lowest cost. Further, MNA is the best combination of practicability, risk, cost, and benefit to achieve the ROs.

5.6 CONSISTENCY WITH WATER MANAGEMENT PLANS

The proposed remedy of MNA is consistent with the water management plans of local water providers; no active supply wells are impacted by the plume and remedial actions are proposed to restore water quality. 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.

5.7 CONSISTENCY WITH GENERAL LAND USE PLANNING

With regard to land use impacts, no new construction is necessary to implement the proposed remedy of MNA. MNA is consistent with the existing commercial land use and is not anticipated to negatively impact current or future land use at the property.

5.8 SUMMARY OF COSTS TO IMPLEMENT THE SELECTED REMEDY

MNA is a cost-effective remedial alternative for the Site. During the development of this PRAP, the scope of work to complete the selected remedy of MNA was further defined.

Empirical degradation rate data (see Appendix A) suggest that a time frame of approximately 12 years will be required to meet the AWQS. Costs to implement the selected remedy were updated to reflect the information presented in Appendix A, and refined accordingly to reflect further definition of annual monitoring and reporting requirements, five-year reviews and abandonment of monitoring wells. Considering the timing of expenses and present value evaluation (calculated using a discount rate of 7 percent), the corresponding Net Present Value to implement the selected remedy of MNA is $354,747. A summary of costs to implement the selected remedy is presented in Table 5-2. Detailed cost backup is presented in Appendix B.

Table 5-2. Summary of Updated Costs to Implement MNA at the Site

Year	Calendar Year	Description	Cost[1,2]
1	2016	Monitoring + Reporting + Abandon 7 wells	$30,626
2	2017	Monitoring + Reporting	$15,939
3	2018	Monitoring + Reporting	$16,257
4	2019	Monitoring + Reporting	$16,582
5	2020	Monitoring, Reporting + 5 year review	$39,978
6	2021	Monitoring + Reporting	$17,252
7	2022	Monitoring + Reporting	$17,597
8	2023	Monitoring + Reporting	$17,949
9	2024	Monitoring + Reporting	$18,308
10	2025	Monitoring, Reporting + 5 year review	$44,139
11	2026	Monitoring + Reporting	$19,048
12	2027	Monitoring + Abandon 7 wells + Final Report	$54,800
		Subtotal (includes Project Management)	$308,476
		Contingency (15%)	$46,271
		Total Cost	**$354,747**

Notes

1) A 15% project management factor is included
2) A 2% annual inflation rate is used.

5.9 LEAD AGENCY STATEMENT FOR PROPOSED REMEDY

Based on the information currently available, ADEQ believes the proposed remedy provides the best balance of tradeoffs among the other alternatives with respect to the comparison criteria. ADEQ expects the proposed remedy will satisfy the remedial action criteria pursuant to A.R.S. § 49-282.06 (Section 6.3) and the ROs (Section 4).

5.10 CONTINGENCY FOR PROPOSED REMEDY

As a contingency to expedite the natural degradation process currently taking place at the Site, a round of enhanced reductive dechlorination (ERD) injection could be conducted. If an ERD injection could be conducted in coordination with ERD injections being conducted on nearby sites, this may be a cost effective approach to expediting delisting of the Site.

This contingency would consist of the injection of a carbon-source electron donor substrate such as a soluble food-grade sucrose-based solution or edible oil substrate. Substrate injection would occur once and additional groundwater monitoring and sampling would be conducted.

For this contingency of the reference remedy, an existing monitor well would be used as an injection well to target PCE concentrations. This contingency is primarily intended to expedite MNA progress and qualify the Site for delisting in an expedited time frame. This contingency is expected to cost $8,160 but possibly reduce the cost of the proposed remedy by approximately $71,000.

6.0 COMMUNITY INVOLVEMENT

6.1 PUBLIC COMMENT PERIOD OF PRAP

The public comment period will be no less than 90 days. ADEQ will accept written comments on this PRAP that are postmarked within the comment period and submitted to:

Arizona Department of Environmental Quality
ATTN: Kevin Snyder, Project Manager
1110 West Washington Street
Phoenix, Arizona 85007

6.2 PUBLIC MEETINGS

ADEQ will present the PRAP and all of the alternatives presented in the FS in a 16th Street and Camelback WQARF Site Community Advisory Board meeting. Oral and written comments will also be accepted at the meeting.

6.3 ADMINISTRATIVE RECORD

Interested parties can review the PRAP and other Site documents at the ADEQ Main Office located at 1110 West Washington Street, Phoenix, Arizona. With 24-hour notice, an appointment to review related documentation is available Monday through Friday from 8:30 a.m. to 4:30 p.m. at the ADEQ Records Management Center. Please contact (602) 771-4380 or (800) 234-5677 to schedule an appointment to review these documents.

6.4 OTHER CONTACT INFORMATION

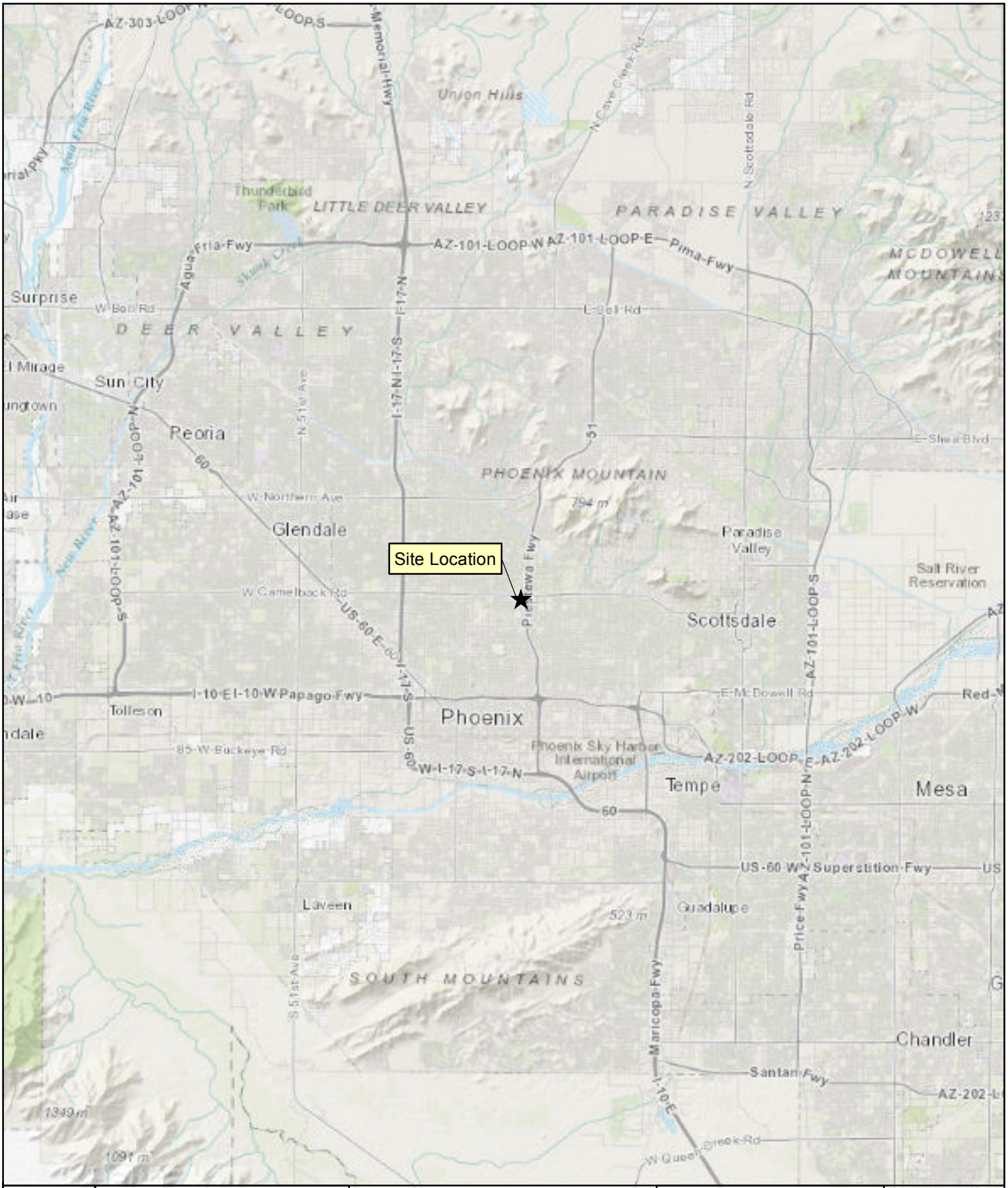
Name/Title	Phone/Fax	E-mail
Kevin Snyder, ADEQ Project Manager	(602) 771-4186 / (602) 771-2302	kcs@azdeq.gov
Wendy Flood, ADEQ Community Involvement Coordinator	(602) 771-4410 / (602) 771-2302	*wv1@azdeq.gov*

7.0 REFERENCES

ADEQ/Brown and Caldwell, 2015. Remedial Investigation Report, 16th Street and Camelback Road WQARF Site. May 2015.

Matrix-CALIBRE, 2015. Feasibility Study, 16th Street and Camelback Road WQARF Site. June 2015.

FIGURES



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Legend

★ Site Location

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Site Location Map
Proposed Remedial Action Plan
16th Street & Camelback
WQARF Site

July 2016

ADEQ Arizona Department of Environmental Quality

Matrix ENVIRONMENTAL

CALIBRE

Figure
1-1

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Drawing Date: 11/30/2015

Legend

Monitoring Well

Former Buildings

Site Layout and Monitoring Well Locations

Proposed Remedial Action Plan
16th Street & Camelback WQARF Site
July 2016

ADEQ Arizona Department of Environmental Quality

Matrix ENVIRONMENTAL

CALIBRE

0 100 200 Feet

Figure
1-2

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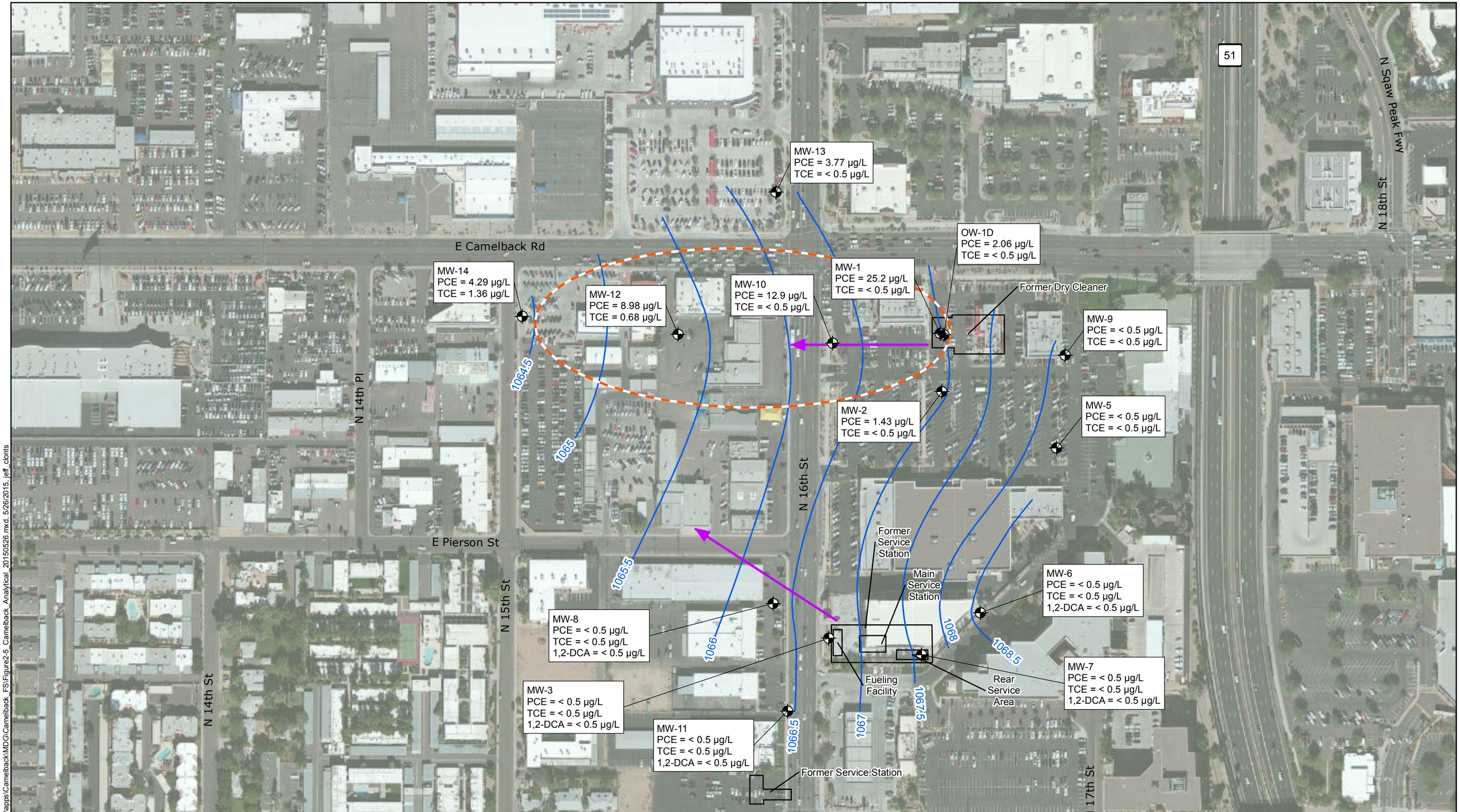

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Drawing Date: 11/30/2015

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- Monitoring Well
- Groundwater Potentiometric Contour
- Approximate Plume Boundary for PCE at AWQS of 5 ug/L
- Groundwater Flow Direction
- Former Buildings

Notes:
AWQS for PCE = 5 µg/L; TCE = 5 µg/L

All 1,2-DCA results are < 0.5 µg/L at north plume wells

February 2015 Groundwater Chemistry and Potentiometric Surface
16th Street & Camelback
WQARF Site

July 2016

ADEQ Arizona Department of Environmental Quality

Matrix ENVIRONMENTAL

CALIBRE

0 100 200 Feet

Figure 2-1

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APPENDIX A

Memorandum

To: Kevin Snyder, ADEQ Remedial Projects Unit

From: Tom McKeon, CALIBRE

Date: November 13, 2015

Subject: Performance Monitoring Decision Logic & Recommendations for Ongoing Groundwater Monitoring at the 16th Street and Camelback Water Quality Assurance Revolving Fund Site

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Introduction

In fiscal year (FY) 2015, the Matrix-CALIBRE Team completed a Feasibility Study[1] (FS) for the 16th Street and Camelback Water Quality Assurance Revolving Fund (WQARF) Site (the Site) under an Arizona Superfund Remedial Action Contract Task Order assignment. The FS presented and evaluated Site monitoring data for contaminants of concern (COCs) in groundwater at the Site. This evaluation demonstrated COC concentrations have been declining over several years. Based on the results of a comparative analysis presented in the FS, Monitored Natural Attenuation (MNA) was recommended as the groundwater remedy for the Site.

Purpose

The purpose of this Technical Memorandum is to provide recommendations regarding performance monitoring that will be used to judge the effectiveness and adequacy of the MNA remedy selected for groundwater at the Site. A decision logic for the selection of groundwater monitoring wells to include in a performance monitoring program and for deciding when monitoring can be terminated at the Site or at a given well is included herein to provide a basis for these recommendations. The logic includes a distinction between two volatile organic compound (VOC) plumes that exist at the Site (i.e., the South Plume and the North Plume) because of differing sources, COCs and Site conditions.

Background

Detailed background information regarding the Site is found in the FS. In summary, two distinct

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[1] Matrix-CALIBRE, 2015. Feasibility Study for the 16th and Camelback Water Quality Assurance Revolving Fund Site. Arizona Superfund Response Action Contract. June 2015.

plumes, referred to herein as the South Plume and the North Plume (see Figure 1) exist at the Site. A summary of information regarding these plumes with information relevant to the recommendations included in this Technical Memorandum follows.

South Plume. The South Plume emanated from a service station and the primary chemical of concern (COC) was 1,2-dichloroethane (1,2-DCA). The highest initial concentrations were observed in MW-3, where concentrations in the range of 200 micrograms per liter (µg/L) to 350 µg/L had been detected in 2000 and 2001. Since that time, the concentrations of 1,2-DCA have been below the Aquifer Water Quality Standard (AWQS), of 5 µg/L in all of the monitoring wells in the South Plume area. The Remedial Action Objectives (RAOs) presented in the FS for groundwater at the Site have been met in the South Plume. Therefore, no further action is required in this area and no further monitoring is recommended in the south plume monitoring wells.

North Plume. The North Plume emanated from a former dry cleaner and the primary COC is tetrachloroethene (PCE). Historically, the highest concentrations of PCE were observed in MW-1 (270 µg/L in 2000). Over the last year or two, concentrations have declined in MW-1 and down-gradient well MW-10 to between 10 and 25 µg/L. In the FS, the reference remedy describes monitoring to document MNA for a period up to 20 years. Table 1 provides information about each of the monitoring wells in and near the North Plume with respect to recommended performance monitoring to demonstrate remedy effectiveness.

Table 1. North Plume Performance Monitoring Recommendations

Well	**Location**	**Decision Logic Notes**
MW-9	Up gradient	PCE has never been detected. No further monitoring is recommended at this location.
MW-5	Up gradient	PCE has never been detected. No further monitoring is recommended at this location.
MW-2	Approximately 100 feet south of source area.	PCE has been less than the AWQS in four sampling events beginning in May 2013. No further monitoring is recommended at this location.
MW-1	At source area	PCE has been detected above the AWQS in the most recent sampling events. **Performance monitoring is recommended at this location.** MW-1 is discussed further in text following this table.

OW-1D	At source area	PCE has been less than the AWQS in three sampling events beginning in February 2014. OW-1D is discussed further in text following this table. **Performance monitoring is recommended at this location.**
MW-10	Approximately 250 feet downgradient (west northwest) from MW-1	PCE has been detected above the AWQS in the most recent sampling events**. Continued performance monitoring is recommended.**
MW-12**	Approximately 350 feet down gradient (west northwest) from MW-10	PCE has been detected above the AWQS in the most recent sampling events, this well may also serve as a "sentinel" location**. Continued performance monitoring is recommended.**
MW-14**	Approximately 350 feet down gradient (west northwest) from MW-12	PCE concentrations are below the AWQS but on a slight upward trend. Because this well is in a "sentinel" location**, continued performance monitoring is recommended.**
MW-13	Approximately 300 feet north of the centerline of the plume.	PCE concentrations are below the AWQS but on a slight upward trend. Because of the upward trend, **continued performance monitoring is recommended.**

** These two wells are in sentinel well locations (MW-12 and MW-14) and may continue to be sampled after they are below the AWQS if other up-gradient wells are still above the AWQS.

As indicated in bold in the Table 1, ongoing performance monitoring is recommended at six wells within the North Plume: MW-1, OW-1D, MW-10, MW-12, MW-14, and MW-13.

MW-1 and OW-1D

MW-1 and OW-1D are located approximately 9 feet apart but the PCE results are significantly different. During the most recent sampling event in February 2015, the PCE concentration in OW-1D was 2.06 µg/L and the PCE concentration in MW-1 was 25.2 µg/L. MW-1 was installed in 1992 and the well construction log indicates a screen length of 15.25 feet with the base at 79.5 ft bgs. The field crew measured the total depth of MW-1 as 80.26 feet on one occasion and 81 feet on another. The depth to water was measured as 78.0 feet below ground surface (bgs) when the permeable diffusion bag (PDB) was deployed in January 2015 and 78.25 ft bgs when it was retrieved in February. The PDB was only partially saturated when retrieved. Approximately 3

inches of the PDB appeared to have been above water based on inspection at the surface. The PDB used was 1.5 ft long indicating the base of the PBD was at a depth of approximately 79.5 ft bgs and the PDB (a flexible water-filled membrane) may not push into a sediment/sludge layer at the base of a well. These different measurements indicate the well may have a sump below the well screen.

There is a possibility that the PDB is not exposed to "groundwater" but is instead exposed to water in a sump at the base of the well and/or sludge/sediment accumulated within the lowermost portion of the well. If this is true, samples from MW-1 may not be representative of groundwater. During the next sampling event, the field crew should attempt to flush or purge sediment from the base of MW-1 and if possible determine the depth to the bottom of the well screen and bottom of the well.

Well OW-1D was installed in 2003 and the well construction log indicates a screen length of 30 feet screened from 70 to 100 ft bgs. The depth to water in OW-1D was measured 77.81 ft bgs in the February 2015 sampling. The well survey information reported in April 2003 indicates the two wells have a casing elevation within 0.44 ft (i.e., MW-1 is 0.44 ft higher than OW-1D). The PDB sample results described above are taken from a PDB placed at 81 ft bgs in OW-1D.

Anticipated Duration of Monitoring Program

A statistical evaluation of the historical monitoring data was completed as a means of estimating how long the monitoring may be required. This used regression to fit an exponential curve to the historical data and subsequently using the regression equation to estimate first order decay rate and corresponding half-lives. These data can be used to extrapolate when concentrations might be less than the AWQS for PCE. As with any statistical methodology, there is uncertainty that can be evaluated qualitatively (how well does the best- fit line seem to fit the data) and quantitatively by calculating Confidence Interval Limits (CIL) for the best fit line. Table 2 presents the results of a statistical analysis performed on historical data from the wells that are proposed for sampling.

Table 2. Estimated Attenuation Half-lives based on data from each Monitoring Well

Well	**Median estimate $t_{1/2}$ (years)**	**Upper CIL $t_{1/2}$(years)**
MW-1	3.2	14
MW-10	5.1	11
MW-12	8.9	13
OW-1D	3.0	9.0
Average of 4 wells above	**5.1**	**12**
Consolidated Data (all wells pooled into single data set)	**2.8**	**11**

The attenuation estimates in the last row of Table 2 were calculated by pooling all of the data together and calculating the half-lives on the consolidated data set. The attenuation estimates shown in the table indicate that a median half-life between 2.8 and 5.1 years is predicted based on the data from individual wells. The highest concentration measured in 2015 was 25.2 µg/L in MW-1; but this data point remains suspect. Plugging a half-life of 2.8 years into an exponential decay equation predicts that the concentration in MW-1 will be at the AWQS of 5 µg/L in 6.5 years. Using the higher estimate for the half-life (5.1 years) leads to a prediction of 11.9 years. Using the upper CIL as an upper bound of the time duration indicates that 25 to 27 years of monitoring could be required. The results for MW-1 and similar results for MW-10 are shown in Table 3.

Table 3. Estimated Time to Reach AWQS

			Average of 4 wells		Pooled Data	
	Starting concentration (C_o in 2015) µg/L	Percent reduction required to meet AWQS	Median t ½ 5.1 years	Upper CIL t ½ 12 years	Median t ½ 2.8 years	Upper CIL t ½ 11 years
			Time in years to reach AWQS of 5 µg/L (for PCE)			
MW-1	25.2	80%	**11.9**	**27.1**	**6.5**	**24.8**
MW-10	12.9	61%	**6.9**	**15.8**	**3.8**	**14.4**

As indicated in the FS and discussed in this memorandum, there is some uncertainty about the well construction details of MW-1 and consequently the monitoring results. There is a possibility that the results from MW-1 are influenced by sediment in the sump at the bottom of the well and the results are biased high, in other words some of the projected monitoring durations shown in Table 3 for MW-1 are suspected to be unrealistically long. For estimating purposes, the low value of the pooled data for MW-10 (3.8 years, rounded to 4 years) and the high value of the median

data for MW-1 (11.9 years rounded to 12) will be used to bound the projected timeframe that monitoring may be required.

Monitoring Frequency and Termination of Monitoring

Groundwater monitoring has been conducted in the North Plume wells since 1999. Concentrations of COCs have declined to relatively low values over the last several years. Accordingly, collecting one sample per year should be sufficient to monitor and evaluate the ongoing effectiveness of MNA as a groundwater remedy for the Site. Termination of performance monitoring at a given monitoring well location can occur after the PCE concentration in a given well declines below the AWQS followed by one additional confirmation sample result at the given well in a subsequent period. An exception to this rule is for the wells down gradient of the source area, MW-12 and MW-14, where because of their location as sentinel wells, concentrations may increase due to advective transport from the source area. Consequently, the trend at those wells should be considered before monitoring is terminated.

Wells not recommended for groundwater sampling with the exception of up-gradient well MW-9 should be abandoned in accordance with Arizona Department of Water Resources (ADWR) requirements.

Summary and Recommendations

In summary, concentrations of 1,2-DCA in groundwater monitoring wells located in the South Plume have been below the AWQS since 2001 and ongoing attenuation processes in this area have already resulted in meeting the groundwater RAOs presented in the FS. Therefore, no further action/no additional monitoring is recommended in South Plume monitoring wells (MW-3, MW-6, MW-7, MW-8, and MW-11).

Continued monitoring of select groundwater monitoring wells is recommended in the North Plume. Three wells have been dropped from the proposed monitoring program (MW-2, MW-5, and MW-9) because they are located up gradient or cross gradient from the source area and the PCE concentrations are less than the AWQS. The six remaining monitoring wells (MW-1, OW-1D, MW-10, MW-12, MW-14, and MW-13) will be sampled annually until the PCE concentrations in all of the wells are below the AWQS. Up gradient well MW-9 may be sampled periodically, such as once every 5 years, to verify that impacts from up-gradient plumes (if any) are identified. Monitoring may be terminated earlier in individual wells if results in two consecutive monitoring events are below the AWQS, with the exception of MW-12 and MW-14, which are in sentinel locations, down gradient from the source area. It is anticipated that these wells may need to be monitored annually if any up-gradient wells remain above the AWQS. After each monitoring event, the data will be evaluated to see if trends are observed that suggest a change in sampling protocols is appropriate.

Figure

Drawn By: JKC

QC'd By: CW

Drawing Date: 05/26/2015

Legend

North Plume Monitoring Well

South Plume Monitoring Well

Former Buildings

Monitoring Well Locations
Performance Monitoring Tech Memo
16th Street & Camelback WQARF Site

November 11, 2015

ADEQ Arizona Department of Environmental Quality

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0 100 200 Feet

Figure
-1-

FILE: G:\gis_projects\ADEQ\active\apps\WVB_Sample_Locs.mxd, 11/13/2014, wilson_wheeler

APPENDIX B

Costs to Implement Recommended Remedy of MNA for 16th Street and Camelback WQARF Site

Updated November 2015

Calendar Year	Description	Cost[1,2]
2016	Monitoring + Reporting + Abandon 7 wells	$30,626
2017	Monitoring + Reporting	$15,939
2018	Monitoring + Reporting	$16,257
2019	Monitoring + Reporting	$16,582
2020	Monitoring + Reporting + 5 year review	$39,978
2021	Monitoring + Reporting	$17,252
2022	Monitoring + Reporting	$17,597
2023	Monitoring + Reporting	$17,949
2024	Monitoring + Reporting	$18,308
2025	Monitoring + Reporting + 5 year review	$44,139
2026	Monitoring + Reporting	$19,048
2027	Monitoring + Abandon 7 wells + Final Report	$54,800
	Subtotal (includes Project Management)	$308,476
	Contingency (15%)	$46,271
	Total Cost	**$354,747**

Notes:

2 A 15% project management factor is included.

3 A 2% inflation rate is assumed.

16th Street and Camelback WQARF Site
PRAP Cost Estimate

Assumptions
1) Abandon all 5 South Plume wells
2) Abandon North Plume Wells MW-2 and MW-5
3) Sample six wells annually for 12 years: MW-1, OW-1D, MW-10, MW-12, MW-13, and MW-14)
4) Sample MW-9 twice (year 5, year 10)
5)Collect 1 dup and 1 MS/MSD per sampling event
6) Prepare 5-year reviews on year 5 and 10)
7) Abandon all wells in year 4 or 12
8) Project Management at 15% is applied on the summary tables. 15%
9) Prepare a completion report when all wells are below AWQC
10) Inflation Rate **2%**
http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1304.pdf
(The rate varies in the first few predictive years before settling in at 2%)

ANNUAL MONITORING COSTS

	Units	Qty	Unit Cost	Total Cost
9 Wells				
Trip Prep	hrs	8	$100	$800
Travel + ODCs	ea	1	$2,026	$2,026
Sample collection (2 person, travel field)	hrs	32	$100	$3,200
Sample analysis (VOCs, MNA Parameters)	samples	8	$200	$1,600
Reporting	ea	1		$8,000
Total				**$15,626**

Sampling ODCs

	Units	Qty	Unit Cost	Total Cost
Airfare	ea	2	$400	$800
Hotel	ea	4	$113	$452
Per diem	ea	4	$71	$284
Truck	day	2	$120	$240
Misc	ea	1	$250	$250
				$2,026

Well Abandonment

Year 1 (7 wells)	$15,000
Yea 4 (7 wells)	$16,236
Year 12 (7 wells)	$19,024

Five Year Review

	Units	Qty	Unit Cost	Total Cost
Report Preparation	hrs	160	$100	$16,000
Report Review	hrs	10	$160	$1,600
Meeting to Discuss	hrs	16	$160	$2,560
Travel and ODCs	ea	1	$730	$730
Total				**$20,890**
Escalated for year 5				**$23,064**
Escalated for year 10				**$25,464**

Five-yr review ODCs

	Units	Qty	Unit Cost	Total Cost
Airfare	ea	1	$400	$400
Hotel	ea	1	$113	$113
Per diem	ea	1.5	$71	$107
Car	day	1	$60	$60
Misc	ea	1	$50	$50
Total				$730

Final Site Closure Report

	Units	Qty	Unit Cost	Total Cost
Report Preparation	hrs	80	$100	$8,000
Report Review	hrs	10	$160	$1,600
Meeting to Discuss	hrs	16	$160	$2,560
Travel and ODCs	ea	1	$730	$730
Total				**$12,890**
Escalated to Year 4				**$13,952**
Escalated to Year 12				**$16,347**