SIXTH FIVE-YEAR REVIEW REPORT FOR MOTOROLA 52nd STREET SUPERFUND SITE PHOENIX, MARICOPA COUNTY, ARIZONA

PREPARED BY

U.S. Army Corps of Engineers

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FOR

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Executive Summary

This is the Sixth Five-Year Review (FYR) of the Motorola 52nd Street Superfund Site (M52 Site) located in the City of Phoenix in Maricopa County, Arizona. The Site underlies a 7-mile stretch of a highly urbanized region in east-central Phoenix, Arizona, and spans from just east of Sky Harbor Airport (52nd Street) to downtown Phoenix (at 7th Avenue). The purpose of this FYR is to review information to determine if the selected interim remedies, which primarily consist of groundwater containment, extraction, and treatment, are and will continue to be protective of human health and the environment including addressing vapor intrusion from the groundwater plume.

The U.S. Environmental Protection Agency (EPA) placed the Site on the National Priorities List in 1989. Investigations in the 1980s revealed volatile organic compounds (VOCs) in groundwater at the Motorola Facility and to the west. The Site consists of three Operable Units (OUs)[1]; two of which are addressed in this review. OU1 is the easternmost portion of the groundwater plume and includes the former Motorola Facility an electronic manufacturer. OU2 is adjacent to the western boundary of OU1 and includes the Honeywell 34th Street manufacturing facilities and other OU2 facilities. OU3 is the westernmost portion of the groundwater plume and includes the Arizona Public Service facility and other OU3 facilities. EPA has not selected a remedy for OU3; therefore, it is not included in this FYR.

The groundwater basin in this area is not currently used for drinking water but is a potential future drinking water source.

In the 1988 Record of Decision and Letter of Determination for OU1, the 1994 Record of Decision for OU2, and the 1999 Explanation of Significant Differences for OU2, the EPA, with concurrence from the Arizona Department of Environmental Quality (ADEQ), selected the following interim remedies to protect long-term human health and the environment:

- 1988 Record of Decision for OU1: Soil vapor extraction for source areas and groundwater treatment and extraction to contain and recover volatile organic compounds.

- 1994 Record of Decision and 1999 Explanation of Significant Differences for OU2: Contain and extract contaminated groundwater and establish a capture zone across the entire width and depth of the trichloroethene (TCE) plume.

The parties responsible for the contamination at the M52 Site implemented an OU1 and an OU2 interim groundwater remedy to protect human health and the environment to prevent further contamination of downgradient areas that may be used in the future for drinking water purposes.

[1] During cleanup, a site can be divided into distinct areas depending on the complexity of the problems associated with the site. These areas, called operable units, may address geographic areas of a site, specific site problems, or areas where a specific action is required.

Groundwater interim remedies for OU1 and OU2 include containment and removal of VOCs from groundwater by respective centralized groundwater extraction and treatment plants.

The OU1 Integrated Groundwater Treatment Plant (IGWTP) treats groundwater drawn from the OU1 extraction wells, which is then discharged by a pipeline to the Old Crosscut Canal (OCC). Local sanitary sewers receive the treated groundwater during the annual OCC maintenance "dry up" period by the Salt River Project (SRP). The 20th Street Groundwater Extraction System (GES) treats groundwater from the OU2 extraction wells. Treated water is discharged to the Grand Canal except when SRP shuts down the canal for annual winter maintenance. The parties responsible for the contamination at the M52 Site conduct major maintenance operations during the annual canal shutdown period. Both treatment systems remove VOCs including trichloroethene (TCE), tetrachloroethene (PCE), 1,1,1-trichloroethane (1,1-TCA), and associated degradation products from the extracted groundwater to meet the federal drinking water standards.

The remedy for OU1 and OU2 is functioning as intended except for an area in OU2 where capture is insufficient. Due to extended drought conditions, regional and local water levels have steadily decreased since the baseline year of 1992 and 1996, respectively. The decline in groundwater levels has caused extraction system efficiencies to decrease. Currently, the OU2 capture zone does not contain the width of the plume in the Salt River Gravel and Basin Fill hydrostatigraphic units. However, the OU2 Working Group is implementing a pilot study using two new injection wells that will inject treated groundwater to increase the capture in the southern portion of the plume. The interim remedial objective for OU1 is groundwater containment; the interim remedial objectives for OU2 are groundwater containment and mass reduction. Therefore, no cleanup values were selected, nor toxicity data used.

When vapor intrusion became recognized as an environmental concern, EPA began investigation of this exposure pathway in OU1, resulting in mitigation systems being installed at sixteen residences in the previous FYR period and one commercial building during this FYR period. Based on a review of the vapor intrusion data collected over the last five to ten years for OU1 and OU2, the vapor intrusion investigation for OU1 is complete and investigation is in progress for OU2. Further evaluation of the vapor intrusion pathway will be included in the upcoming Remedial Investigation/Feasibility Study (RI/FS) reports for each OU.

Groundwater levels are expected to continue to decline at the M52 Site and regionally. As surface water sources become less available, the usage of groundwater is likely to increase and contribute to an overall decrease of groundwater from drought. The ability of the existing OU2 interim remedy to effectively contain the groundwater plume in the face of decreasing water levels has already become an issue.

The OU1 interim remedy protects human health and the environment because there is no exposure to contaminated groundwater and vapor intrusion mitigation systems have been installed where required. Groundwater extraction and treatment to contain the OU1 plume is ongoing.

The OU2 interim remedy is currently protective of human health and the environment. Groundwater extraction and treatment to contain the OU1 plume from migrating into OU2 is ongoing. While groundwater appears to be escaping the containment in some areas, there is currently no exposure to groundwater in OU2. A groundwater reinjection pilot project is ongoing to improve capture of the groundwater plume. The vapor intrusion study is ongoing but current data indicate no mitigation will be necessary. However, in order for the remedy to be protective in the long-term, evaluating the effectiveness of the treated groundwater reinjection in improving the capture zone for the interim remedy and monitoring the migration of contamination from the Earll plume is necessary.

Contents

Executive Summary ..... **i**
List of Figures ..... **v**
List of Tables ..... **vi**
List of Abbreviations and Acronyms ..... **vii**
1. Introduction **1**
1.1. Background 3
1.2. Physical Characteristics 3
1.3. Surface Water 8
1.4. Hydrogeology 8
2. Remedial Actions Summary **11**
2.1. Basis for Taking Action 11
2.2. Remedy Selection 11
2.2.1. Operable Unit 1 Interim Remedy Selection 11
2.2.2. Operable Unit 2 Interim Remedy Selection 12
2.3. Remedy Implementation 13
2.3.1. Operable Unit 1 Groundwater Remedy Implementation 13
2.3.2. Operable Unit 1 Soil Remedy Implementation 13
2.3.3. Operable Unit 2 Groundwater Remedy Implementation 14
2.4. System Operations/Operation and Maintenance 15
3. Progress Since the Last Five-Year Review **15**
3.1. Previous Five-Year Review Protectiveness Statement and Issues 15
3.2. Work Completed During this Five-Year Review Period 20
4. Five-Year Review Process **20**
4.1. Community Notification and Site Interviews 20
4.1.1. Five-Year Review Public Notice 20
4.1.2. Site Interviews 20
4.2. Data Review 22
4.2.1. Operable Unit 1 22
4.2.2. Operable Unit 2 28
4.3. Site Inspection 35
5. Technical Assessment **35**

5.1. Question A: Is the remedy functioning as intended by the decision documents? 35
5.2. Question B: Are the exposure assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid? 36
5.3. Question C: Has Any Other Information Come to Light That Could Call into Question the Protectiveness of the Remedy? 36
6. Issues/Recommendations 37
6.1. Other Findings 38
7. Protectiveness Statement 38
8. Next Review 39
Appendix A: List of Documents Reviewed 40
Appendix B: Site Chronology 42
Appendix C: Data Review 46
Appendix D: ARAR Assessment 54
Appendix E: Email with Public Notice 56
Appendix F: Interview Forms 57
Appendix G: Site Inspection Report and Photos 68

List of Figures

Figure 1. M52 Motorola Superfund Site Location Map 5
Figure 2. Detailed Map of the OU1 Integrated Groundwater Treatment Plant and Extraction System 6
Figure 3. Detailed Map of OU2 Treatment Plant and Extraction System 7
Figure 4. Schematic Cross-Section Across M52 Site 10
Figure 5. OU1 Basin Fill 2020 PCE Plume 24
Figure 6. OU1 Basin Fill 2020 Potentiometric Surface and Capture Zones 25
Figure 7. OU1 Basin Fill 2020 TCE Plume 26
Figure 8. OU1 Basin Fill and Bedrock Cross-Section 2020 TCE Plume 27
Figure 9. OU2 Salt River Gravel Groundwater Potentiometric Surface and Capture Zone. 30
Figure 10. OU2 Basin Fill Groundwater Potentiometric Surface and Capture Zone. 31
Figure 11. OU2 Salt River Gravel 2020 TCE Plume. 32
Figure 12. OU2 Basin Fill 2020 TCE Plume. 33
Figure 13. OU2 Salt River Gravel, Basin Fill, and Bedrock Cross-Section 2020 TCE Plume. 34

List of Tables

Table 1. Five-Year Review Summary Form 2
Table 2: Status of Recommendations from the 2016 Five-Year Review 17
Table 3. Issues and Recommendations Identified in the Five-Year Review 37
Table 4. Protectiveness Statement 38

List of Abbreviations and Acronyms

ADEQ	Arizona Department of Environmental Quality
ARAR	applicable or relevant and appropriate requirements
ATP	Acid Treatment Plant
BF	Basin Fill
bgs	below ground surface
CFR	Code of Federal Regulations
DNAPL	dense non-aqueous phase liquid
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five Year Review
gpm	gallons per minute
HSU	hydrostratigraphic unit
IGWTP	Integrated Groundwater Treatment Plant
$\mu g/m^3$	micrograms per cubic meter
µg/L	micrograms per liter
OCC	Old Crosscut Canal
O&M	Operation and Maintenance
OU	Operable Unit
PCE	tetrachloroethene
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
M52	Motorola 52nd Street
NXP	formerly Motorola Co., company responsible for cleaning up Motorola Site
SRG	Salt River Gravel
SRP	Salt River Project
SWPL	Southwest Parking Lot
1,1,1-TCA	trichloroethane
TCE	trichloroethene
USACE	United States Army Corps of Engineers
VOC	volatile organic compound

1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in each FYR report. In addition, the FYR report identifies issues found during the review, if any, and documents recommendations to address them

The U.S. Environmental Protection Agency (EPA) has prepared this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act Section 121, 40 Code of Federal Regulation Section 300.430(f)(4)(ii) of the National Contingency Plan and EPA policy.

This is the Sixth FYR for the Motorola 52nd Street Superfund (M52) Site. The triggering action for this statutory review is the completion date of the previous FYR in September 2016. The FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the site at levels that do not allow for unlimited use and unrestricted exposure.

The M52 Site consists of three OUs[2], two of which are addressed in this FYR. OU1 is the easternmost portion of the groundwater plume and includes the former Motorola 52nd Street Facility (Motorola Facility), an electronics manufacturer. OU2 is adjacent to the western boundary of OU1 and includes the Honeywell 34th Street manufacturing facilities and other facilities. OU3 is the westernmost portion of the groundwater plume and includes the Arizona Public Service facility and other facilities. OU3 is in the remedial investigation/feasibility study (RI/FS) phase and does not yet have a selected remedy; therefore, it is not included in this FYR.

The M52 FYR was led by Rachel Loftin, EPA Region 9 Remedial Project Manager. Participants included EPA, Arizona Department of Environmental Quality (ADEQ), U.S. Army Corps of Engineers (USACE), NXP (formerly Motorola), Honeywell, and contractors representing the Potentially Responsible Parties (PRPs). Participants included Cynthia Wetmore, EPA Region 9 Superfund Five-Year Review Coordinator, and from the U.S. Army Corps of Engineers (USACE): Jennifer Phillippe, Physical Scientist; Justin McNabb, Geologist, and Matthew Marsten, Site Inspector. The review began on November 2, 2020.

[2] During cleanup, a site can be divided into distinct areas depending on the complexity of the problems associated with the site. These areas, called operable units, may address geographic areas of a site, specific site problems, or areas where a specific action is required.

Table 1. Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Motorola 52nd Street Superfund Site		
EPA ID: AZD009004177		
Region: 9	**State:** AZ	**City/County:** Phoenix, Maricopa County
SITE STATUS		
National Priorities List Status: Final		
Multiple Operable Units? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Rachel Loftin, Remedial Project Manager		
Author affiliation: EPA		
Review period: 11/2/2020 - 9/28/2021		
Date of site inspection: 7/15/2021		
Type of review: Statutory		
Review number: 6		
Triggering action date: 9/27/2016		
Due date *(five years after triggering action date)*: 9/27/2021		

1.1. Background

The M52 Site is located in the City of Phoenix, in Maricopa County, Arizona. Motorola Inc. owned and operated the former Motorola Facility from 1956 to 1999. Motorola's successor party responsible for M52 Site cleanup is now NXP. As part of its electronics manufacturing operation, Motorola used solvents, including volatile organic compounds such as trichloroethene (TCE), tetrachloroethene (PCE), and 1,1,1-trichloroethane (1,1,1-TCA) to clean and degrease parts and equipment. In the 1980's, investigations revealed groundwater contamination at the Motorola Facility and to the west. In 1989, the M52 Site was added to the Superfund National Priorities List.

1.2. Physical Characteristics

The M52 Site is generally defined by the extent of contaminated groundwater that underlies approximately 7-miles of a highly urbanized region in east-central Phoenix, Arizona. The City of Phoenix provides potable water (sourced from supplies outside of the M52 Site) to area residents. Groundwater extracted from the M52 Site is not used as a source of drinking water. The M52 groundwater plume spans from just east of Sky Harbor Airport around 52nd Street to 7th Avenue. The boundaries of the three OUs were developed to designate study areas where remedial investigation and/or response activities are occurring. (Figure 1). The OU boundaries extend beyond the extent of contamination and are as follows:

- OU1 (approximately 500 acres in area) is the easternmost operable unit and is located north of State Route 202, west of Papago Park and the Papago Park Military Reservation, and primarily east of the Old Crosscut Canal (OCC). It includes the former Motorola Facility at 5005 E. McDowell Road and several mixed residential/commercial neighborhoods and is roughly bounded by Palm Lane to the north, 52nd Street to the east, Roosevelt Street to the south, and 44th Street to the west.

- OU2 (approximately 3,800 acres in area) is between the western boundary of Operable Unit 1 and the eastern boundary of Operable Unit 3. It is primarily located south of State Route 202 and north of Sky Harbor Airport. Operable Unit 2 includes the Honeywell 34th Street manufacturing facility and other potential source facilities, several mixed residential/commercial neighborhoods and is approximately bounded by McDowell Road to the north, 44th Street to the east, Buckeye Road to the south, and 20th Street to the west.

- OU3 (approximately 3,000 acres in area) is the westernmost OU and is primarily located south of Interstate 10 (I-10) and west of State Route 51. It includes the Arizona Public Service facility and other facilities, several mixed residential/commercial neighborhoods and is generally bounded by McDowell Road to the north, 20th Street to the east, Buckeye Road to the south, and 7th Avenue to the west. OU3 is in the RI/FS phase and does not yet have a ROD; therefore, it is not evaluated in this FYR.

Currently, there are two known water supply wells located within M52 OU1 that are not associated with the cleanup. These are the privately owned Morgan Well 4626G, which is used for landscaping and has remained unchanged since the 1988 Letter of Determination by ADEQ, and the interim ROD were

completed. The second well is the SRP Well 18E-5N, an irrigation supply well that discharges into the Grand Canal. Both wells operate on an intermittent basis as needed.

Land use at the M52 Site has not significantly changed since contamination was first discovered at the former Motorola Facility in 1982. Land use is comprised of a mixture of residential, commercial, and industrial uses.

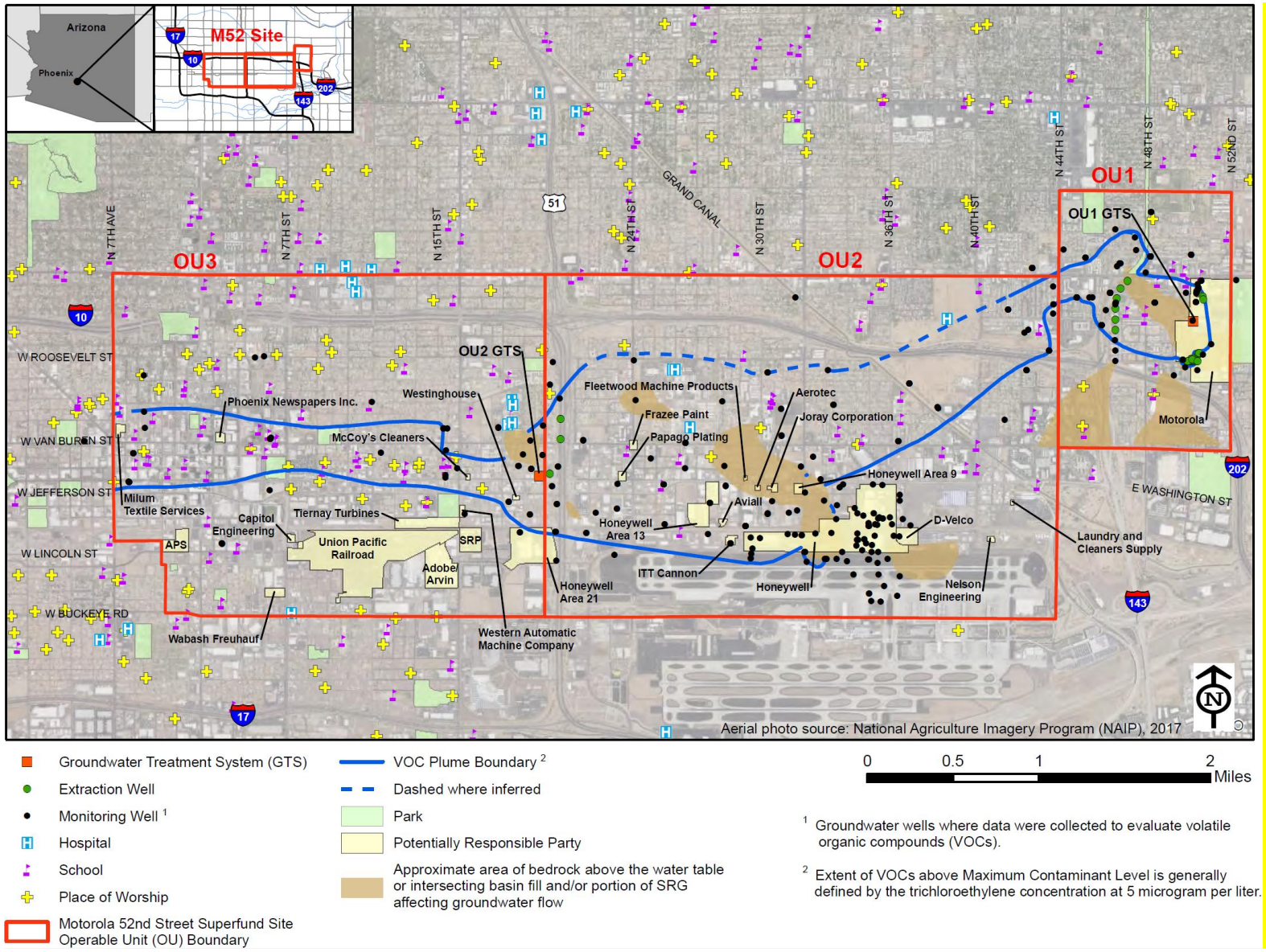
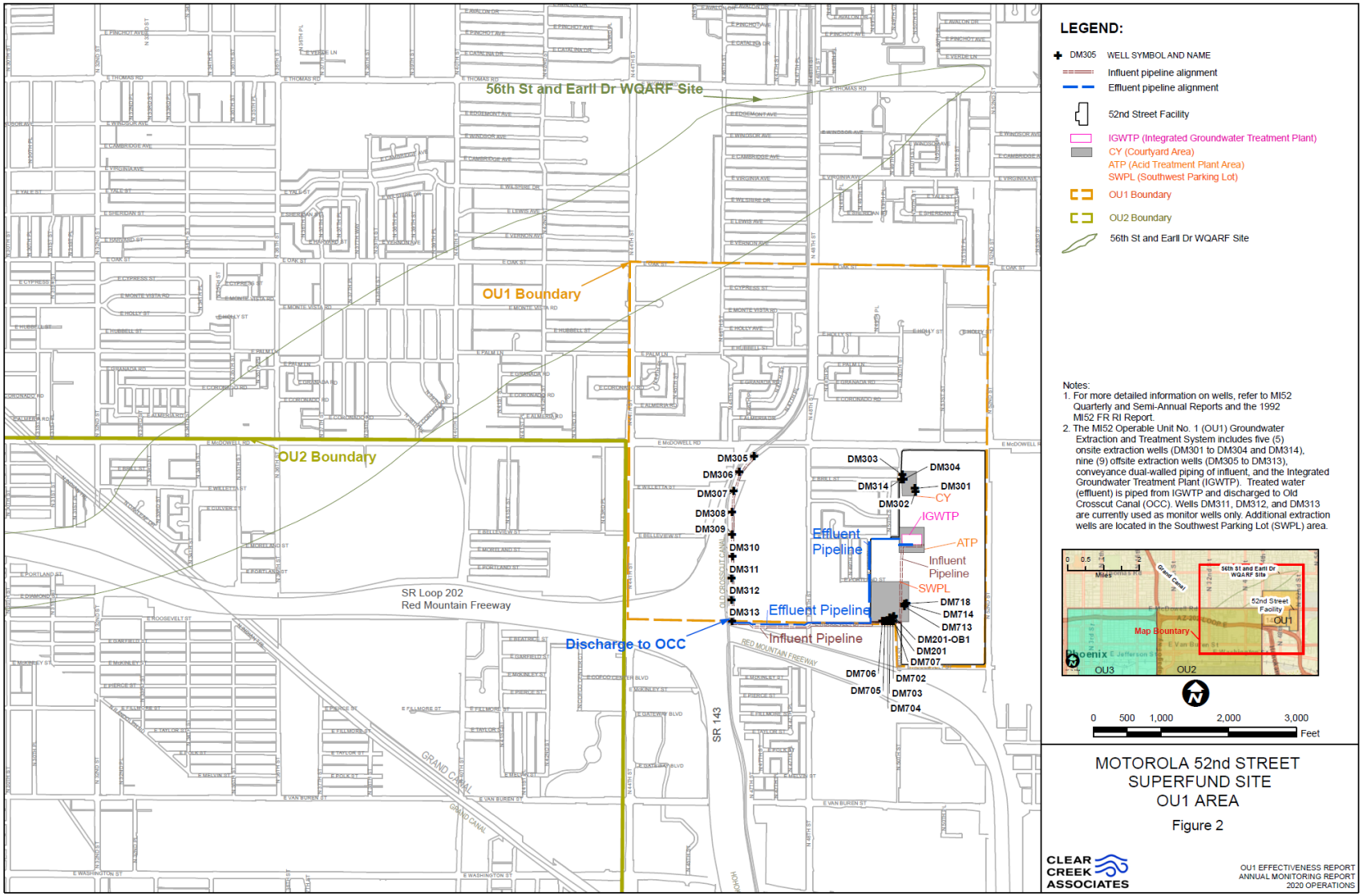
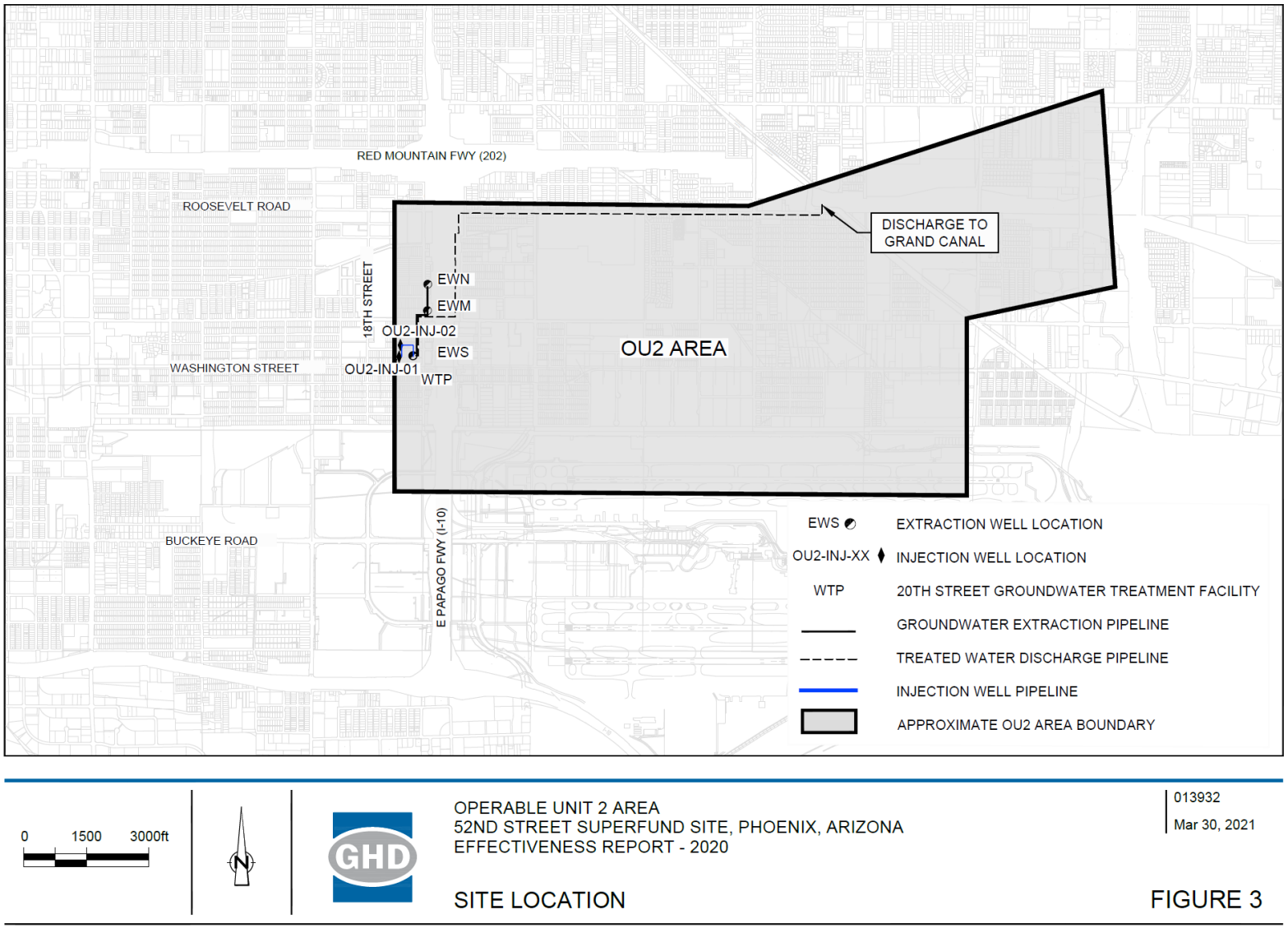


Figure 1. M52 Motorola Superfund Site Location Map



Source: Clear Creek Associates (2021) OU1 Effectiveness Report 2020 Operations Motorola 52nd Street Superfund Site.

Figure 2. Detailed Map of the OU1 Integrated Groundwater Treatment Plant and Extraction System



Source: GHD (2021). OU2 Effectiveness Report 2020, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Phoenix, Arizona

Figure 3. Detailed Map of OU2 Treatment Plant and Extraction System

1.3. Surface Water

This section describes the surface water bodies that serve as discharge points for the treated groundwater from the OU1 and OU2 groundwater interim remedies. The Salt River is a dominant surface water feature in the vicinity of the M52 Site and is located approximately one to two miles south of the M52 Site. The Salt River flows on an intermittent basis in response to significant rainfall events and/or releases from upstream dams. The direction of surface water flow is generally from east to west.

Located throughout the Phoenix Metropolitan Area is an extensive man-made canal system that was used historically to convey water for agricultural purposes. Currently, the canal system is operated by the Salt River Project (SRP) to supply water for irrigational use and includes two canals within the boundaries of M52 which are the discharge points for treated groundwater from the OU1 and OU2 interim remedies:

- The OCC is in OU1 between 44th and 46th Street (adjacent to State Route 143) and connects the Grand Canal to the Arizona Canal. The OCC is used to convey stormwater to the Salt River but can be operated to transfer water between the Grand and Arizona Canals (SRP, 2010). The OU1 treated water is discharged to the OCC (Figure 2).

- The Grand Canal runs diagonally across OU2 from just north of the Salt River (south of Washington Street) across metropolitan Phoenix to the Agua Fria River near the Glendale Municipal Airport. The Grand Canal receives treated water from the OU2 interim remedy (Figure 3).

1.4. Hydrogeology

Groundwater at the M52 Site occurs within the unconsolidated sedimentary deposits and underlying bedrock of the West Salt River Valley sub-basin of the Phoenix Active Management Area. Basin wide, the Salt River Valley alluvial aquifer is defined by three hydrogeologic units: the Lower Alluvial Unit, Middle Alluvial Unit, and the Upper Alluvial Unit. The Upper Alluvial Unit near the eastern boundary of the West Salt River Valley is the primary focus of the M52 Site containment investigation and is comprised of the following hydrostratigraphic units (HSUs):

- **Salt River Gravel (SRG):** Representative of the older channel deposits of the Salt River and is comprised of coarse-grained rounded gravels, cobbles, and boulders that include minor amounts of interbedded and laterally discontinuous fine-grained (sandy) deposits. The SRG also referred to as HSU A or the Shallow Zone (S), is not present in OU1. It is present in central and western OU2 and OU3.

- **Basin Fill:** The upper portion of the Basin Fill includes interbedded coarse and fine-grained deposits with gravel that are similar to the SRG. The Basin Fill also referred to as HSU B is present in all three OUs. The lower portion of the Basin Fill is relatively more consolidated than HSU A and HSU B and includes a fine-grained layer underlain by interbedded fines (silt) and sand. The Lower Basin Fill is also referred to as HSU D and is not present in OU1. It is present in OU2 and OU3.

- **Bedrock:** The underlying bedrock is HSU C and consists of Precambrian (Proterozoic) metarhyolite and granite, as well as Tertiary volcanics and indurated sediments. Bedrock is included as an HSU because groundwater contamination is known to move between alluvium and fractured bedrock where present; predominantly in OU1. The dissolved groundwater contaminants are predominately transported within the SRG and Basin Fill units. Figure 4 shows a schematic cross-section of the HSUs across M52.

In OU1, the thickness of Basin Fill varies from less than 20 feet at the former Motorola Facility to approximately 150 feet west of the former Motorola Facility at about 40th Street. The BF is unconfined, and groundwater is encountered at depths between approximately 37 and 82 feet below ground surface (bgs) across OU1 in 2020 (Clear Creek Associates, 2021). The hydraulic conductivity of the Basin Fill in OU1 varies from 2 feet/day to approximately 50 feet/day. Generally, groundwater flow in the Basin Fill at OU1 is toward the west to southwest but is strongly influenced by groundwater extraction occurring at the former Motorola Facility and off-site in the vicinity of the OCC. Groundwater flow in the Basin Fill is also influenced by the presence of lower permeability bedrock ridge that penetrates the Basin Fill. Hydraulic conductivity within bedrock is strongly influenced by the presence, frequency, and interconnectedness of open fractures. Fracture densities measured in rock core samples from boreholes within OU1 ranged from 1 to more than 15 fractures per foot. However, many of the fractures have been healed with secondary mineralization. Measurements of hydraulic conductivity in bedrock vary from 1.4 x 10^{-3} feet/day to 2.1 feet/day.

In OU2, the Basin Fill is the shallowest unit, from approximately North 34th Street to the eastern boundary. The Basin Fill ranges from approximately 150 to over 225 feet thick in this portion of OU2 and groundwater is encountered at a depth of approximately 75 feet bgs. The SRG is encountered west of North 34th Street and thicken toward the west. At the western OU2 boundary, the SRG thickness ranges up to 145 feet thick, with the underlying Basin Fill ranging from 80 to 95 feet thick. Depths to groundwater in the SRG range from about 96 feet in central OU2 to about 106 feet at the western boundary (GHD Services, Inc., 2021).

Locally, the groundwater flow direction is impacted by the OU2 groundwater extraction system; however, the flow is generally toward the west-southwest across OU2. The average hydraulic conductivity in the Basin Fill is about 37 feet/day, while the hydraulic conductivity of the SRG is around 250 feet/day (GHD, 2021). Two bedrock rises within OU2, including the Honeywell Bedrock Ridge and the Airport Ridge, penetrate through the Basin Fill and the saturated portion of the SRG, which intercept and divert groundwater flow in both these HSUs. Groundwater recharge to the Basin Fill and SRG occurs from precipitation, infiltration from the Salt River, runoff from regional mountains, and irrigation. Significant stormwater discharges and upstream surface water releases to the Salt River particularly impact groundwater levels and flow directions in the immediate vicinity of the river (i.e., near the Honeywell 34th Street Facility) within OU2.

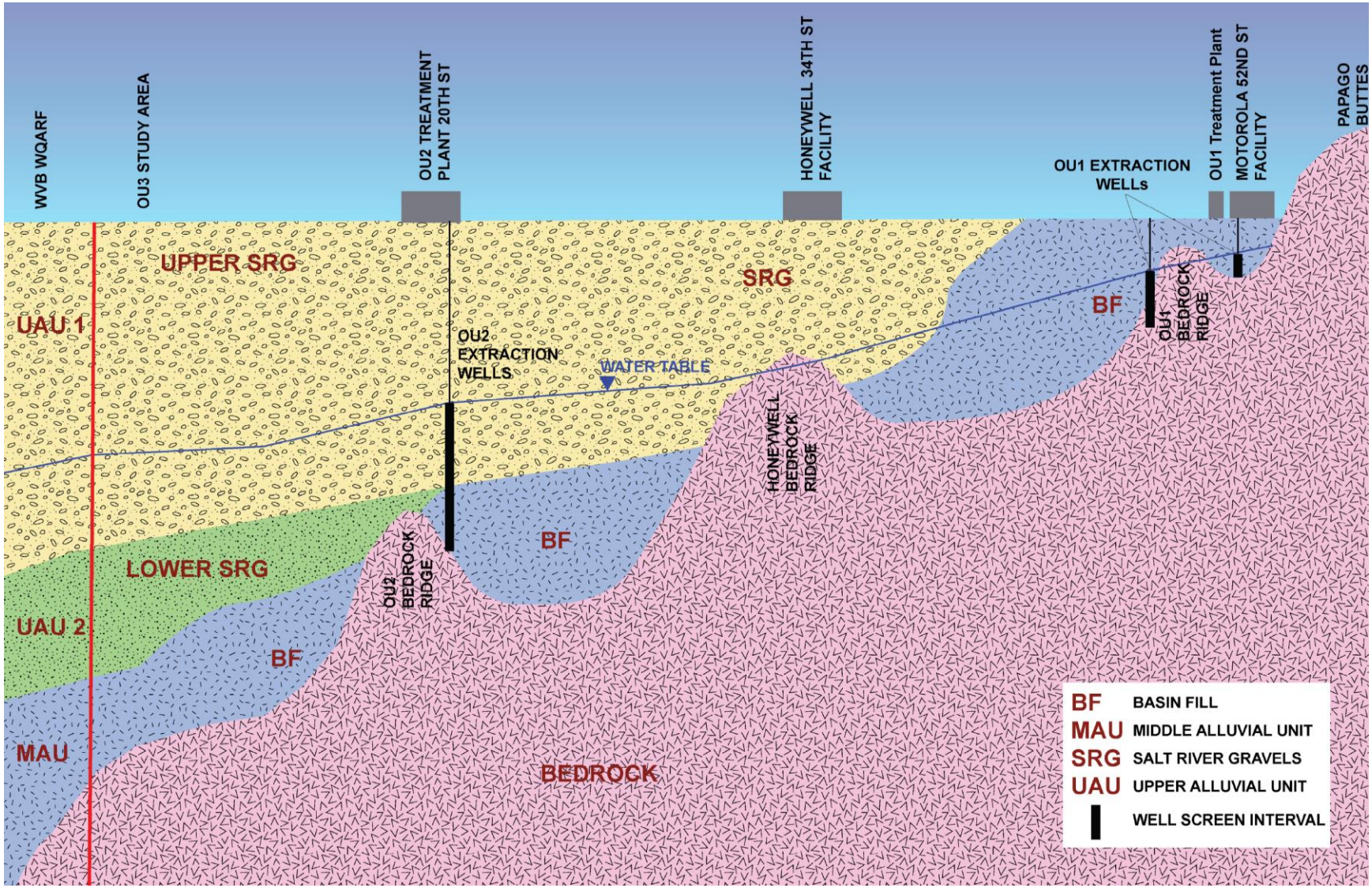


Figure 4. Schematic Cross-Section Across M52 Site

2. Remedial Actions Summary

2.1. Basis for Taking Action

Volatile organic compounds (VOCs) were found in groundwater, soil, and soil gas at the M52 Site. These VOCs, predominately TCE, have been detected in groundwater across M52 OU1, OU2, and OU3 forming a plume approximately 7 miles west of the former Motorola Facility at levels greater than EPA drinking water standards. Currently, the groundwater basin in this area is used for irrigation and non-potable uses but is a potential future drinking water source.

2.2. Remedy Selection

2.2.1. Operable Unit 1 Interim Remedy Selection

The OU1 ROD, issued by the EPA in September 1988, accompanied by ADEQ's 1988 Letter of Determination, serves as EPA's and ADEQ's selection of the interim remedial action. The objectives of the OU1 interim remedy are to: 1) contain the migration of high concentrations of volatile organic compounds VOCs in alluvium groundwater east of the OCC at 46th Street and at the Courtyard/50th Street area, and 2) treat the extracted groundwater to a level which will meet federal and state drinking water standards for the specific uses of the water and groundwater use restrictions. The interim remedy also requires soil and a soil gas evaluation and soil gas remediation at the former Motorola Facility source areas: Acid Treatment Plant (ATP), Courtyard, and Southwest Parking Lot (SWPL). Although not explicitly stated as remedial action objectives, the remedy selected was intended as an interim solution for the cleanup of OU1 contamination.

The major components of the OU1 interim remedy selected include the following:

- Containment, extraction, and treatment of groundwater from the Courtyard/50th Street area at the Motorola Facility.
- Extraction and treatment of organic contaminants in soil gas at the Courtyard/50th Street, acid treatment plant, and southwest parking lot areas of the Site.
- Extraction of groundwater designed to contain contaminant migration in alluvium groundwater (east of) at the OCC.
- Treatment of groundwater extracted from the OCC containment system at the former Motorola plant property.
- Use of all treated groundwater at the former Motorola Facility to replace water purchased for manufacturing processes from the City of Phoenix.

The OU1 interim remedy did not select restoration of the aquifer as a remedial action objective; however, the Letter of Determination explained that compliance with an aquifer restoration applicable or relevant and appropriate requirement would be revisited in the final ROD. The remedy was designed to meet the substantive requirements of applicable permits.

2.2.2. Operable Unit 2 Interim Remedy Selection

In July 1994, EPA issued and ADEQ concurred with a ROD selecting the interim groundwater remedy for OU2. The purpose of the Operable Unit 2 interim remedy is to provide additional containment of contaminated portions of the groundwater downgradient of OU1. The interim remedy began operations on December 13, 2001.

In the OU2 ROD, EPA identified the following remedial action objectives:

- Establish a capture zone across the entire OU2 width and depth of the contaminant plume.
- Begin to remove contaminants from the groundwater for eventual restoration of the aquifer as a potential source of drinking water.
- Collect additional hydrogeologic data to facilitate development of additional remedies.

The OU2 interim remedy selected in the ROD includes groundwater extraction near 20th Street and Washington Street, treatment of water by either air stripping (with off-gas treatment by synthetic resin adsorption) or advanced oxidation, and injection of treated water back into the aquifer in locations allowing for additional control of the contaminant plume. The OU2 ROD specifies that extracted groundwater be treated to levels at or below federal drinking water standards. No specific contaminants of concern were specified in the ROD.

In September 1999, EPA issued and ADEQ concurred with an Explanation of Significant Differences (ESD) to the OU2 ROD for the OU2 interim remedy. The 1999 ESD modified the OU2 interim remedy to make it more efficient and cost effective. The remedial action objectives for the OU2 interim remedy as modified by the 1999 ESD include the following:

- Extraction of groundwater to contain the full width and depth of the plume near I-10.
- Reduce concentrations of contaminated groundwater within the alluvial aquifer upgradient of the extraction wells.

The remedy, as modified by the ESD, includes treatment of extracted groundwater via carbon adsorption for TCE, PCE, 1,1,1-TCA, and other breakdown products, ultraviolet oxidation for vinyl chloride, and discharge of treated water to the Salt River Project Grand Canal.

2.3. Remedy Implementation

2.3.1. Operable Unit 1 Groundwater Remedy Implementation

From 1984 to 1986, Motorola installed a pilot treatment plant at the former Motorola Facility to treat extracted groundwater from the Courtyard source area via air stripping. Motorola operated the pilot treatment plant from September 1986 through July 1992. Additional remedy components were installed, and Motorola began operating the integrated groundwater treatment plant (IGWTP) on the Motorola Facility in 1992.

The IGWTP interim remedy included: 1) installation of extraction wells along the eastern bank of the OCC to contain migration of contamination downgradient of the facility; 2) construction of a pipeline to convey groundwater from the OCC extraction wells to the IGWTP; 3) construction of a pipeline to convey groundwater from the Courtyard area wells to the IGWTP; and 4) treatment of groundwater at the IGWTP via air stripping, polishing with liquid-phase granular active carbon, and treatment of the off-gas with vapor-phase carbon.

All OU1 groundwater extraction wells were completed at the bedrock/alluvium interface. The treated groundwater is discharged at the OCC and used for irrigation purposes. Dense non-aqueous phase liquid (free product/DNAPL) is recovered on a weekly to biweekly basis by bailing and/or pumping from a bedrock extraction well. The recovered DNAPL is temporarily stored at the IGWTP in the solvent recovery storage tank system prior to disposal as hazardous waste.

Groundwater extraction in OU1 is conducted in accordance with the requirements of a Poor-Quality Groundwater Withdraw Permit issued by the Arizona Department of Water Resources, which requires quarterly water level monitoring and annual sampling of extraction wells with semi-annual reporting. Currently, there is no air permit for OU1 treatment operations, but the operations meet the substantive requirements of Maricopa County's air permit for emissions.

2.3.2. Operable Unit 1 Soil Remedy Implementation

According to the OU1 ROD, three source areas at the former Motorola Facility (Courtyard, ATP, SWPL) were to be remediated using soil vapor extraction (SVE) as part of the OU1 interim remedy:

- Motorola operated a successful pilot SVE system in the Courtyard area from September 1992 through March 1993; however, contaminant levels measured two years after the pilot test was completed showed contaminant levels had rebounded to those which existed prior to operation of the pilot SVE system. Motorola submitted a letter requesting closure of the Courtyard SVE system on April 30, 1998, stating that continued SVE operations would not be effective at eliminating the residual contaminant mass. ADEQ denied Motorola's request. ADEQ recommended revisiting the potential for soil gas remediation in this area pending revision of Arizona's Soil Rule and performance monitoring of the groundwater interim remedy. This area is being revisited as part of the ongoing RI/FS.

- No active soil remediation in the ATP has occurred to date. EPA, ADEQ, and NXP (formerly Motorola) are conducting a soil gas investigation of acid treatment plant area as part of the ongoing final RI/FS.

- In February 1993, Motorola operated a pilot air-sparge/SVE test in the SWPL area including three SVE wells and one air-sparge well, confirming that these technologies were effective in reducing contamination in the SWPL area. A full-scale SVE system operated from November 1996 through April 1997. In 2002, ADEQ determined that the soil cleanup in the SWPL area required in the letter of determination was complete. This area is also being evaluated as part of the ongoing soil gas and vapor intrusion to indoor air evaluation. Current property transfer and planned redevelopment in the SWPL area are resulting in relocation of groundwater extraction wells and additional vapor intrusion assessment.

2.3.3. Operable Unit 2 Groundwater Remedy Implementation

Motorola (now NXP) and Honeywell (OU2 Working Group) began construction of the 20th Street groundwater treatment facility in March 2000 and completed it in September 2001. The treatment system became fully operational on December 13, 2001. Three groundwater extraction wells located along 20th Street supply groundwater to the 20th Street groundwater treatment facility. The 20th Street groundwater treatment facility is designed to treat approximately 5,300 gallons per minute (gpm).

The extraction wells are designed to provide hydraulic containment east of Interstate 10. There are also 59 monitoring wells that constitute the OU2 treatment system monitoring network. The OU2 groundwater extraction system (GES) consists of:

- Eighteen granular activated carbon vessels (water pumped directly through the vessels without exposure to air in an equalization tank)

- Three groundwater extraction wells

- Ultraviolet oxidation system

- Two newly installed injection wells (see Section 3.2)

Groundwater from the extraction wells is pumped to the treatment plant and through four pairs of carbon vessels connected in series. The ultraviolet oxidation system is not in operation because vinyl chloride has not been detected in extracted groundwater. The treated water is discharged to the Grand Canal and used for irrigation purposes. During the annual SRP Grand Canal shutdown, generally the month of January, the OU2 Working Group shuts down the treatment system and completes major repairs and routine maintenance.

Occasional slow flow back-flushing of the carbon units is required to flush out entrained air from the carbon and re-stratify carbon in the vessels. The back-flushed water is collected in a backwash wastewater

tank and is subsequently discharged to the city of Phoenix sanitary sewer system. Spent carbon is returned to the supplier for regeneration and then is returned to the treatment plant.

2.4. System Operations/Operation and Maintenance

This section presents operation and maintenance (O&M) information for the OU1 IGWTP, OU2 GES and the OU1 vapor intrusion mitigation systems.

The O&M Manuals for the treatment systems outline periodic inspections and sampling requirements for existing discharge requirements. The O&M Manual for OU1 IGWTP was updated in March 2020 to address previous issues identified in the 2016 FYR. The O&M Manual for Vapor Intrusion Mitigation Systems installed in residences and a commercial building in OU1 was also updated in July 2019 to reflect approved indoor air passive vapor sampling devices called Radiellos and installation of an additional mitigation system.

The O&M Manual for OU2 was updated in 2016. Several activities associated with the OU2 remedy are ongoing. A pilot project for reinjecting treated groundwater to improve plume capture by creating a groundwater "mound" was submitted in 2019 (GHD, 2019). The work plan was approved, and implementation was delayed, but will be restarted later in 2021 and will be incorporated into the O&M Manual. Biofouling of the newly installed injection wells and infrastructure at the OU2 GES has occurred and a longer-term disinfection treatment program, currently in effect, will be added to the O&M Manual in the near future.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statements from the 2016 FYR for the M52 Site state the following:

OU1 1 Protectiveness Statement

The Operable Unit 1 interim remedy is currently protective of human health and the environment because groundwater is confirmed to be contained laterally and there is currently no exposure to contaminated groundwater in the OU. For long-term protectiveness, evaluation is necessary regarding effects of the lowering groundwater table, treatment plant inefficiencies associated with equipment age, the Motorola Facility soil cleanup, and vertical containment specifically due to the presence of dense non-aqueous phase liquid (DNAPL) in bedrock. Protectiveness with regard to the long-term final remedy, including groundwater restoration and OU-wide vapor intrusion remediation, are expected to be addressed by the OU1 final remedy, which is still under investigation.

OU2 Protectiveness Statement

A protectiveness determination at the Operable Unit 2 interim remedy cannot be made until further information is obtained for potential vapor intrusion. EPA is currently conducting a vapor intrusion

investigation, including soil vapor sampling and indoor air sampling at and near areas of concern. It is expected that the investigation will take approximately 1 year to complete, at which time a protectiveness determination will be made. In addition, for long-term protectiveness, the interim remedy shall demonstrate a capture zone across the entire width and depth of the contaminant plume, including the area southeast of the 20th Street Groundwater Treatment Facility, and evaluate effects of the declining groundwater table. For long-term protectiveness, Operable Unit 2 is undergoing a Remedial Investigation/Feasibility Study evaluation which will need to look at groundwater restoration and the potential for vapor intrusion as part of the final Operable Unit 2 remedy.

The 2016 FYR included nine issues and recommendations. Each recommendation and the current status are discussed below.

Table 2: Status of Recommendations from the 2016 Five-Year Review

Operable Unit #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1	DNAPL present in bedrock at and near the former Motorola Facility continues to serve as an ongoing source of groundwater contamination upgradient of the extraction and treatment system. Without addressing this ongoing source, complete plume containment may be jeopardized, and the OU1 cleanup may have to continue many years longer than anticipated.	Continue review and investigation of approaches to mitigate the DNAPL present in bedrock at and near the Motorola Facility and address in the upcoming RI/FS.	Ongoing	A Technical Impracticability waiver for the DNAPL is being evaluated as part of the RI/FS under way. Data continues to indicate capture is complete at OU1. EPA anticipates completion in 2023. EPA anticipates the RI/FS will be completed in 2024.	
1	The OU1 Interim Remedy is less efficient than originally expected in the ROD. In part because the groundwater table continues to lower, groundwater extraction rates are also declining. This decreased efficiency could potentially impact remedial effectiveness, particularly with respect to groundwater plume containment.	Complete RI/FS	Ongoing	Evaluate optimization of the IGWTP in the upcoming FS and the impact that potential dewatering of the alluvium will have on the plume containment. EPA anticipates completion in 2024.	
1	The interim groundwater treatment plant equipment is aging. Also, the level of operational complexity to maintain the effectiveness of the interim groundwater treatment plant may lead to future operational issues and a decline in Operation and Maintenance adequacy. During site inspection for this 5 Year Review, these specific potential concerns were observed: • Treatment of only 30 to 40% of the original design flow • Relatively high per unit cost for treatment • Non-functional sump controls for the pipeline double-containment system • Removal of two liquid-phase carbon units from service for treatment of scale and recycling of descaling/scale prevention solution in process operations • Signs of environmental exposure/weathering of equipment and process areas • Insufficient detail in maintenance documentation	Conduct an engineering review of interim groundwater treatment plant operations to optimize the system. Update operation and maintenance manual to improve efficiency and require better documentation of operations.	Completed	A revised O&M Manual for OU1, which addresses the specific issues listed, was completed.	March 2020

Operable Unit #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1	The SVE operations identified in the ROD have ceased; the effectiveness of completed soil vapor cleanup activities has not been adequately evaluated. Soil vapor cleanup in the ATP area as required by the ROD has not been conducted.	Evaluate residual soil/soil vapor contamination in the Courtyard, ATP and SWPL, and the past and potential future effectiveness of the SVE operations as part of the upcoming RI/FS.	Ongoing	Additional soil gas sampling has been conducted. Due to redevelopment of the SWPL area, this work is being expedited, and is anticipated to be completed in 2022. EPA anticipates the RI/FS will be completed in 2024.	
1	While the evaluation and mitigation of vapor intrusion to indoor air are being implemented, a long-term remedy that addresses vapor intrusion needs to be evaluated.	Evaluate vapor intrusion in light of current investigations and mitigation, throughout the OU1 as part of the upcoming RI/FS.	Completed	Vapor intrusion sampling at the Motorola Facility and off-site in the surrounding neighborhood was completed between 2011 and 2019. Seventeen sub-slab depressurization systems were installed off-site and continue to operate and be monitored. Vapor intrusion is being considered as part of the final remedy. An ISCO and bioaugmentation pilot study (Plumestop ®) was conducted in 2018 to reduce the contaminant mass in groundwater where vapor intrusion was occurring. The conclusion was this technology would not scale up and be economically feasible to treat groundwater in the Almeria area. EPA anticipates the RI/FS will be completed in 2024.	Mitigation 2011-2019 Pilot Study 2021
1	The 1988 OU1 Interim Remedy decision anticipated a final remedy within a few years of implementation of the interim remedy. The final remedy has not been implemented as of 2016, and the delay is impacting long-term sustainability of the OU1 IGWTP.	Finalize the OU1 RI/FS, develop a Technical Impracticability Waiver to produce the final FS	Ongoing	Containment with the OU1 interim remedy is occurring. NXP is evaluating upgrade options for the IGWTP to include in the FS. Several SVE projects, VI investigation & mitigation, mass reduction pilot studies, data gap evaluations, new gw well installations/monitoring, potential contaminants of concern gw evaluations, etc., have been conducted as RI activities, and as required to reach a final remedy. EPA anticipates the RI/FS will be completed in 2024.	

Operable Unit #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
2	Contamination in the area southeast of the OU2 GES exceeds the MCLs and follows a flow path outside the area of capture. The current interim remedy would not capture this contamination.	Evaluate the Injection Wells ability to enhance the OU2 GES capture.	Completed	In 2020, the OU2 Working Group installed two injection wells and connecting piping to the OU2 GES and completed start up testing. However, reinjection of treated groundwater has not begun operation due to biofouling of the OU2 GES. The reinjection of treated groundwater is intended to improve the capture of the contaminated groundwater, as well as address the dewatering in the area due to extraction and decreasing groundwater levels.	2020-2021
2	The 1994 OU2 Interim Remedy decision anticipated a final remedy within five years of implementation of the interim remedy. The final remedy has not been implemented as of 2016, and the delay is impacting the effectiveness and long-term sustainability of the OU2 GES.	Finalize the OU2 RI/FS and select a final remedy by 2019.	Ongoing	Ongoing evaluation of the interim remedy in the Effectiveness Reports have identified capture issues. An interim in-situ chemical oxidation pilot study was performed to address loss of capture. However, the evaluation indicated an alternative was needed which led to the injection well installation. The injection well effectiveness will be evaluated after operation begins. OU2-wide VI investigation is ongoing, source facility RIs and remedies have been implemented under enforceable orders, as needed to reach a final remedy The RI/FS is expected to be completed in 2024	
2	Initial assessment for vapor intrusion in OU2 was conducted with EPA's TAGA mobile lab, and several areas were identified for further investigation where vapor intrusion may be of concern. Honeywell and NXP are currently conducting a vapor intrusion investigation in these areas to determine whether and where there may be the potential for vapor intrusion, and to implement mitigation if vapor intrusion is found to be occurring.	Complete the vapor intrusion evaluation in OU2. Include the results in the OU2 RI/FS.	Ongoing	Vapor intrusion results reported to date have not required the installation of mitigation systems. However, indoor air testing is not complete. The program was delayed due to the COVID-19 epidemic; however, alternative sampling approaches are being evaluated to continue. Vapor intrusion is being considered as part of the final remedy.	2022

3.2. Work Completed During this Five-Year Review Period

During this FYR period, NXP continued operating the OU1 IGWTP, and monitoring soil gas and groundwater in general accordance with the interim remedy decision documents. A RI/FS for the final, long-term remedies at OU1 is ongoing. NXP installed vapor intrusion mitigation at residences in response to vapor intrusion concerns due to elevated groundwater concentrations in the Almeria area in OU1. Additionally, a Plumestop® in-situ pilot test was conducted from 2018 to 2021 to assess a longer-term option rather than individual residential vapor intrusion mitigation systems. The finding is that this technology is not a viable option for OU1. Also in OU1, NXP completed a vapor intrusion investigation at the Motorola Facility and installed an additional vapor mitigation system on one commercial building. NXP continued to monitor the 16 sub-slab depressurization systems installed at residential properties during the previous FYR periods.

Within OU2, an in-situ chemical oxidation (ISCO) program was implemented in 2018 as a contingent remedy for the central and southern portions of OU2 to assess effectiveness of ISCO as an interim remedial measure to address the incomplete capture associated with declining regional groundwater levels. Because ISCO was not a viable long-term option, NXP completed construction of an enhancement to the OU2 GES. This effort included installing two injection wells to reinject treated groundwater to improve the capture of the contaminated groundwater and address the dewatering in the area due to extraction and declining groundwater levels. The OU2 vapor intrusion investigation is ongoing. The subsurface soil gas sampling is nearly complete; however, due to the COVID-19 pandemic indoor air sampling has been delayed. Based on data collected through August 2021, vapor intrusion is not occurring, and mitigation measures have not been required.

4. Five-Year Review Process

4.1. Community Notification and Site Interviews

4.1.1. Five-Year Review Public Notice

EPA notified the public through the M52 Site Community Information Group email distribution list on July 22, 2021 (Appendix E). The email stated that there was a FYR in progress and invited the public to submit comments to the EPA. No comments were received. The results of the review and the report will be made available at the M52 Site information repository located at Burton Barr Central Library, 1221 N. Central Avenue, Phoenix, Arizona and Saguaro Branch Library 2808 N. 46th Street, Phoenix, Arizona.

4.1.2. Site Interviews

During the Five-Year Review process, an interview was conducted with representatives from the M52 Community Information Group, OU1 groundwater treatment system operators, GHD Services, OU2 groundwater treatment system operators, City of Phoenix, and Arizona Department of Environmental Quality, to document any perceived problems or successes with the remedy that have been implemented to date. The results of these interviews are summarized below (Appendix F).

The City of Phoenix Environmental Programs Coordinator's response was generally positive on the overall project and remedy performance. Good coordination and communication from the EPA and the Arizona Department of Environmental Quality with the City of Phoenix was highlighted in the interview response. One area of improvement that was mentioned was in keeping the Site website current and providing electronic copies of reports for public information. The City of Phoenix representative also expressed appreciation of community involvement activities (regular meetings, fact sheets, etc.) and that the groundwater was being restored to beneficial use.

The M52 Community Information Group Interview Form was completed by a co-chair of the Community Information Group who is also a community activist. In general, the M52 community feels dissatisfaction with the EPA remedy believed to be ineffective, that the agencies are not providing sufficient or accurate information to the CIG on a frequency they would prefer, EPA should also remediate the adjacent state groundwater plume as requested by the state, and Community Information Group technical preferences should be fully evaluated.

OU1 treatment system representatives did not note any specific concerns regarding the overall project or system operations and maintenance. The only unexpected maintenance issue mentioned was difficulties removing liquid granulated activated carbon from two vessels. Optimization efforts prior to the review period were discussed, but no optimization efforts within the review period were conducted. No comments were provided on remedy performance, contaminant trends, or protectiveness of the remedy.

OU2 treatment system representatives did not note any specific concerns regarding the overall project, system operations and maintenance, or overall remedy performance. They did detail concerns regarding lack of horizontal and vertical containment of the groundwater plume in the southern portion of OU2 near 20th Street. The lack of containment was related to decreasing groundwater elevations, which have resulted in lower groundwater extraction rates. They detailed several optimization efforts related to improving the capture zone of the treatment system and/or reducing contaminant concentrations. The most recent optimization effort in the central portion of the Site initiated in 2020/21 and involved the reinjection of treated groundwater. Implementation of the reinjection program has been delayed because of corrosion issues; however, measures to reduce the corrosion are ongoing. Additional system software updates are planned for 2022.

The Arizona Department of Environmental Quality (ADEQ) has partnered with EPA in the ongoing investigation and cleanup for the M52 groundwater plume since inception of this Superfund Site in the mid-1980s. ADEQ is the lead agency for the M52 groundwater plume, while EPA is the lead agency for vapor intrusion. ADEQ indicates the OU1 remedial efforts are satisfactory and progressing well. ADEQ also indicates a preference for the ongoing work to restore complete capture of the OU2 plume - and the overall OU2 investigation and cleanup to be expediated – suggesting separating the vapor intrusion investigation from the groundwater investigation to reach a groundwater-only final remedy more quickly. Although not a part of this FYR, ADEQ also expresses a desire for the OU3 ongoing investigation to be expedited and an OU3 remedy installed soon and reiterated concerns relating to the State's adjacent regional groundwater cleanup.

4.2. Data Review

This section presents the results of the review of groundwater data collected over the past five years for OU1 and OU2. Appendix C includes a more detailed assessment for this FYR period. For OU1 and OU2, the USACE evaluated the extraction and treatment systems for plume containment, mass removal, and treatment efficiency to remove VOCs from the extracted groundwater.

While the OU1 and OU2 groundwater extraction systems appear to be containing a majority of the plume, the OU2 Working Group is enhancing capture due to observed VOC mass migrating into OU3. Due to the declining regional groundwater levels, the capture zone for OU2 is no longer completely effective. For OU1, the capture zone has an area that needs close monitoring to confirm that plume capture is maintained. Based on a review of the vapor intrusion data collected over the last five to ten years for OU1 and OU2, the evaluation of the vapor intrusion pathway is complete in OU1 and the investigation is ongoing in OU2. However, OU2 has not needed mitigation based on the data collected to date. Vapor intrusion mitigation using sub-slab depressurization systems was installed in OU1 at 16 residential locations and one commercial facility. Further evaluation of the vapor intrusion pathway will be included in the upcoming RI/FS.

4.2.1. Operable Unit 1

Due to extended drought conditions, regional and local water levels have steadily decreased since the baseline year of 1992. The decline in groundwater levels has caused extraction system efficiencies to change through time, and the decrease in system efficiency was noted in the previous review. It is possible, that as drought conditions continue the extraction network could dewater the aquifer to the extent it is no longer saturated above the bedrock and would then contain the plume. However, residual contamination may remain in the unsaturated zone. Some extraction wells may need to be moved to continue to control contaminants in the saturated alluvium.

The OU1 area is complicated by two additional plumes that are not site-related entering the OU. The 56th and Earll state Site (Earll) plume crosses the northwest corner of OU1 and then enters the OU2 boundary (Figure 2). An unidentified PCE plume trends parallel to the Earll plume and lies between this plume and the OU1 plume (Figure 5). Since the treatment system's installation in 2005, PCE concentrations were observed to increase in well DM609 upgradient of the Motorola Facility (Figure 6). As this well is upgradient, the groundwater results indicate the presence of an unknown source not related to the M52 Site. PCE is also detected in wells downgradient of well DM609 and includes wells DM616, DM118, DM120 and DM607. These wells lie outside the OU1 capture zone and will continue to migrate southwest outside the capture zone toward OU2. Portions of the PCE plume are also found within the capture area as evidenced by results for wells EW18 and DM619. However, well DM619 also shows TCE increasing in concentration whereas the other wells show PCE distinctly the dominant VOC.

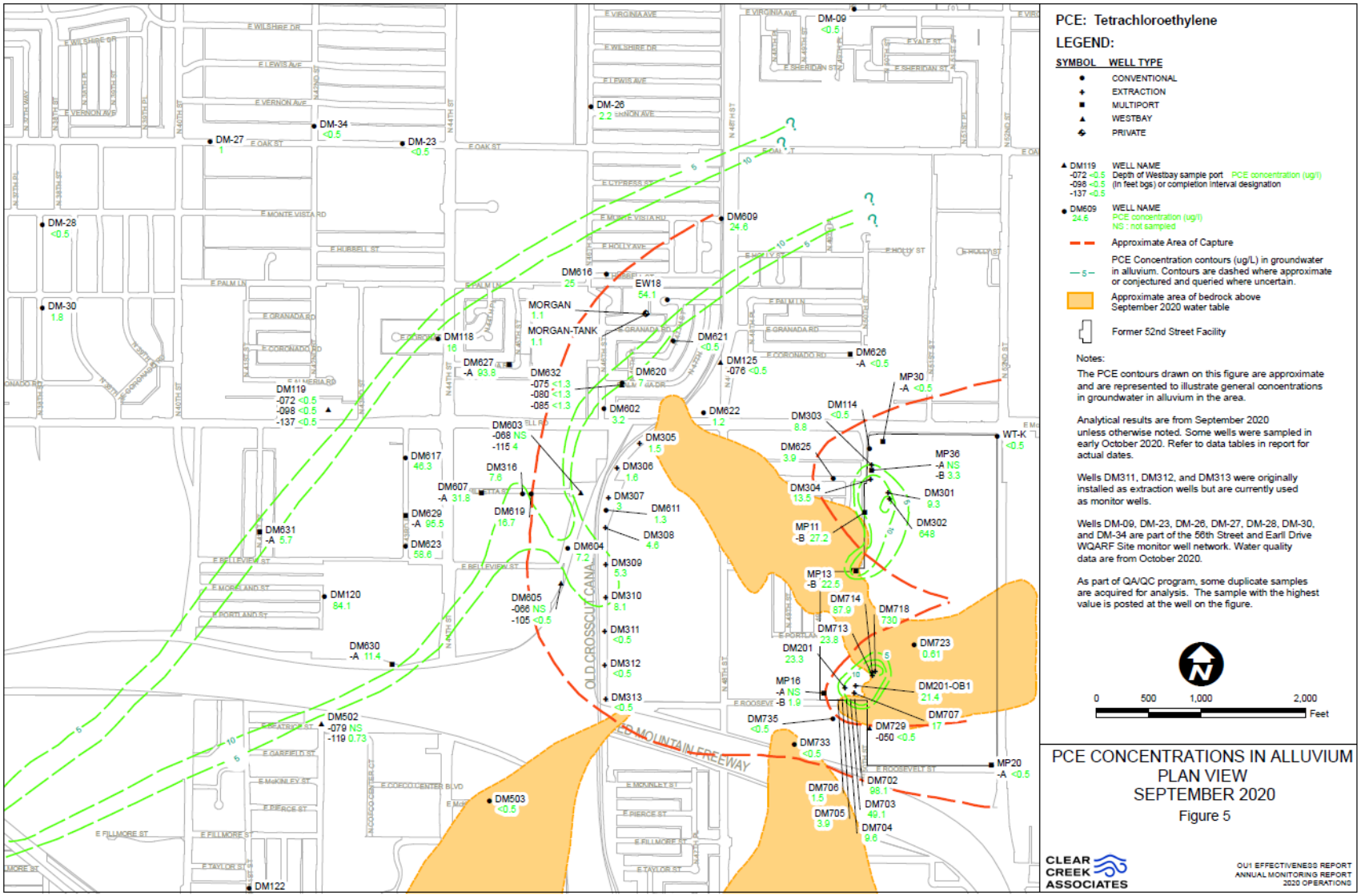
Well DM619 and to a lesser degree the nearby well DM316, which has been less frequently sampled, are located at the edge and near the capture zone, respectively. NXP suggests that localized degradation of PCE may be occurring, which could explain the increasing TCE trends or low concentrations here as well as for other PCE impacted wells. Because these two wells are at the edge of capture, the potentiometric

maps indicate that the wells are located where the gradient is relatively flat (Figure 6). Some TCE detected in wells outside the capture zone is suspected to be the result of back diffusion of contaminants that are adsorbed to fine-grained aquifer materials and/or from stagnant or low flow zone (Figure 7). Both the TCE and PCE concentration decreased in the 2020 samples from these two wells.

NXP presented several lines of evidence including numerical modeling that indicated most of the alluvial plume and bedrock sourcing from the Motorola Facility are captured by the current system. Due to the declining groundwater levels and history of extraction, dewatering of the Basin Fill is an issue that will need to be addressed in the RI/FS. The capture zone area near well DM619 warrants careful monitoring to ensure there is not a loss of capture in the near term. Significant mass has been removed from the alluvial aquifer; however, due to DNAPL in the bedrock TCE concentrations remain elevated in bedrock wells, which will need to be addressed in the future Technical Impracticability Waiver request.

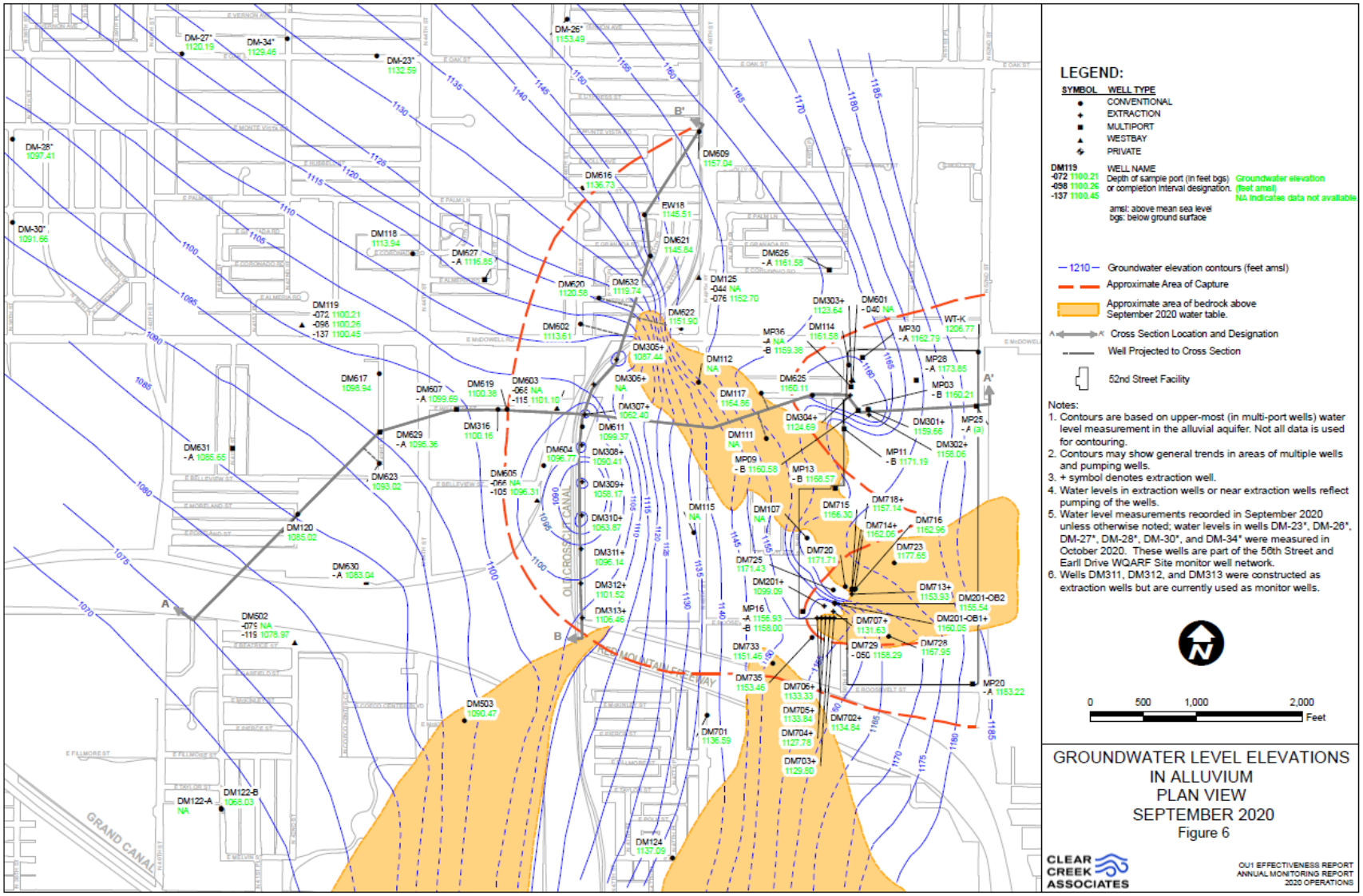
During 2020, 22 groundwater extraction wells were operated within OU1. The average pumping rate for the extraction wells were: Courtyard 14.7 gallons per minute (gpm), SWPL 1.6 gpm, and offsite OCC 172.3 gpm. An estimated 633 pounds of VOCs were removed from 89.5 million gallons of groundwater for an average 7 pounds of contaminants removed per million gallons of groundwater treated. From start-up through 2020, approximately 4.2 billion gallons of water have been extracted and an estimated 28,000 pounds of VOCs have been recovered. Although the IGWTP system is aging, it is effectively treating the groundwater that is extracted from the Motorola Facility, operating at 97.7 percent of the year in 2020.

The vapor intrusion investigation at the Motorola Facility and the surrounding area was conducted from 2011 until 2019 and included sampling of over 100 buildings. Based on the indoor air results, NXP installed sub-slab depressurization systems at 16 residential properties during the 2016 FYR period. During this FYR period, one commercial property also had a vapor mitigation system installed. NXP monitors these systems based on the approved O&M Manual. NXP also tracks property transfers where vapor intrusion mitigation systems were refused, to offer new owners the option to install a mitigation system. No vapor intrusion mitigation was necessary at the former Motorola Facility. With the mitigation systems in place, there is no known exposure via vapor intrusion from groundwater in OU1 except potentially where mitigation systems were refused.



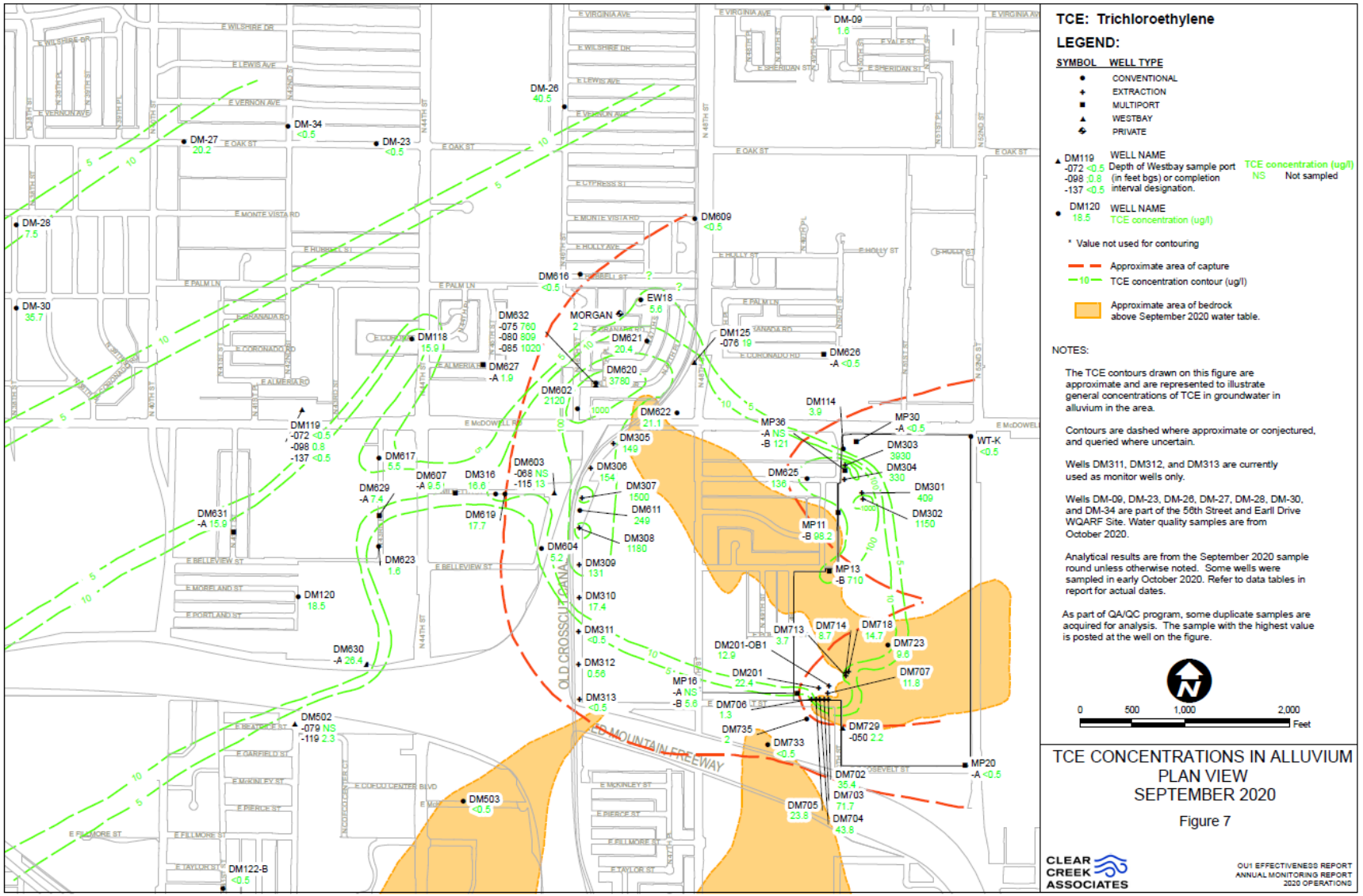
Source: Clear Creek Associates (2021). OU1 Effectiveness Report 2020, 52nd Street Superfund Site, Phoenix, Arizona

Figure 5. OU1 Basin Fill 2020 PCE Plume



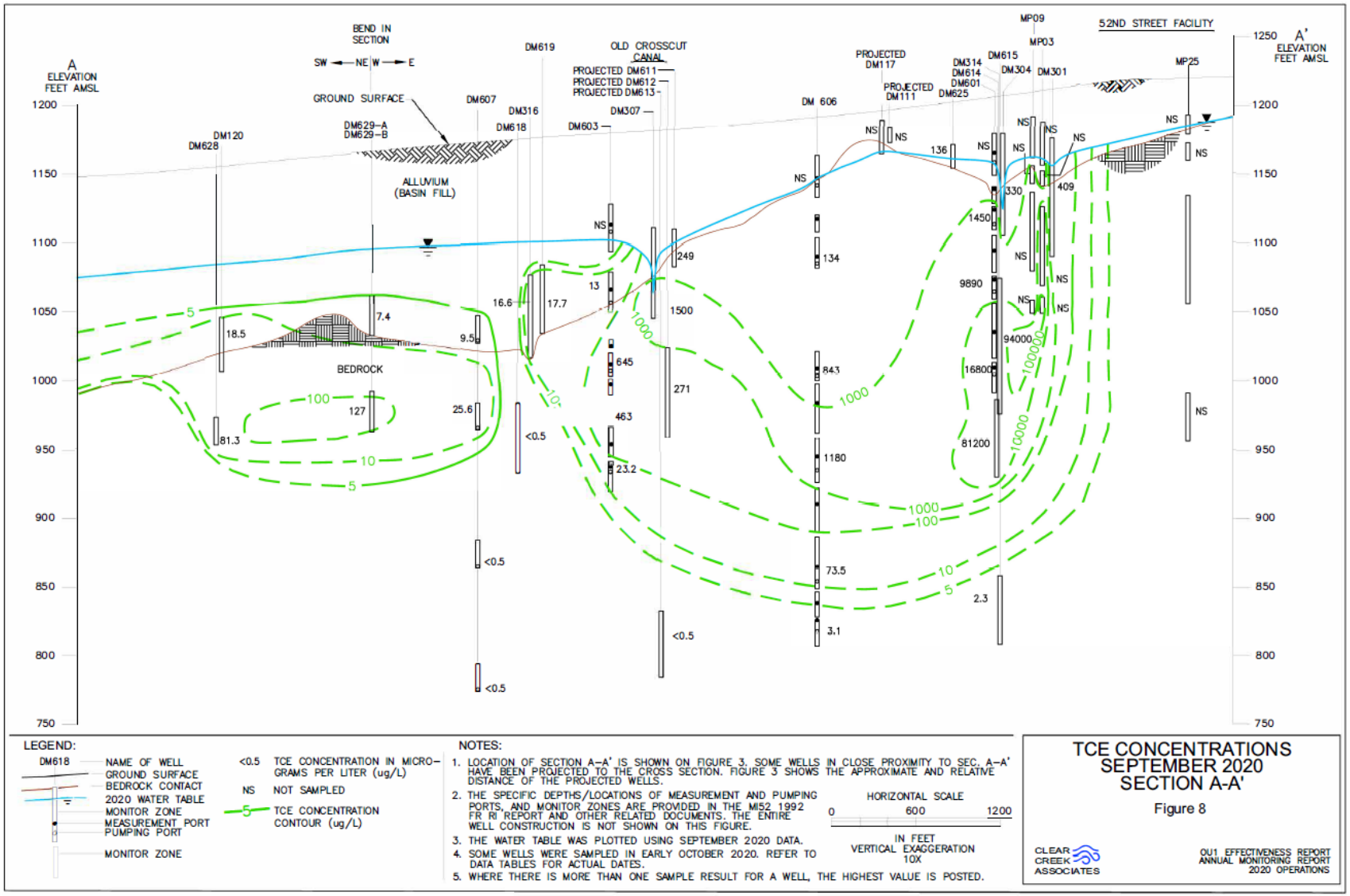
Source: Clear Creek Associates (2021). OU1 Effectiveness Report 2020, 52nd Street Superfund Site, Phoenix, Arizona

Figure 6. OU1 Basin Fill 2020 Potentiometric Surface and Capture Zones



Source: Clear Creek Associates (2021). OU1 Effectiveness Report 2020, 52nd Street Superfund Site, Phoenix, Arizona

Figure 7. OU1 Basin Fill 2020 TCE Plume



Source: Clear Creek Associates (2021). OU1 Effectiveness Report 2020, 52nd Street Superfund Site, Phoenix, Arizona

Figure 8. OU1 Basin Fill and Bedrock Cross-Section 2020 TCE Plume

4.2.2. Operable Unit 2

Based on increasing TCE concentration treads recently observed in certain downgradient monitoring wells, low levels of TCE were slowly migrating past the capture zone in the southern portion of the OU2 (south of monitoring well NW11-M in the SRG and south of NW16-D in the Basin Fill) (Figure 9 and 10). In 2018, the OU2 Working Group implemented a contingent remedial measure in these two areas using ISCO injections in existing wells. In 2020 two injection wells, associated pipelines and vaults were installed to enhance hydraulic capture in the central portion of the capture zone for the longer term. Injection of treated groundwater will also help recharge groundwater in the area and attenuate TCE concentrations downgradient of the OU2 capture zone. However, following the injection well start up test, the OU2 extraction wells, injection wells and pipeline were impacted by Gallionella, a corrosion-causing microorganism. A reddish deposit was found throughout the system. The OU2 Working Group implemented a disinfection program that was initiated in July 2021 (GHD, 2021). An ongoing disinfection maintenance program is being developed. The injection well effectiveness will need to be evaluated to ensure the capture zone is restored once operational as the potential for greater TCE mass to migrate south of the current is a capture zone is a concern.

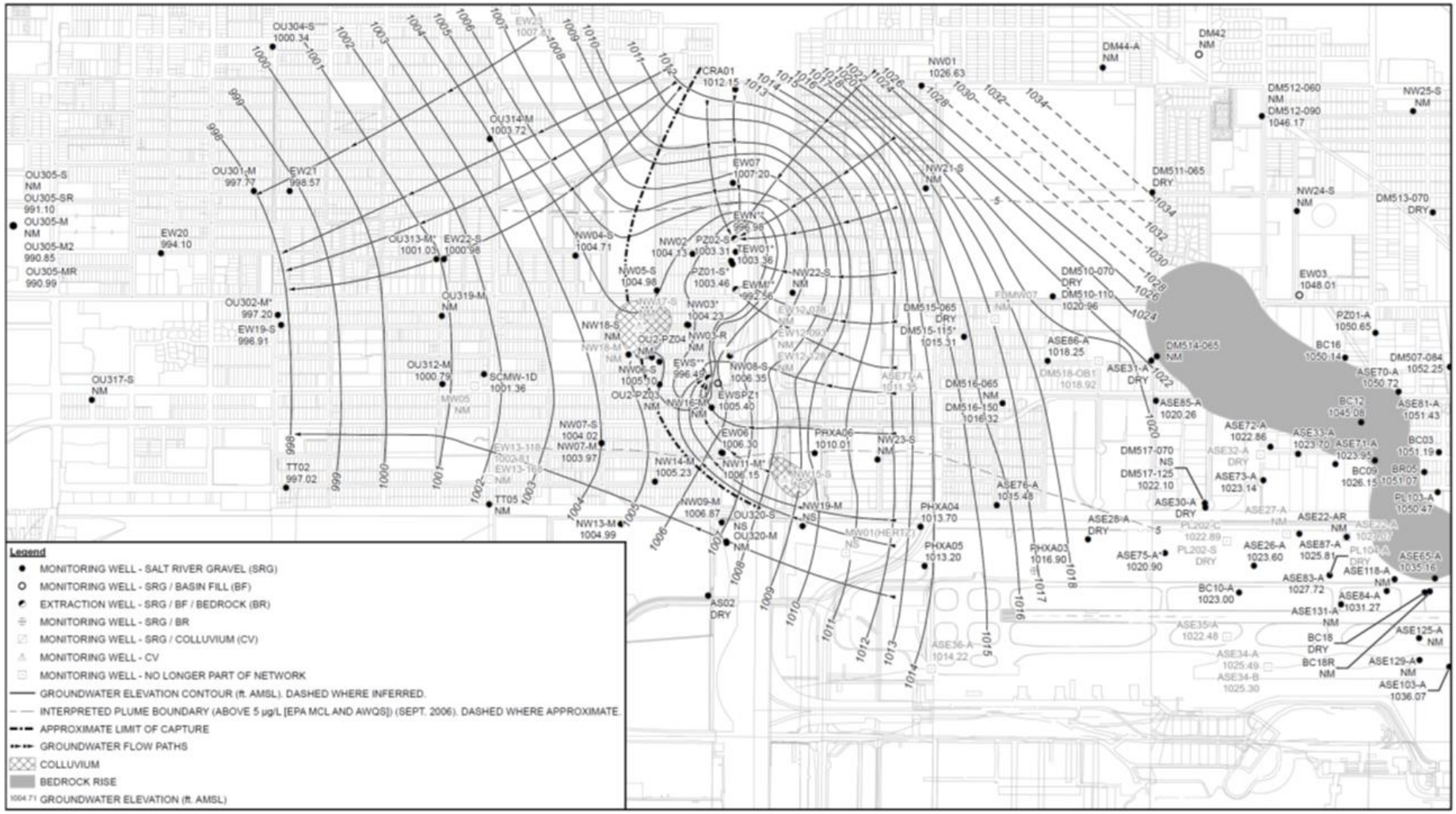
Over the past five years, PCE and TCE concentrations increased in wells NW01 and CRA01 located on the northern edge of the capture zone. TCE concentrations in well NW01 are above drinking water standards, and PCE concentrations in wells CRA01 and NW01 are increasing but remain below drinking water standards. In 2021, the TCE 5 µg/L contour was approximately 800 feet south of Well CRA-01. However, these wells are downgradient of DM44-A and DM42, which are extraction wells at the southern end of the Earll plume. VOCs from the Earll plume are moving southwest into OU2 and across the north portion of the capture zone. Northern monitoring wells further east of well CRA01 within the OU2 plume with VOC concentrations have groundwater flow toward the southwest and toward the central portion of the OU2 GES. Therefore, the impacts observed at the northern portion of OU2 are attributed to the Earll plume.

Contaminant concentrations in wells close to the extraction system (such as wells NW08M and NW16M) are increasing, indicating success in drawing the plume toward the extraction wells in the vicinity of the extraction well system. The 2020 groundwater flow lines indicate the plume is captured at depth.

During 2020, the OU2 GES three groundwater extraction wells operated at a combined average pumping rate of 1,411 gpm. An estimated 205 pounds of VOCs was removed from 688 million gallons of groundwater for an average 0.30 pounds of contaminants removed per million gallons of groundwater treated. From startup (2001) through 2020, approximately 7.9 billion gallons of groundwater have been extracted and treated and an estimated 15,800 pounds of VOCs have been recovered (approximately 0.88 pound per million gallons). The OU2 extraction system is effectively treating the groundwater that is extracted from the OU2, operating at 99 percent of the year in 2020 excluding the shutdown period required by SRP.

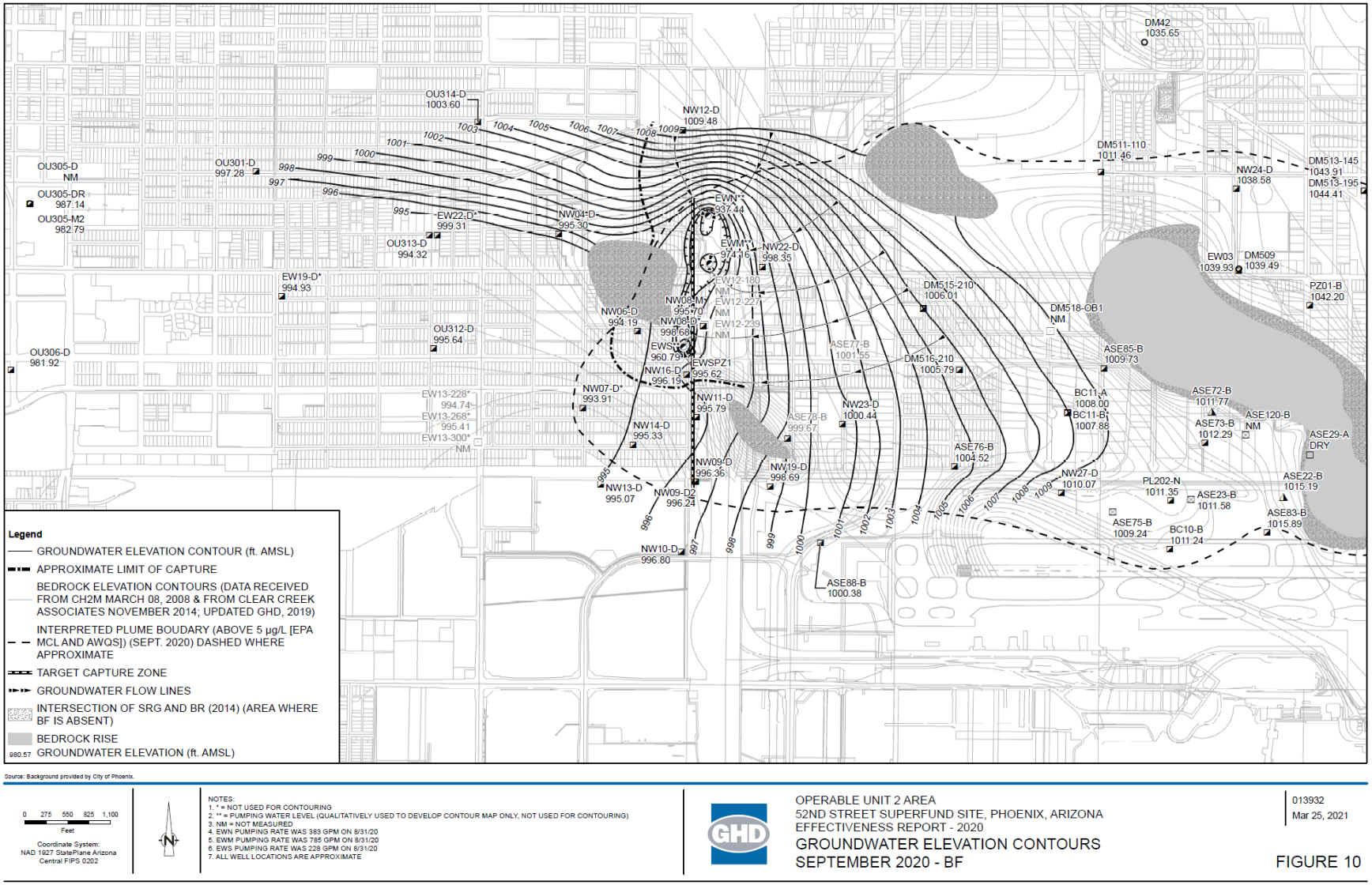
The vapor intrusion investigation is ongoing in OU2. Based on sampling results received through the end of August 2021, no mitigation of the vapor intrusion pathway is necessary. The vapor intrusion pathway

in OU2 will be addressed in the forthcoming RI/FS and final, long-term remedy. One area remains to be sampled for subsurface soil gas to complete this portion of the vapor intrusion investigation. Indoor air sampling was halted during the COVID-19 pandemic restrictions. However, alternative approaches to setting sampling devices in buildings are being developed to complete the vapor intrusion indoor air investigation.



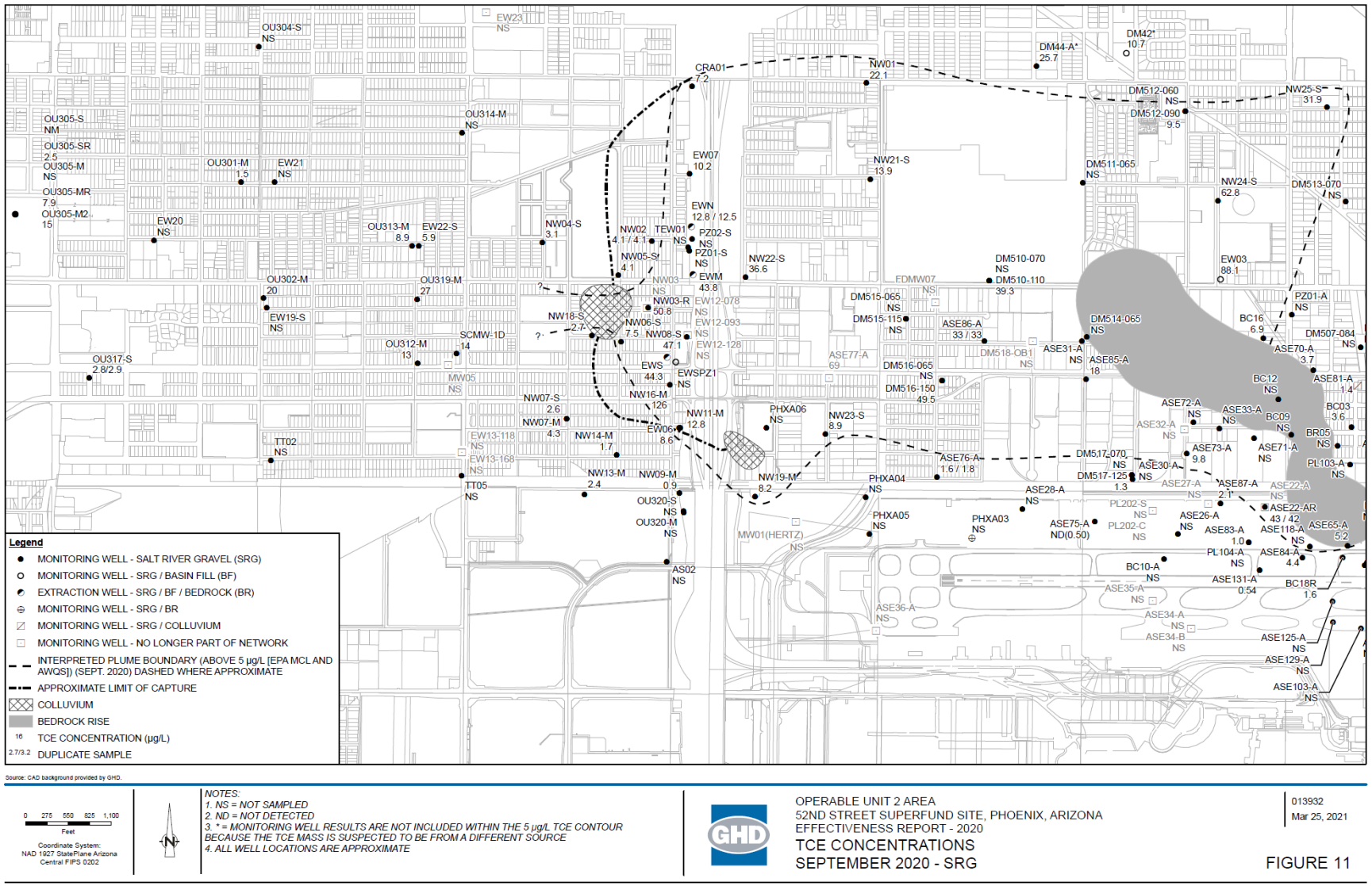
Source: GHD (2021). Effectiveness Report – 2020, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, OU2 Area, Phoenix, Arizona

Figure 9. OU2 Salt River Gravel Groundwater Potentiometric Surface and Capture Zone.



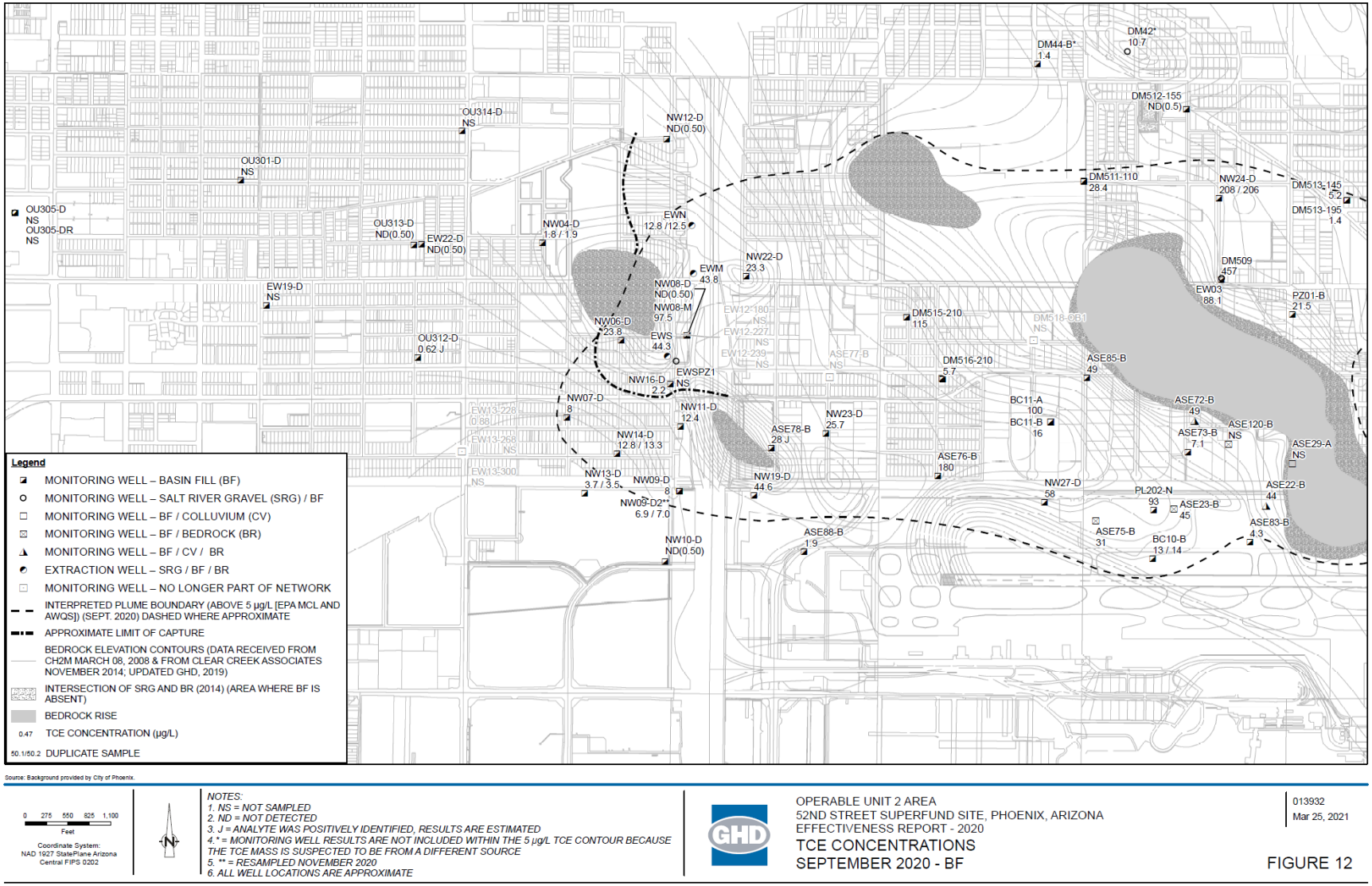
Source: GHD (2021). Effectiveness Report – 2020, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, OU2 Area, Phoenix, Arizona

Figure 10. OU2 Basin Fill Groundwater Potentiometric Surface and Capture Zone.



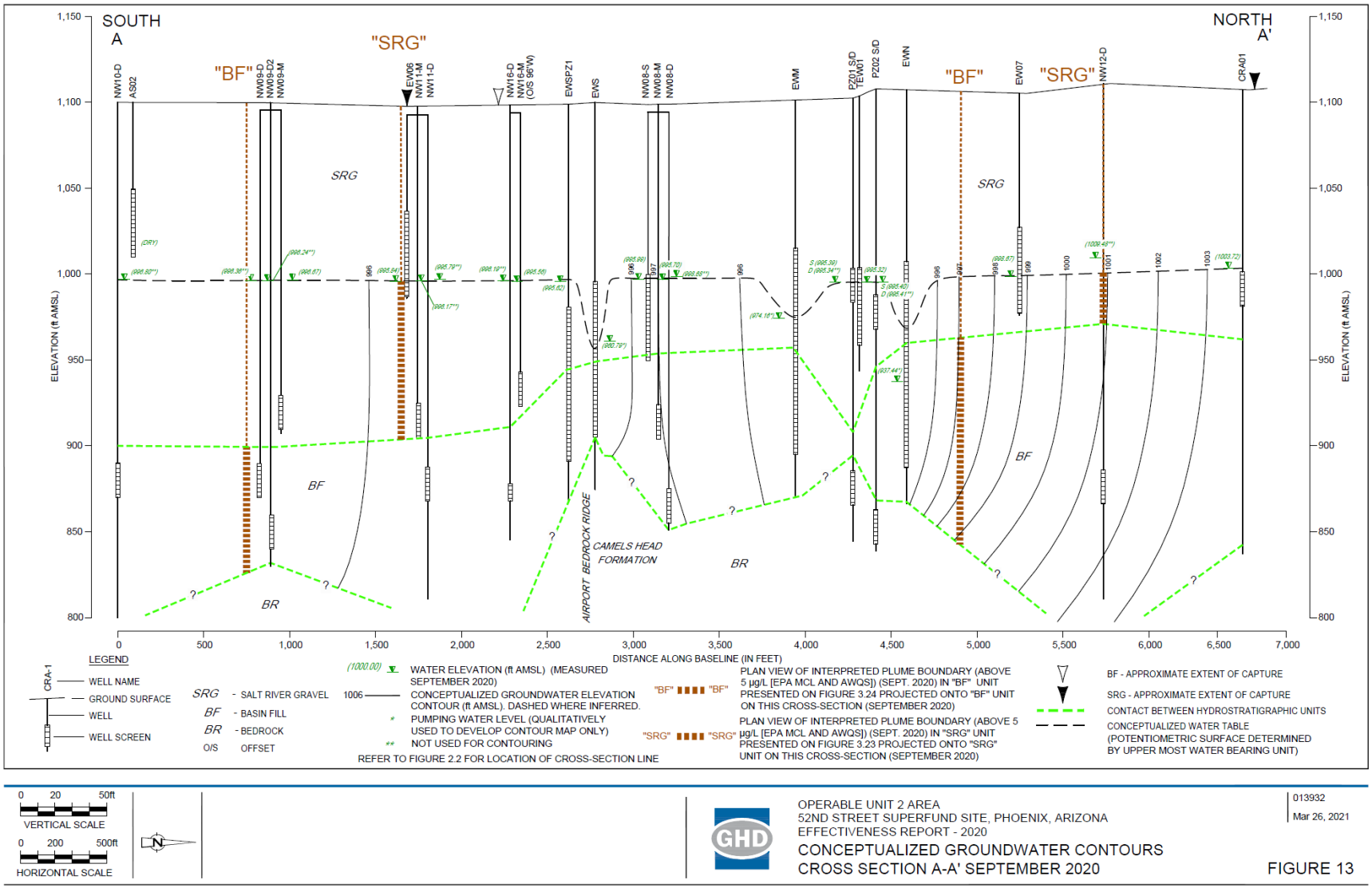
Source: GHD (2021). Effectiveness Report – 2020, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, OU2 Area, Phoenix, Arizona

Figure 11. OU2 Salt River Gravel 2020 TCE Plume.



Source: GHD (2021). Effectiveness Report – 2020, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, OU2 Area, Phoenix, Arizona

Figure 12. OU2 Basin Fill 2020 TCE Plume.



Source: GHD (2021). Effectiveness Report – 2020, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, OU2 Area, Phoenix, Arizona

Figure 13. OU2 Salt River Gravel, Basin Fill, and Bedrock Cross-Section 2020 TCE Plume.

4.3. Site Inspection

The inspection of the Site was conducted on July 15, 2021 by Matthew Masten, USACE. In attendance were Manfred Plaschke, Dave Hilliard and Nicole Rubenstein from GHD, Jenn McCall from NXP and Jason Weed and Leo Willson from Gutierrez-Palmenberg. The purpose of the inspection was to assess the condition of the remedy and verify that the remedy is operating as intended.

All components of the remedial action for M52 Operable Unit 1 and Operable Unit 2 appear to be in good condition and are currently operating as intended. All systems and wells were found to be well secured and free from vandalism. The OU2 injection wells and associated vaults were well secured and in good condition, as expected given their recent installation

5. Technical Assessment

5.1. Question A: Is the remedy functioning as intended by the decision documents?

Yes, the remedy for OU1 and OU2 are generally functioning as intended.

Due to extended drought conditions, regional and local water levels have steadily decreased since the baseline years of 1992 and 1996, respectively. The decline in groundwater levels has caused extraction system efficiencies to decrease. As the capture zones in OU2 is currently not sufficiently robust, close monitoring of capture zone performance is necessary to ensure capture is maintained.

In OU1, impacted groundwater is complicated by the influx of contamination from an unidentified upgradient PCE source that appears to be migrating from a location between the 56th and Earll plume to the west and the OU1 plume on the east. The PCE plume migrates southwest between the OU1 and Earll plumes with portions migrating into the OU1 capture zone at the northern boundary. The wells within the PCE plume are dominated by PCE, but two wells at the edge of the capture zone also include some increases in TCE. The TCE concentrations observed may be the result of several processes such as PCE degradation, back diffusion, or potential slow migration from the OU1 plume due to the flat gradient at the edge of the plume. It is possible, that as drought conditions continue, the extraction network could dewater the alluvial aquifer to the extent it is no longer saturated above the bedrock and would then contain the plume. If this occurs, some extraction wells may need to be relocated to meet the objectives of removing saturation from the alluvium.

The OU2 plume is migrating past the southern portion of the capture zone in the SRG and Basin Fill . The OU2 Working Group implemented an interim ISCO program in 2018. As a longer term solution, two injection wells were installed to enhance plume capture in this area. As of 2021, the system is installed, but because of biofouling, the system is being disinfected and will be ready to be online later in 2021. These improvements are expected to improve the effectiveness of the capture zone.

PCE and TCE concentrations are increasing in wells located on the northern edge of the capture zone. However, PCE and TCE increases are due to the upgradient 56th and Earll Street state site migrating into

the OU2 area to the east. The nearest upgradient wells with VOCs are the extraction wells for the Earll site.

RI/FS reports for the final long-term remedies at the M52 Site are ongoing for OU1 and OU2. As part of determining the final OU1 remedy, NXP is also preparing a Technical Impracticability Waiver for the DNAPL present in the bedrock beneath Operable Unit 1. EPA will consider the applicability of a Technical Impracticability Waiver zone after the RI/FS.

5.2. Question B: Are the exposure assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?

The interim remedial objective for OU1 is containment. Therefore, no cleanup values were selected, nor toxicity data used.

EPA's understanding of the vapor intrusion pathway has changed since the remedy was originally selected. While vapor intrusion was not originally considered in the OU1 interim ROD, EPA has overseen the investigation and mitigation of this exposure pathway. The vapor intrusion investigation at OU1 was conducted from 2011 until 2019 and included sampling of over 100 buildings. Based on the vapor results, NXP installed sub-slab depressurization systems at one commercial property and 16 residential properties. With the mitigation systems in place, there is no exposure via vapor intrusion from groundwater in OU1. The vapor intrusion pathway in OU1 will be addressed in the forthcoming RI/FS and final, long-term remedy.

The interim remedial objectives for OU2 are containment and/or mass reduction. No cleanup values were selected, nor toxicity data used.

The vapor intrusion investigation is ongoing in OU2. Based on sampling results received through the end of August 2021, no mitigation of the vapor intrusion pathway is necessary. The vapor intrusion pathway in OU2 will be addressed in the forthcoming RI/FS and final long-term remedy.

At the north end of the OU2 capture zone, concentrations are increasing from the upgradient Earll plume migrating into OU2. This area needs to be monitored to determine if additional action is required by the responsible party for the Earll state site. Continuing migration from the upgradient source may result in the OU2 treatment system's inability to fully contain these detections in the alluvial aquifer (Basin Fill).

5.3. Question C: Has Any Other Information Come to Light That Could Call into Question the Protectiveness of the Remedy?

Arizona has warmed approximately two degrees over the past century (EPA, 2016), which has contributed to decreased snowpack and increased droughts. The availability of water will continue to be a concern as the climate continues to warm. As surface water sources become less available, the usage of groundwater is likely to increase and contribute to an overall groundwater level decline. The ability of the existing interim remedies in OU1 and OU2 to effectively contain the groundwater plume in the face of

decreasing groundwater levels has already become an issue at the M52 Site. Sentinel wells for OU2 detected plume migration past the capture zone that has prompted ongoing actions to regain full capture. Furthermore, the continued, regional decline of water levels indicates that the existing extraction wells may not be able to contain the groundwater plume without modification. However, EPA is considering alternatives such as reinjection to regain complete capture, if necessary.

While increased wildfires are often associated with higher temperatures and prolonged droughts, the M52 Site was not identified to be at increased risk of wildfires by the Government Accounting Office 2019 report on climate change. In fact, the M52 Site was identified as being potentially at moderate risk for increased flooding (GAO, 2019). In desert climates, such as Arizona, flash floods can occur with relatively small rainfall totals since the ground surface is unable to absorb water quickly. The increased risk of flooding in certain areas is the result of changes to the hydrologic cycle related to climate change. Flooding could impact the protectiveness of the interim remedies if the groundwater treatment facilities and/or associated extraction wells and conveyance lines were damaged by flood waters or if electrical service to the extraction wells and treatment systems were interrupted. However, periodic flooding provides additional groundwater recharge as observed in the groundwater basin.

6. Issues/Recommendations

Table 3. Issues and Recommendations Identified in the Five-Year Review

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU2	**Issue Category: Remedy Performance**			
	Issue: In OU2, containment has been lost in the southern portion of the former capture zone.			
	Recommendation: Complete the ongoing injection pilot test and determine is a revised remedy is needed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	2025
OU(s): OU2	Issue Category: Remedy Performance			
	Issue: Contamination from the State Site, Earll, is migrating into OU2.			
	Recommendation: Monitor the northern capture zone to assess if mass from the Earll plume is migrating beyond the OU2 capture zone.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	2025

6.1. *Other Findings*

The following are recommendations that were identified during the Five-Year Review to improve the performance of the remedy and/or improve management of operations and maintenance, but do not affect current and/or future protectiveness:

- Complete the RI/FS for OU1 to address the following items:
    - Optimization of the IGWTP and assess the impact that potential dewatering of the alluvium will have on the plume containment
    - Mitigation or isolation of the DNAPL present in bedrock at and near the Motorola Facility.
    - Inclusion of final remedy for vapor intrusion risk.
    - Evaluation of residual soil/soil vapor contamination in the Courtyard, ATP and SWPL, and the past and potential future effectiveness of the SVE operations.
- Complete the RI/FS for OU2

- Monitor an unknown upgradient PCE source is present in OU1, which may result in a future loss of capture.

7. Protectiveness Statement

Table 4. Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: OU1	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The OU1 interim remedy protects human health and the environment because there is no exposure to contaminated groundwater and vapor intrusion mitigation systems have been installed where required. Groundwater extraction and treatment to contain the OU1 plume is ongoing.	
Protectiveness Statement(s)	
Operable Unit: OU2	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The OU2 interim remedy is currently protective of human health and the environment. Groundwater extraction and treatment to contain the OU1 plume from migrating into OU2 is ongoing. While groundwater appears to be escaping the containment in some areas, there is currently no exposure to groundwater in OU2. A groundwater reinjection pilot project is ongoing to improve capture of the groundwater plume. The vapor intrusion study is ongoing but current data indicate no mitigation will be necessary. However, in order for the remedy to be protective in the long-term, evaluating the effectiveness of the treated groundwater reinjection in improving the capture zone for the interim remedy and monitoring the migration of contamination from the Earll plume is necessary.	

8. Next Review

The next FYR report for the M52 Site is required five years from the completion date of this review.

Appendix A: List of Documents Reviewed

ADEQ. 1988. Arizona Department of Environmental Quality. *Record of Decision,* Motorola 52nd Street Site, Phoenix, Arizona.

ADEQ, 1992. Arizona Department of Environmental Quality. *Baseline Risk Assessment*. Motorola, Inc. 52nd Street Facility, Phoenix, Arizona.

ADEQ. 1994. Arizona Department of Environmental Quality. *Record of Decision,* Operable Unit Two, East Phoenix Groundwater Containment, Motorola 52nd Street Superfund Site, Phoenix, Arizona.

Clear Creek Associates. 2017. *Final Work Plan Focused Mass Reduction Field-Scale Pilot Project, Operable Unit 1 Area, Motorola 52nd Street Superfund Site, Phoenix Arizona.* June 2017.

Clear Creek Associates. 2017. *Operable Unit No. 1 Effectiveness Report 2016 Operations Motorola 52nd Street Superfund Site.* March 2017.

Clear Creek Associates. 2017. *Industrial Vapor Intrusion to Indoor Air Evaluation Report, Former Motorola 52nd Street Facility Property, Motorola 52nd Street Superfund Site, Phoenix, Arizona.* August 2017.

Clear Creek Associates. 2017. *Residential Vapor Intrusion to Indoor Air Evaluation Report, Operable Unit 1, Motorola 52nd Street Facility Property, Motorola 52nd Street Superfund Site, Phoenix, Arizona.* November 2017.

Clear Creek Associates. 2018. *Operable Unit No. 1 Effectiveness Report 2017 Operations Motorola 52nd Street Superfund Site.* March 2018.

Clear Creek Associates. 2018. *Bioaugmentation Standard Operating Procedures, Focused Mass Reduction Field-Scale Pilot Project, Operable Unit No. 1 Area, Motorola 52nd Street Superfund Site, Phoenix Arizona.* June 2018.

Clear Creek Associates, 2019. *Operable Unit No. 1 Effectiveness Report 2018 Operations Motorola 52nd Street Superfund Site.* March 2019.

Clear Creek Associates. 2020. *Operable Unit No. 1 Effectiveness Report 2019 Operations Motorola 52nd Street Superfund Site.* April 2020.

Clear Creek Associates. 2021. *Operable Unit No. 1 Effectiveness Report 2019 Operations Motorola 52nd Street Superfund Site.* March 2021.

CRA. 2011. *Revised Final Operation and Maintenance Manual, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix Arizona.* February 2011.

EPA. 1999. *Explanation of Significant Differences (ESD #1) to July 1994 Record of Decision, Operable Unit Two, East Phoenix Groundwater Containment, Motorola 52nd Street Superfund Site, Phoenix, Arizona*. September 1999.

EPA. 2016. *What Climate Change Means for Arizona.* August 2016. https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-az.pdf. Accessed March 1, 2021

GHD. 2016. *Soil Gas Sampling Work Plan, Soil Gas Sampling Investigation, Rev. 1, Motorola 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. November 2016.

GHD. 2017. *Proposed Addendum to the Indoor Air Evaluation Work Plan, Motorola, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. August 2017.

GHD. 2018. *Effectiveness Report – 2016, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. February 2018.

GHD. 2018. *Proposed Addendum #2 to the Indoor Air Evaluation Work Plan, Motorola 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. March 2018.

GHD. 2018. *Pilot Study Work Plan for In-Situ Chemical Oxidation, Motorola 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. January 2018.

GHD. 2018. *Revised Proposed Addendum #3 to the Indoor Air Evaluation Work Plan, Motorola 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. June 2018.

GHD. 2019. *Effectiveness Report – 2017, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. January 2019.

GHD. 2019. *Work Plan to Provide Long-Term Response for Central Portion of Site (Injection Well(s)), 52nd Street Superfund Site, Operable Unit 2 (OU2), Phoenix, Arizona*. August 2019.

GHD. 2020. *Effectiveness Report – 2018, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. January 2020.

GHD. 2020. *Effectiveness Report – 2019, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. April 2020.

GHD. 2021. *Effectiveness Report – 2020, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. March 2021.

NXP USA, Inc. 2019. *Vapor Intrusion Mitigation Systems Operations and Maintenance Plan, Operable Unit 1 Area, 52nd Street Motorola Superfund Site, Phoenix, Arizona.* July 2019.

Government Accounting Office. 2019. Interactive Map: https://www.gao.gov/multimedia/GAO-20-73/interactive/. Accessed 02/16/2021.

Appendix B: Site Chronology

Operable Unit 1 Chronology

Event	Date
2016	
Freescale (now NXP) submits Conveyance Pipeline Construction Report	January 6, 2016
Freescale installs six new monitoring wells to address data gaps, DM624 through DM631	January through March 2016
Freescale submits Building Inventory Report as part of the Industrial Vapor Intrusion to Indoor Air Investigation at the Former Motorola Inc. 52nd Street Facility	January 2016
Freescale submits the 2015 Operations Operable Unit 1 Effectiveness Report	March 2016
Freescale submits well completion report (DM624 through DM631) Motorola 52nd Street Superfund OU1 Area	June 2016
Freescale conducts indoor air sampling and system checks at mitigation locations in OU1	February 2016
Freescale submits validated indoor air mitigation location sampling results for February sampling	March 2016
EPA issues results letters for February indoor air sampling at OU1mitigated locations	June 2016
Freescale submits January through June 2016 OU1 Supplemental Data Submittal for groundwater and soil vapor monitoring	July 2016
Freescale submits validated indoor air data for 52nd St Facility July-August sampling as part of the Industrial Vapor Intrusion to Indoor Air Investigation	August 2016
Freescale submits Source Area Investigation and SWPL Confirmation Sampling Data Submittal, Former Motorola 52nd Street Facility, Motorola 52nd Street Superfund Site OU1 Area	August 2016
EPA issues results letters for July-August indoor air sampling for Industrial Vapor Intrusion to Indoor Air Investigation, 52nd St Facility	October 2016
Freescale submits Work Plan for Focused Mass Reduction Field-Scale Pilot Project (Almeria Area), OU1 Area, Motorola 52nd Street Superfund Site	Draft – October 2016
Official change from Freescale to NXP USA, Inc. (NXP)	November 2016
2017	
NXP conducts systems checks at OU1mitigation locations	February 2017
NXP submits the 2016 OU1 Effectiveness Report	March 2017
NXP submits Technical Memorandum, OU1 Groundwater Model, Motorola 52nd Street Superfund Site (for the flow model)	March 2017
NXP submits Work Plan for Focused Mass Reduction Field-Scale Pilot Project, OU1, Motorola 52nd Street Superfund Site	Revised Draft – May 2017 Final – June 2017
NXP submits January through June 2017 OU1Supplemental Data Submittal for groundwater and soil vapor monitoring	July 2017
NXP submits Industrial Vapor Intrusion to Indoor Air Evaluation Report, 52nd St Facility	Draft – August 2017 Final – October 2017
EPA Submits Letter of Determination of Completion of the Industrial Vapor Intrusion Investigation, Motorola 52nd Street Superfund Site – OU1	August 11, 2017
NXP submits monthly progress reports for Focused Mass Reduction Field-Scale Pilot Project	November, December 2017
NXP installs wells for the Focused Mass Reduction Field-Scale Pilot Project (DM632, IW-01 through IW-04)	December 2017
2018	
NXP conducts indoor air sampling and systems checks at mitigation locations in OU1	February 2018
NXP submits data to EPA for indoor air sampling at mitigation locations in OU1	March 2018

Event	Date
NXP submits validated results for VP-11 and VP-13 Re-sampling, SWPL Confirmation Sampling, OU1, Motorola 52nd Street Superfund Site	March 2018
NXP submits Well Installation Report, Focused Mass Reduction Field-Scale Pilot Project, OU1, Motorola 52nd Street Superfund Site (DM632, IW-01 through IW-04)	March 2018
NXP submits the 2017 Operations OU1 Effectiveness Report	March 2018
NXP submits OU1Area Groundwater Model Update and Sensitivity Analysis, Motorola 52nd Street Superfund Site (flow model)	May 2018
EPA issues results letters for February indoor air sampling at OU1mitigated locations	May 2018
NXP submits January through June 2018 OU1 Supplemental Data Submittal for groundwater and soil vapor monitoring	July 2018
NXP submits indoor air and sub-slab sampling results, June 2018 sampling of Sonoran Science Academy	August 2018
NXP submits monthly progress reports and sampling results for Focused Mass Reduction Field-Scale Pilot Project	January through December 2018
2019	
NXP conducts system checks at mitigation locations in OU1	February 2019
NXP submits the 2018 Operations OU1 Effectiveness Report	March 2019
NXP submits January through June 2019 Supplemental Data Submittal for groundwater and soil vapor monitoring	July 2019
NXP submits monthly progress reports and sampling results for Focused Mass Reduction Field-Scale Pilot Project	January through December 2019
2020	
NXP conducts indoor air sampling and system checks at mitigation locations in OU1	February 2020
NXP submits data to EPA for indoor air sampling at mitigation locations	March 2020
NXP submits the 2019 Operations OU1 Effectiveness Report	April 2020 (pursuant to a COVID-19 related approved extension)
EPA sends results letters for February 2020 mitigation indoor air sampling	May 2020
NXP submits Data Gaps Work Plan, Operable Unit 1 Area, Motorola 52nd Street Superfund Site	June 2020
NXP submits January through June 2020 Supplemental Data Submittal for groundwater and soil vapor monitoring	July 2020
NXP submits Work Plan, Field Sampling Plan, and Quality Assurance Project Plan, Industrial Soil Gas to Indoor Air Vapor Intrusion Evaluation, W-Building – Former Motorola 52nd Street Facility, Operable Unit 1, Motorola 52nd Street Superfund Site	Draft – September 2020 Final – January 2021
NXP conducts warm weather indoor air sampling at W Building, 52nd St Facility and submits data to EPA	October 2020
NXP conducts cool weather indoor air sampling at W Building, 52nd St Facility and submits data to EPA	December 2020
NXP conducts primary and confirmation perimeter soil gas sampling at W Building, 52nd St Facility	January 2021
NXP submits monthly progress reports and sampling results for Focused Mass Reduction Field-Scale Pilot Project	January through July 2020

Operable Unit 2 Chronology

Event	Date
2017	
EPA letter approving OU2 Soil Gas Sampling Workplan	January 11, 2017
EPA letter approving OU2 Indoor Air Evaluation Workplan	January 12, 2017
OU2 Working Group submitted September through November 2016 Groundwater Monitoring Report	January 13, 2017
OU2 Working Group submitted October through December 2016 Quarterly Progress Report	January 13, 2017
NXP on behalf of OU2 Working Group wrote letter requesting reporting frequency change from quarterly to semi-annual for groundwater and remedial progress reports	April 6, 2017
ADEQ letter approving reporting frequency change from quarterly to semi-annual	April 12, 2017
OU2 Working Group submitted 2016 Effectiveness Report for OU2	May 12, 2017
OU2 Working Group submitted December 2016 through May 2017 Semi-Annual Groundwater Monitoring Report	July 13, 2017
OU2 Working Group submitted January through June 2017 Semi-Annual Remedial Progress Report	July 14, 2017
OU2 Working Group submitted Proposed Addendum to the Indoor Air Work Plan for the OU2 -wide VI Investigation	August 24, 2017
OU2 Working Group submitted the Pilot Study Work Plan for In-Situ Chemical Oxidation for the Southern Portion of OU2	October 26, 2017
2018	
OU2 Working Group submitted Revision to Pilot Study Work Plan for In-Situ Chemical Oxidation for the Southern Portion of OU2	January 10, 2018
OU2 Working Group submitted Revised 2016 Effectiveness Report for OU2	February 9. 2018
OU2 Working Group proposed Addendum No. 2 to the Indoor Air Work Plan for the OU2 -wide VI Investigation	March 5, 2018
OU2 Working Group submitted 2017 Effectiveness Report for OU2	March 30, 2018
OU2 Working Group proposed Addendum No. 2 to the Indoor Air Work Plan for the OU2 -wide VI Investigation	April 11, 2018
OU2 Working Group proposed Addendum No. 3 to the Indoor Air Work Plan for the OU2 -wide VI Investigation	May 16, 2018
Operable Unit 2 Companies submitted Revised 2017 Effectiveness Report for OU2	May 31, 2018
OU2 Working Group submitted Revised Proposed Addendum No. 3 to the Indoor Air Work Plan for the OU2 -wide VI Investigation	June 29, 2018
OU2 Working Group submitted January through June 2018 Semi-Annual Remedial Progress Report	July 13, 2018
OU2 Working Group submitted December 2017 through May 2018 Semi-Annual Groundwater Monitoring Report	July 13, 2018
OU2 Working Group proposed Next Step/Path Forward for OU2 VI Investigation	November 1, 2018
OU2 Working Group submitted Revised January through June 2018 Semi-Annual Remedial Progress Report	December 3, 2018
OU2 Working Group submitted Revised December 2017 through May 2018 Groundwater Monitoring Report	December 18, 2018
2019	
OU2 Working Group submitted Second Revision of 2017 Effectiveness Report for OU2	January 22, 2019
OU2 Working Group submitted Response to EPA's Comments to February 1, 4, 7 and 8, 2019 Preliminary Indoor Air Sampling Results Submittals and Proposed Indoor Air Sampling (PRIAS) boundary	March 4, 2019
OU2 Working Group submitted 2018 Effectiveness Report for OU2	March 29, 2019
OU2 Working Group submitted Work Plan for Well Abandonment (NW03), Well Replacement (NW03R) and Installation of Three Pilot Borings/Two Piezometers	May 17, 2019
OU2 Working Group submitted Revised Work Plan for Well Abandonment (NW03), Well Replacement (NW03R) and Installation of Three Pilot Borings/Two Piezometers	June 11, 2019
Operable Unit 2 Companies submitted December 2018 through May 2019 Groundwater Monitoring Report	July 15, 2019
Operable Unit 2 Companies submitted January through June 2019 Semi-Annual Remedial Progress Report	July 15, 2019

Event	Date
OU2 Working Group submitted Work Plan to Provide Long Term Response for Central Portion of Site (Injection Well[s])	August 1, 2019
OU2 Working Group submitted Response to Comments on the Work Plan to Provide an Enhancement Revision to the Work Plan to Provide Enhancement to the Interim Remedy for Central Portion of Site (Injection Well[s])	December 6, 2019
2020	
OU2 Working Group submitted Revised 2018 Effectiveness Report for OU2	January 6, 2020
OU2 Working Group submitted 2019 Effectiveness Report for Operable Unit 2	April 15, 2020
OU2 Working Group submitted Responses to the Agencies' March 25, 2020 Comments to the Companies' Responses to the Agencies' September 9, 2019 Comments on the Work Plan to Provide an Enhancement to the Interim Remedy for Central Portion of Site (Injection Well[s])	May 8, 2020
OU2 Working Group submitted Revised December 2018 through May 2019 Groundwater Monitoring Report	May 11, 2020
OU2 Working Group submitted January through June 2020 Semi-Annual Remedial Progress Report	July 15, 2020
OU2 Working Group submitted December 2019 through May 2020 Semi-Annual Groundwater Monitoring Report	July 15, 2020
OU2 Working Group submitted Responses to the Agencies' Reply to GHD's 2nd Response to Comments on "Work Plan to Provide an Enhancement to the Interim Remedy Central Portion of Site (Injection Well[s])" dated June 19, 2020	August 20, 2020
OU2 Working Group submitted Well Completion Report OU2 Injection Wells (Final Draft)	October 1, 2020
OU2 Working Group submitted Request to Abandon Temporary Soil Gas Sampling Points, Soil Gas and Vapor Intrusion to Indoor Air Investigation	November 25, 2020
EPA approves Request to Abandon Temporary Soil Gas Sampling Points in Areas 1 through 4, 6 and 7, Soil Gas and Vapor Intrusion to Indoor Air Investigation	December 2, 2020
OU2 Working Group submitted Revised 2019 Effectiveness Report for OU2	December 18, 2020
2021	
OU2 Working Group submitted 2020 Effectiveness Report for OU2	March 31, 2021
OU2 Working Group submitted draft OU2 Groundwater Extraction System and Injection Wells draft Well and Pipeline Disinfection Plan	July 6, 2021

Appendix C: Data Review

This data review examined data collected over the past five years to evaluate whether the remedial action objectives of plume containment for both OU1 and OU2, and reduction of the plume mass in OU2 are being achieved. NXP and the OU2 Working Group operate groundwater extraction well and treatment systems at OU1 and OU2, respectively, to contain the plume and treat extracted groundwater.

Due to extended drought conditions, regional and local water levels have steadily decreased since the baseline year of 1992 for OU1 and 1996 for OU2. The decline in groundwater levels has caused extraction system efficiencies to change through time along with dewatering by the extraction of the groundwater for treatment. The decrease in system efficiency was noted in the previous Five-Year Review.

OU1 Data Review

Based on the review of the potentiometric maps, numeric modeling conducted by NXP, chemical and water level hydrographs, and Mann-Kendall trend tests performed by the USACE, OU1 IGWTP captures the OU1 plume upgradient of the extraction wells in the Basin Fill and bedrock (Figure C-1 and C-2). The 2020 Annual Report indicated that there was an additional PCE plume west of the OU1 plume (Clear Creek, 2021). This plume is from an unknown source and lies between the OU1 plume and the Earll plume (Figure C-1).

In 2004, PCE was detected in well EW18 after years of no detections of PCE. Well DM609 upgradient of the OU1 plume and directly upgradient of EW-18, showed increasing PCE concentrations since its installation, but not TCE. With time, PCE was increasingly detected in wells downgradient of well DM609 within and outside the capture zone to the west. The corresponding TCE results were stable or declining. Monitoring of wells in the Earll plume also had increasing PCE detections after PCE was detected in well EW-18, indicating the Earll plume was not the source.

Figure C-3 posts the Mann-Kendall trend tests for TCE for the 2016 through 2019 for selected wells within and near the OU1 capture zone boundary with the exception of well DM120. Stable or no trends were determined for all wells except well EW18. Well EW18 is at the northern most edge of the OU1 plume and indicates the mass in this area is being pulled to the extraction wells. Well DM120 was stable but outside the capture zone where a decreasing trend would be expected with the cut off of the source at the capture boundary. The remaining wells indicate the continued movement of TCE mass toward the extraction wells. The low and persistent TCE concentration west of the capture zone as seen in well DM120 may be from several sources including back diffusion from fine grained material, stagnation or low flow areas, and/or possible degradation of the incoming PCE where anaerobic conditions occur.

Two wells that are in close proximity at the center of the capture zone, well DM619 on the capture boundary and well DM316 directly west of well DM619 had increasing TCE concentrations along with associated influence from the unknown PCE plume. The TCE may be the result of fairly flat groundwater gradient in the area or back diffusion, but the increasing trend in TCE may also indicate some localized migration of VOCs from the OU1 plume at this point. Figure C-1 shows the 5 and 10 µg/L contours just

outside the capture zone boundary. However, the TCE and PCE concentrations in these two wells both declined in 2020.

OU2 Data Review

USACE reviewed groundwater data from OU2 sentinel wells along the plume edge to evaluate effectiveness of the containment, evaluating for concentrations below MCLs in the sentinel wells to define the edge of the plume or decreasing concentrations indicating that contaminants were migrating away from this location. The USACE also completed Mann-Kendall trend tests for selected wells in the SRG and Basin Fill (2015 through 2019)(C-4 and C-5).

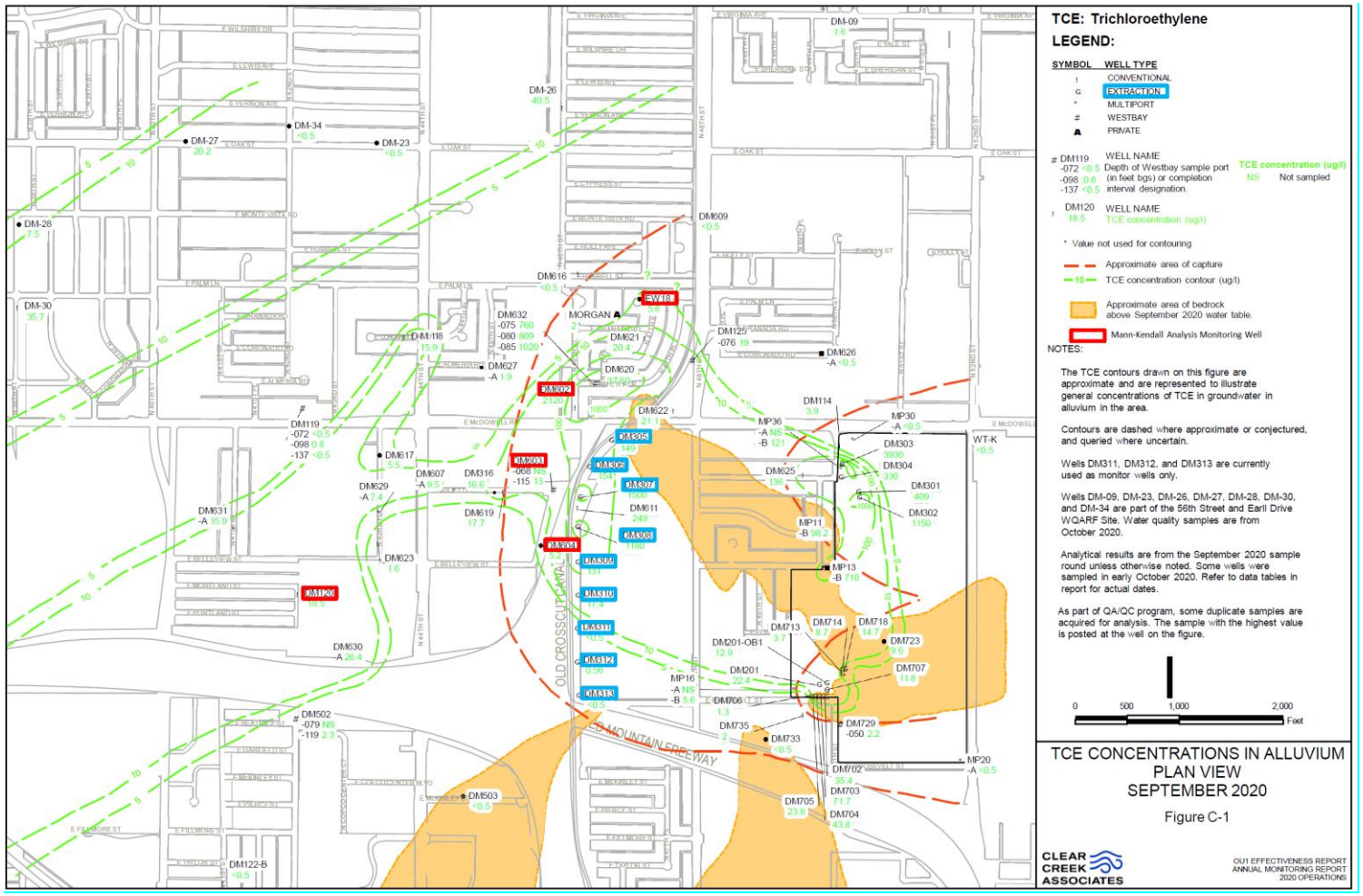
The OU2 Working Group notes that wells upgradient of the OU2 extraction wells with increasing contaminant concentration trends indicate that VOCs are being drawn toward the extraction wells. They also state that wells cross gradient or downgradient should be decreasing in contaminant concentration as the upgradient source is cut off by the extraction well system. While this is seen across most of OU2, TCE and PCE concentrations for two northern SRG sentinel wells, well NW01 and well CRA01, had no detections in 2010 and 2012, respectively, when TCE and PCE concentration began a slow increase in detected concentrations. Figure C-4 shows the Mann-Kendall test result of increasing PCE for these two wells for data collected over the period of 2016 through 2019.

The nearest SRG wells to the east of these two sentinel wells that continue to have TCE and PCE concentrations would flow southwest towards the EWN and not toward well NW01 or well CRA01. The mass moving into the SRG in this northern area possibly from the Earll plume as two upgradient Earll plume extraction wells (well DM44-A and well DM42) are approximately upgradient/sidegradient of well NW01 and well CRA01 and north of the OU2 plume. In 2020, these extraction wells reported TCE at 25.7 and 10.7 µg/l, respectively. As there are limited number of wells directly upgradient of the sentinel wells, the potentiometric surface is not well characterized and the possibility exists that other upgradient sources or the Earll plume is not completely characterized in this area. The Basin Fill sentinel well NW12-D, in the same northern area is not impacted and the TCE concentrations measured for the Earll plume extraction wells are lower, 1.4 and 10.7 µg/l, respectively. However, the sentinel wells lie within the OU2 capture zone.

The OU2 groundwater capture zone extends north of the OU2 plume in the SRG and Basin Fill HSUs. However, to the south the plume capture only reaches to well NW11-M (SRG) and well NW-16D (Basin Fill) and does not encompass the southern extent of the OU2 plume. Although the Mann-Kendall results for wells in the southern area wells in the Basin Fill (wells NW19D, NW09D, and NW7D) indicated no trends (Figure C-5), the OU2 Annual Report (GHD, 2021) presented Mann-Kendall results for a longer period that showed increasing trends in these wells supporting the lack of capture in the area. In the SRG, three wells (OU313-M, OU312-M and NW07-M) located downgradient of the capture zone were stable (Figure C-5) but for a longer period of time, well NW07M and well OU313-M had decreasing trends and indicates that the loss of VOC mass has not migrated far from the capture zone.

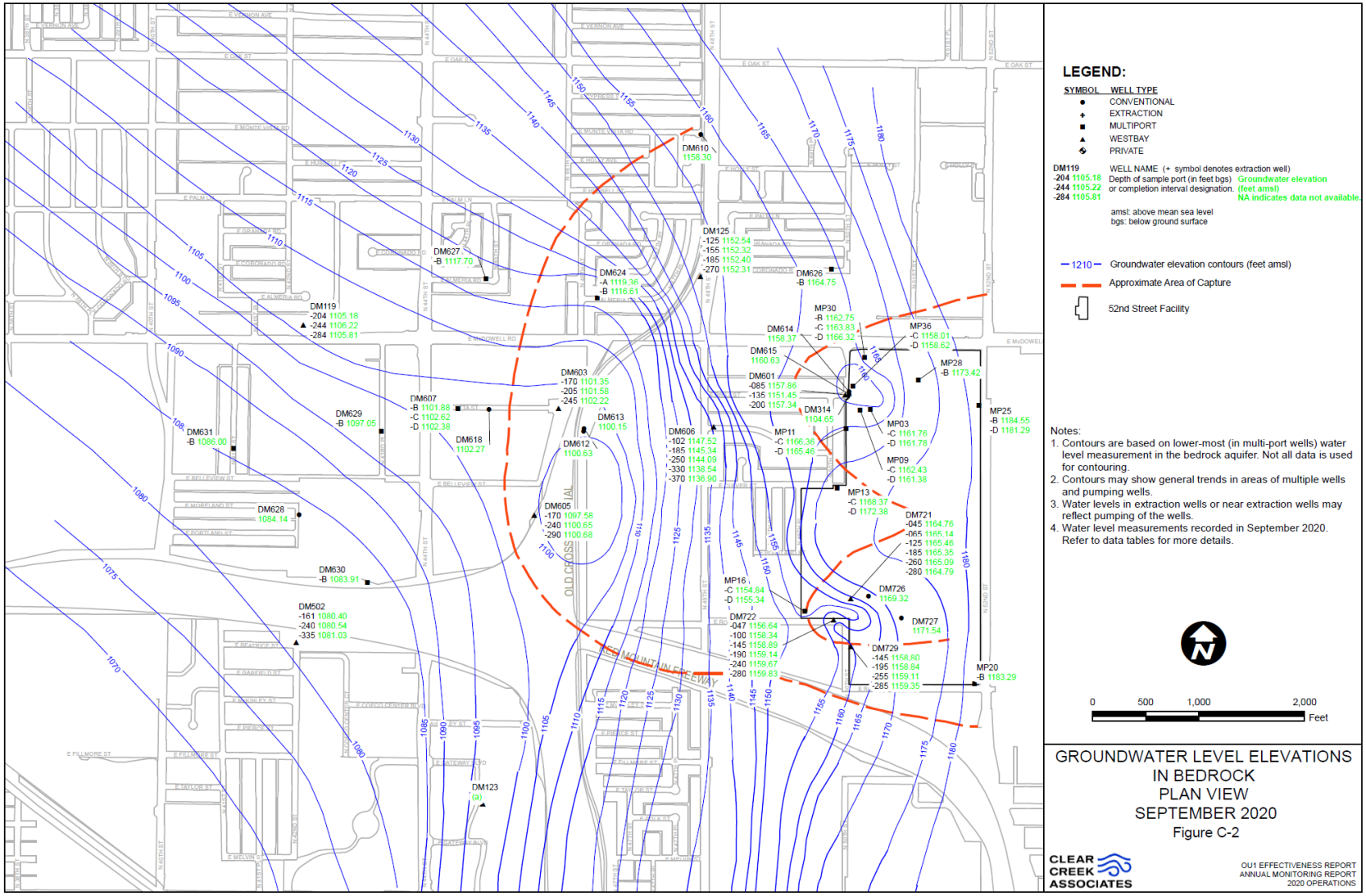
The VOC concentration increases in monitoring wells downgradient of the OU2 GES in the southern area, is the result of the hydraulic capture zone not extending across the width of the plume in this area.

The OU2 Working Group is working to address this loss of capture. They conducted an ISCO pilot test in 2018, which had a positive but only short-term effect in reducing TCE concentrations. Since then, two injection wells were installed to enhance hydraulic capture as a longer-term solution. These injection wells are expected to be operational later in 2021 and will be evaluated to confirm complete groundwater capture and the impact on the local groundwater hydraulics.



Source: Clear Creek Associates (2021). OU1 Effectiveness Report 2020, 52nd Street Superfund Site, Phoenix, Arizona

Figure C-1. OU1 2021 TCE concentration map showing TCE plume in the alluvium, OU1 capture zone, TCE outside the capture zone and the Earll plume in the northwest corner. A PCE plume, initially identified based on sample data from wells DM609 and EW18, migrates to the southwest and comingles with the uncaptured TCE mass between the OU1 and Earll plumes. Westernmost OU1 extraction wells are highlighted in blue. Mann-Kendall trend tests were completed on the red highlighted wells. (see Figure C-5).



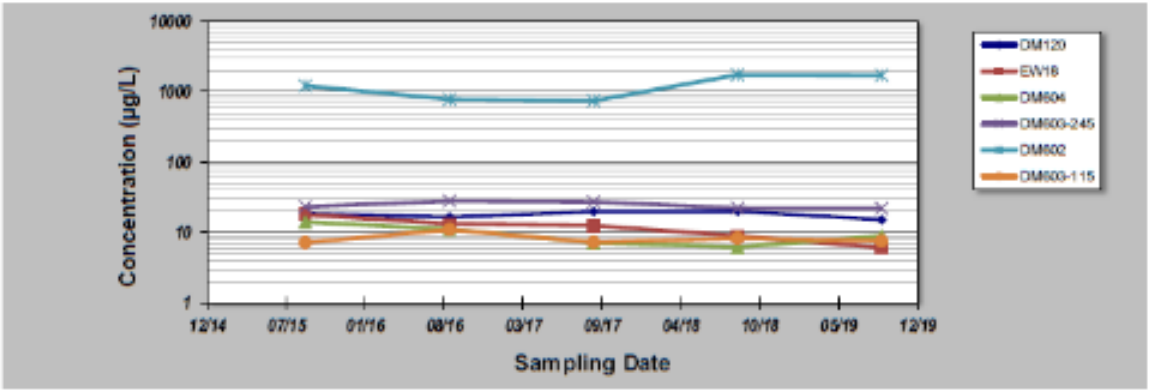
Source: Clear Creek Associates (2021). OU1 Effectiveness Report 2020, 52nd Street Superfund Site, Phoenix, Arizona

Figure C-2. Insert OU1 Bedrock Capture Zone.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 5-Mar-21
Facility Name: Motorola OU1
Conducted By: USACE
Job ID:
Constituent: TCE
Concentration Units: µg/L

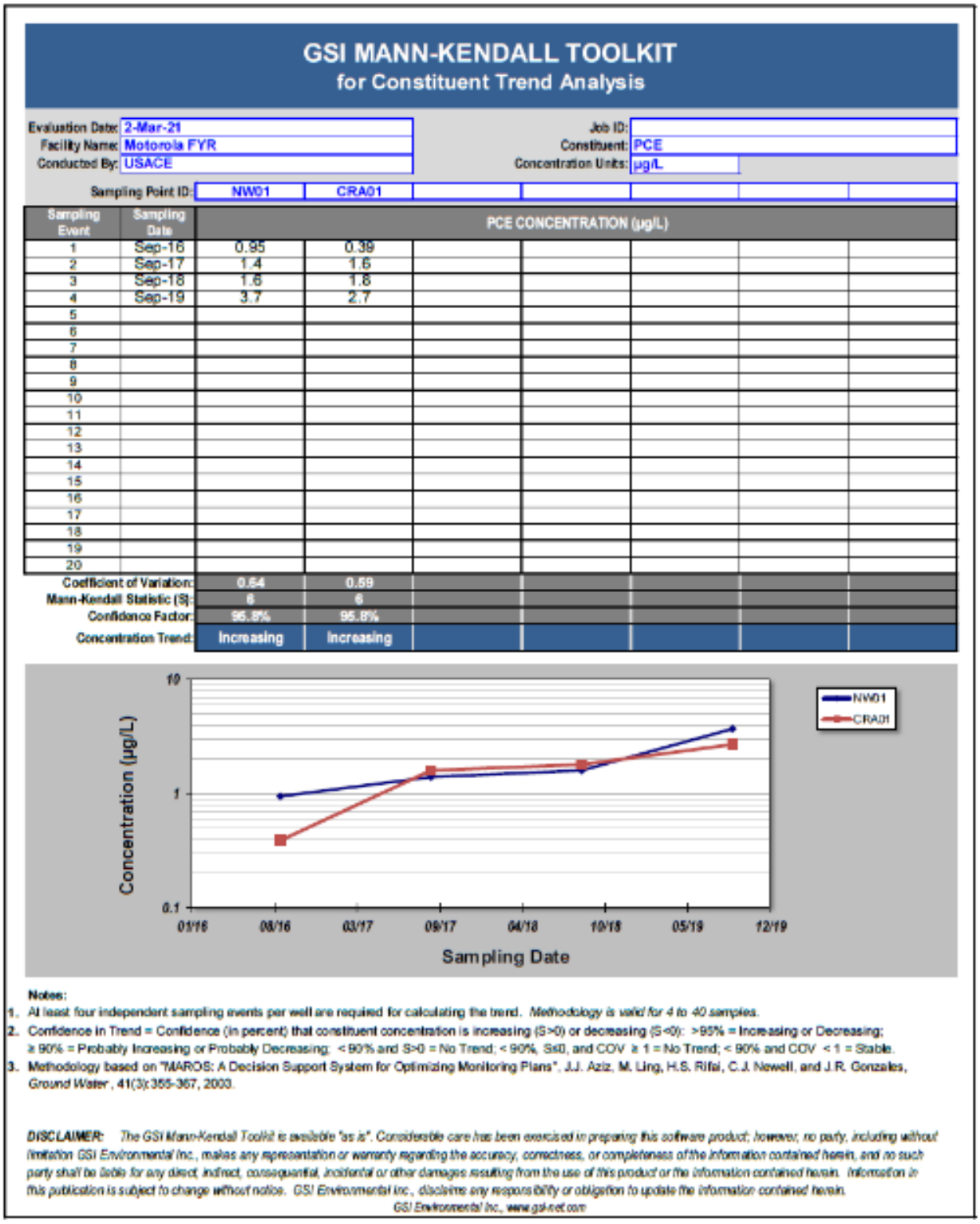
Sampling Point ID:	DM120	EW18	DM604	DM603-245	DM602	DM603-115	
Sampling Event	Sampling Date	TCE CONCENTRATION (µg/L)					
1	1-Sep-15	18.8	18	14.2	23.3	1230	7.2
2	1-Sep-16	16.6	13.4	11.1	28.1	784	11
3	1-Sep-17	19.8	12.6	7.2	27.4	747	7.3
4	1-Sep-18	20.1	9	6.2	22.2	1750	8.3
5	1-Sep-19	15.3	6.1	9	22.1	1730	7.6
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
Coefficient of Variation:		0.12	0.38	0.34	0.12	0.39	0.19
Mann-Kendall Statistic (S):		0	-10	-6	-6	2	2
Confidence Factor:		40.8%	99.2%	88.3%	88.3%	59.2%	59.2%
Concentration Trend:		Stable	Decreasing	Stable	Stable	No Trend	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

Figure C-3. TCE concentration trend plot for selected OU1 sentinel wells (2015 through 2019). Except for DM120, the remaining wells are upgradient and near the edge of the capture zone boundary. The relatively low and stable TCE concentrations in DM120 suggests potential back diffusion of adsorbed contaminants or degradation from the unknown PCE source.



GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Mar-21
Facility Name: Motorola FYR
Conducted By: USACE
Job ID:
Constituent: PCE
Concentration Units: µg/L

Sampling Point ID:		NW01	CRA01					
Sampling Event	Sampling Date	PCE CONCENTRATION (µg/L)						
1	Sep-16	0.95	0.39					
2	Sep-17	1.4	1.6					
3	Sep-18	1.6	1.8					
4	Sep-19	3.7	2.7					
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.64	0.59					
Mann-Kendall Statistic (S):		6	6					
Confidence Factor:		96.8%	96.8%					
Concentration Trend:		Increasing	Increasing					

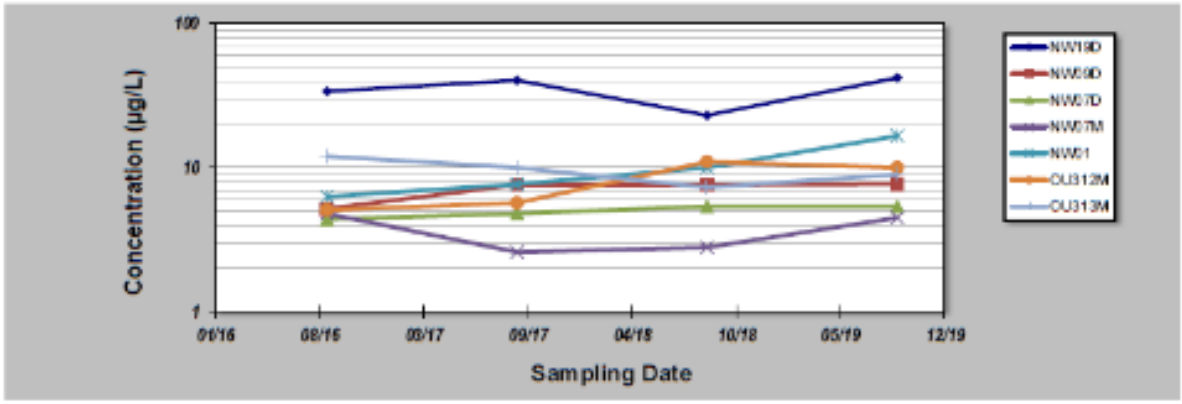
Notes:
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

Figure C-4. PCE concentration trend plot (2016 through 2019) for two sentinel wells in the northern portion of the OU2 plume. While not above drinking water standards, these two wells are increasing in PCE and TCE concentrations. Currently, the wells are within the OU2 extraction well capture zone. However, the VOC source appears to come from the Earll state site (see Figure C-3).

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Mar-21	Job ID:	
Facility Name:	Motorola FYR	Constituent:	TCE
Conducted By:	USACE	Concentration Units:	µg/L

Sampling Point ID:	NW19D	NW09D	NW07D	NW07M	NW01	OU312M	OU313M
Sampling Event	Sampling Date	TCE CONCENTRATION (µg/L)						
1	Sep-16	33.8	5.2	4.4	4.8	6.3	5.1	12
2	Sep-17	40.4	7.6	4.8	2.6	7.7	5.7	10
3	Sep-18	23.1	7.6	5.4	2.8	10	11	7.3
4	Sep-19	42	7.7	5.4	4.5	16.6	10	9
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.25	0.17	0.10	0.31	0.45	0.38	0.21
Mann-Kendall Statistic (S):		2	5	5	0	6	4	-4
Confidence Factor:		62.6%	89.6%	89.6%	37.8%	95.8%	83.3%	83.3%
Concentration Trend:		No Trend	No Trend	No Trend	Stable	Increasing	No Trend	Stable



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3) 355-367, 2003.

Figure C-5. TCE concentration trend plot for selected OU2 sentinel wells (2016 through 2019). NW10 is a northern sentinel well upgradient from CRA01, is also increasing in TCE and PCE concentrations. All other wells are currently stable or show no trend in their concentrations for this FYR period.

Appendix D: ARAR Assessment

Section 121 (d)(2)(A) of Comprehensive Environmental Response, Compensation, and Liability Act specifies that Superfund remedial actions must meet any Federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). ARARs are those standards, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Comprehensive Environmental Response, Compensation, and Liability Act site.

The Letter of Determination and Record of Decision (ROD) for Operable Unit 1 (Operable Unit 1) do not identify any specific ARARs. However, the Letter of Determination maintains that the design of the selected Operable Unit 1 alternative is "*to provide…[c]ompliance with applicable or relevant and appropriate requirements (ARARs) and substantive requirements of permits, (i.e., pre-treatment requirement for effluent discharge to Publicly owned treatment plant, two on-Site Air Quality Permits, Construction Permits and Right of Way Acquisition.)*." Accordingly, the Operable Unit 1 interim remedy has proceeded based on design elements that comply with substantive permit requirements that were identified in the Consent Order with the Arizona Department of Environmental Quality (ADEQ). The interim remedy also requires treatment of extracted water to meet state and federal groundwater standards. For future remedy selection, the ROD explains that drinking water standards will be applied to the groundwater plume in any final remedy when it is selected.

The Operable Unit 2 ROD contains both location- and action-specific ARARs. The interim remedies are for containment of the plume and are not intended to restore the aquifer, therefore, there are no chemical-specific ARARs.

Federal and State laws and regulations that have been promulgated or changed since the last Five-Year Review are described in Table D-1. There have been no revisions to laws or regulations that affect the protectiveness of the remedy.

The following action- or location-specific ARARs have not changed in the past five years, and therefore do not affect protectiveness:

- New Well Construction &Groundwater Use Requirements Arizona Revised Statutes, Title 45; 45 A.R.S. §454.01; and §45-594, 595 and 596
- Arizona Air Pollution Control Regulations A.R.S. 49-401et seq.
- Maricopa County Air Pollution Control Regulations Rules 200, 210,220 and 320
- Discharge to Aquifer A.R.S. §49-241 through 49-244
- 40 Code of Federal Regulations (CFR) 6.302
- 16 U.S.C. Section 469
- 36 CFR Part 65
- A.R.S §41-841 -847
- A.R.S. Section 41-865.

Table D-1. Summary of ARAR Changes for Site in the Past Five Years

Requirement and Citation	Document	Description	Effect on Protectiveness	Comments	Recent Amendment Date
U.S.C. Section 661 et seq.	OU2 Interim ROD	Game, Fur-bearing animals, and fish protections	None	Pub. L. 116–9 inserted section catch line, designated existing provisions as subsec. (b), inserted heading, and added subsec. (a).	2019
Arizona Administrative Code R18-8-261, 262, and 268	OU2 Interim ROD	Identification and Listing of Hazardous Waste, Standards Applicable to Generators of Hazardous Waste, and Land Disposal Restrictions	None	Updated to reflect changes to 40 CFR 261 as of July 1, 2020.	12/31/2020
Arizona Administrative Code Rl8-8-264 (40 CFR Subpart X)	OU2 Interim ROD	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	None	Updated to reflect changes to 40 CFR 261 as of July 1, 2020.	12/31/2020

Appendix E: Email with Public Notice

EPA WANTS TO HEAR FROM YOU ABOUT THE
MOTOROLA 52ND STREET (M52) SUPERFUND CLEANUP

The U.S. Environmental Protection Agency (EPA) has started a Five-Year Review of the cleanup plan for the M52 Superfund site. The site is in Phoenix, Arizona. This review will evaluate if the cleanup plan is working as EPA intended. Federal law requires EPA to review its cleanup plans every five years if:

- a cleanup takes more than five years to complete; or
- hazardous waste is still on-site.

EPA completed the last review in 2016 and found the cleanup plan was working as intended.

What is Included in the Review?

- an inspection of the site and technologies used for the cleanup;
- a review of site data and maintenance records; and
- a review of any new laws or requirements that could affect the cleanup.

EPA Would Like to Hear from You!

If you have any questions or concerns, please contact:

- Carlin Hafiz, EPA Community Involvement Coordinator, (213) 244-1814, hafiz.carlin@epa.gov
- Rachel Loftin, EPA Remedial Project Manager, (415) 972-3253, loftin.rachel@epa.gov

Where Can I Learn More?

Visit EPA's webpage at **www.epa.gov/superfund/motorola52ndst** for more information. EPA has also set up an information repository (which holds paper copies of key documents and reports used in the cleanup) at:

Superfund Record Center
75 Hawthorne Street, Room 3100
San Francisco, CA 94105
Phone: (415) 947-8717
Email: R9records@epa.gov
Hours: 8:00 a.m.-5:00 p.m., Mon.-Fri.
Please call for current hours of operation.

EPA will complete the Five-Year Review report no later than September 30, 2021. When complete, EPA will post the review on the site's website **www.epa.gov/superfund/motorola52ndst** and send a copy to the site information repository listed above.

Background: The Motorola 52nd Street Superfund site (M52) in Phoenix, Ariz. is seven miles long and includes a large area of polluted groundwater and soil. From 1956 to 1999, Motorola Semiconductor Products Sector (now NXP) owned and ran a plant on 52nd Street. There, a leaking storage tank (holding highly toxic chemicals trichloroethylene and tetrachloroethylene) polluted groundwater and soil. Other nearby companies—including Honeywell, Arizona Public Service, and others—also polluted the site's groundwater. Since the mid-1980s, these companies and others responsible for cleaning up the site have run treatment systems under EPA and ADEQ oversight to address the site pollution. While much progress has been made to clean up the site, more investigations are ongoing to finish the cleanup.

Appendix F: Interview Forms

Five-Year Review Interview Record				
Site:	Motorola 52nd Street Superfund Site, Operable Unit 2 (OU2), Phoenix, AZ		**EPA ID No:**	
Interview Type: Post Site Visit Interview Questionnaire Location of Visit: 12 North 20th Street (20th Street Groundwater Treatment Plant), Phoenix, AZ Date: 7/15/2021 Time: 8 – 10:30 a.m.				
Interviewers				
Name		**Title**		**Organization**
Mathew Masten, P.E.		Chief, Technical & Environmental Support Section		USACE
Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Manfred Plaschke	GHD Services Inc.	Project Manager	602-881-0655	manfred.plaschke@ghd.com
David Hilliard	GHD Services Inc.	Site Operator	480-907-4803	david.hilliard@ghd.com
Nicole Rubenstein	GHD Services Inc.	Project Engineer	602-216-7200	nicole.rubenstein@ghd.com

Summary of Conversation

1) What is your overall impression of the project?
Generally good collaboration among the regulated parties (the Companies), regulatory agencies (EPA and ADEQ) and each of their technical consultants (GHD Services, Clear Creek Associates, Jacobs, Hargis, Aptim and Adanta).

2) Is the remedy functioning as expected? How well is the remedy performing?
The interim remedy (OU2 Groundwater Extraction System [GES]) is performing as expected by hydraulically containing the contaminants of concern (VOCs), although it is not currently containing the full width and depth of the VOC plume at 20th Street (I-10). Based on data reported in the 2020 Effectiveness Report (GHD, March 31, 2021), the OU2 GES is effective at containing the groundwater plume in both alluvial aquifer subunits in the northern portion of the OU2 Area near I-10; however, the extent of capture is not interpreted to extend across the southern plume boundary. Because of this, the Companies have implemented interim remedy modifications in the last few years, with the most recent starting in 2020/2021. The most recent modification in 2020 includes finalizing design, permitting, and construction of two injection wells and associated pipelines and vaults, downgradient of the OU2 GES, with the start of treated water injection occurring in 2021. This interim remedy modification is designed to enhance hydraulic capture in the central portion of the Site and improve water quality downgradient of the OU2 capture zone in OU3.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?
Overall, there are long-term decreasing downgradient contaminant concentration trends in downgradient monitor wells screened in the Salt River Gravels and Basin Fill as noted below from page 30 (Section 3.3.5.2 Trends Downgradient) of the 2020 Effectiveness Report (GHD, March 31, 2021):

"In addition to the statistical trend analysis, TCE concentration graphs were prepared to illustrate and compare the TCE contaminant trends for wells downgradient of the OU2 GES. The locations of the wells are shown on Figure 3.7 (SRG) and Figure 3.8 (BF). Representative wells, including monitoring wells within and downgradient of the hydraulic capture zone, were selected to support the hydraulic capture evaluation for each of the subunits of the OU2 GES. TCE concentration graphs are presented as Figures F.3 for SRG wells and F.4 for BF wells (Appendix F 2). Effects of the ISCO pilot test may be a contributing factor to the timing and occurrence of individual well concentration changes.

Five SRG wells depicted in Figure F.3 are located downgradient of the OU2 GES capture zone: NW04 S, NW07 S, NW07 M, NW14 M, and NW18 S. The statistical trend (see Table 1 in Appendix F 1) for four of the five SRG wells for the period 2001 2020 for TCE are decreasing or have no statistical trend. NW14 M has an increasing trend for 2001–2020. The statistical trend (see Table 2 in Appendix F 1) for four of the five SRG wells for the period 2013/2016 2020 for TCE are decreasing or have no statistical trend. NW04 S has increasing trends for 2013/2016 2020; however, NW04 S shows an average TCE concentration of 1.87 µg/L since 2014. So, while the observed statistical trends are not considered to represent a current issue, observed concentrations and trends will continue to be monitored. One downgradient well (NW14 M) displayed a trend that shows a slight increase since 2013. Recent TCE concentrations have shown variability in NW07 M, with concentrations at NW07 M temporarily exceeding the MCL in March 2018, subsequently decline following the 2018 [In Situ Chemical Oxidation] ISCO injections, and has increased since, but are still below the MCL. Concentrations at NW07 S and NW18 S also exhibited similar small increases in TCE concentrations following ISCO injections. The previous increasing TCE trends suggests that there was an issue with the continuous extent of hydraulic capture in the central portion of the Site in the vicinity of the Airport Ridge related to the reduction in extraction rates in response to the declining water table. The recent decline and incremental increases in TCE concentrations in NW07 M, NW07 S, and NW18 S indicates that the ISCO injections have had some success in ameliorating the effects of incomplete hydraulic capture on downgradient water quality in the SRG.

Three BF wells depicted in Figure F.4 in Appendix F 2 are located downgradient of the OU2 GES capture zone: NW07 D, NW13 D, and NW14 D. The statistical trend (see Tables 1 and 2 in Appendix F 1) for these three BF wells for the periods 2001 2020 and two of the three BF wells for the period of 2013/2016 2020 for TCE are decreasing or has no statistical trend. NW07 D, which is outside of the OU2 GES capture zone, has an increasing trend for the period 2013/2016–2020. NW14 D, which is located outside the OU2 GES capture zone, has no statistical TCE trend. Although an increasing trend was observed at NW14 D from approximately 2013 to 2015, the trend since 2016 appears to be generally stable. Monitoring well NW19 D, also located outside the OU2 GES capture zone, had an overall increasing trend until this year and exhibited a significant downtrend following ISCO injections; however, the TCE concentration has stabilized to pre injection levels with no trend identified. TCE has not been detected or detected at very low concentrations below the MCL in downgradient OU3 BF screened monitoring wells OU312 D, EW13 228, and EW13 268, which are located downgradient of wells NW14 D and NW19 D."

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.
GHD has an operator on-site Monday through Friday (approximate 40 hours/week). Additionally, the GHD operator is on-call 24/7/365 for callouts, shutdowns, or emergencies.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.
There have been no significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years. However, several interim remedy enhancements have been undertaken by the Companies from 2017 through 2021 as outlined below.

The following is an excerpt from Section 4.1 (In Situ Chemical Oxidation ((ISCO) Work Plan and Objectives) from Page 29 of the 2018 Annual Effectiveness Report (GHD, 2019):

"On January 10, 2018, the Companies submitted to the Agencies a revised Pilot Study Work Plan (GHD, 2017b) for ISCO for the Site (ISCO WP). The Agencies approved the ISCO WP on April 3, 2018. The ISCO WP focused on the selection of an in-situ treatment remedy enhancement that would reduce the concentrations of Site COCs in groundwater within two localized pilot test areas located within the central and southern portions of the OU2 area. The proposed ISCO pilot study program for the Site was developed as a contingent remedial measure to supplement the existing GES.

During 2017, TCE concentrations increased in SRG wells NW03 and NW18 S, and contingent remedial measures were proposed to enhance mass reduction in the SRG in this area by conducting ISCO injections in those targeted monitoring wells (Figure 4.1).

During 2017, TCE concentrations in the BF in the southern plume area of the Site, south of well NW16 D, had also increased, due to a number of factors outlined in the 2016 ER. Therefore, contingent remedial measures were proposed to reduce mass in wells located south of the southern extent of capture in the BF, with ISCO injection in BF targeted monitoring wells NW11 D and NW19 D (Figure 4.2)."

The following is an excerpt from 2019 Annual Effectiveness Report, Page 31: (GHD, 2020):

"An ISCO pilot study program for the Site was implemented as a contingent remedial measure to reduce TCE concentrations in localized areas. The ISCO pilot program ended following the collection of groundwater samples during the September 2019 annual groundwater sampling event. Refer to the 2018 report (GHD, 2019b) for additional details regarding the revised Pilot Study Work Plan (GHD, 2017b), the selection of an in-situ treatment remedy enhancement (PersulfOx [sodium persulfate]), proposed ISCO injection wells and volumes, and work plan implementation and deviations. Because all field information and analytical data have been collected, and implementation of the ISCO pilot study program has been completed, the information included and discussed herein is intended to provide an overview of the collected data and overall conclusions."

The following is an excerpt from 2020 Annual Effectiveness Report, Page 31 (Section 2.3.2 New Injection wells and pipelines): (GHD, 2020):

"In August and December 2019, GHD outlined installation of two new injection wells and associated pipelines/vaults in a work plan to the Agencies to provide an enhancement to the interim remedy for the central portion of the Site (GHD, 2019d, 2019b, 2020b, e). Historically, the OU2 GES has been successful at capturing VOCs and reducing VOC concentrations throughout the GES Area and downgradient in OU3. However, due to the regional decline of the water table related to the long-term drought, extraction rates for the OU2 GES have decreased over time. Recent groundwater monitoring data indicate that TCE concentrations have increased in a few select monitoring wells immediately west of the extraction wells in the central portion of the Site. In response, the Companies have implemented contingent remedial actions on an interim basis to address the increasing concentrations in the southern and central portions of the Site.

In the summer of 2019, GHD drilled three soil borings (NW 28, NW 29, and NW 30) to evaluate/optimize locations and support the design of two injection wells for the OU2 supplemental interim remedy by collecting depth to bedrock, groundwater levels, and lithologic and grain size information. Piezometers were installed in NW 28 and NW 29 and were subsequently renamed OU2 PZ03 and OU2 PZ04, respectively. NW 30 was abandoned. This work was summarized in a work plan for an enhancement to the interim remedy (GHD, 2019d2019b) and included soil boring logs/well construction details.

Clear Creek Associates (CCA) oversaw the drilling, well installation, and development and testing of the new injection wells (OU2 INJ 1 and OU2 INJ 2) conducted by Yellow Jacket Drilling from March 24, 2020, to May 14, 2020 (CCA, 2020b). Upon completion of drilling of the boreholes, the well casing, sounding tube, and gravel feed tube were installed, and then annular materials (filter pack, bentonite, and cement) were emplaced. The wells were developed by swab and airlift methods. Following the completion of the well development activities, step rate pumping tests were performed to measure the hydraulic properties of the saturated portion of the screened interval, which were ultimately used to size the backwash pumps. Stainless steel casing, 14.5-inch diameter and 0.25-inch wall thickness, was installed to a depth of 180 feet bgs in each new injection well.

Screen consisting of 0.0080 inch louvered "Super Flo" stainless steel was placed from 60 to 180 feet bgs. Sigmund Lindner Glass Beads (Type S 4510 11, 2.40-to-3.45-millimeter diameter) were placed from 55 to 180 feet bgs as the filter pack material (CCA, 2020b). Based on the data and analyses presented herein, CCA recommended that the wells be equipped with permanent backwash pumps capable of producing up to 300 and 600 gallons per minute (gpm).

From May through December 2020, GHD oversaw installation of pipelines and vaults by Hunter Contracting (general contractor). A construction completion report is currently in preparation by GHD that will include as built drawings and geotechnical testing results. Details of the OU2 Area groundwater extraction and treatment system and injection wells are provided in the O&M Manual (CRA, 2004b), revised in 2011 (CRA, 2011a), and revised in 2021 (in progress). After installation of the injection wells and pipelines and vaults, initial production testing was conducted in late December 2020. Injection well OU2 INJ 01 could sustain approximately 300 to 500 gpm injection rate and OU2 INJ 02 could sustain approximately 600 to 900 gpm injection rate. Backwash pumps (for removing fine grained sediment from the injection well screens) were designed to operate at approximately 300 and 600 gpm for OU2 INJ 01 and OU2 INJ 02, respectively. These backwash pumps will operate periodically (monthly) and pump the water through newly installed bag filters to remove sediment prior to treatment through the OU2 GES and discharge.

At the Agencies' requests, monthly water levels will be collected in a subset of the OU2 GES monitoring well network for a period of approximately 9 months after the start of normal operations and reported to the Agencies. Additionally, water level pressure transducers were installed in a series of monitoring wells around the perimeter of the two new injection wells and will also be monitored monthly and reported to the Agencies."

In January/February 2021, corrosion was discovered in the new injection wells and bag filter units. GHD coordinated specialized microbiologic and inorganic groundwater sampling and analysis of injection wells and extraction wells for corrosion issues in April/May 2021. In July and August 2021, corrosion repairs and disinfection of injection wells, extraction wells, pipelines and bag filter vessels will be conducted and when completed a summary memo will be prepared and submitted to Agencies

In Summer of 2021, a project to upgrade the OU2 GES system Controls/Automation includes updating software and hardware such as Programmable Logic Controllers (PLCs) and communications between extraction wells and the treatment compound, was started and will continue into 2022.

6) What are the annual operating costs for your organization's involvement with the site?

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.
No. Please see response to Question 5.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
Every year as part of the annual effectiveness evaluation the O&M/groundwater sampling is reviewed and proposed for the next calendar year. As water levels have dropped in the alluvial aquifer, extraction well flowrates have steadily decreased because there is less available groundwater to pump from 2012 to 2017. Beginning in 2018 through 2020, extraction well pumping has increased from 2017 levels.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?
No
10) Do you have any comments, suggestions, or recommendations regarding the project?
As part of the final RI/FS, the Companies are looking at optimizing the OU2 GES groundwater monitoring network (reducing spatial redundancy, evaluating long term trends and using statistics to reduce sampling frequency) , and also include evaluating low flow or passive sampling rather than traditional 3 well volume purging (current sampling), especially as the water level decline continues.

Additional Site-Specific Questions

[If needed]

Five-Year Review Interview Record			
Site:	Motorola 52nd Street Plant Operable Unit 1 (M52-OU1)	**EPA ID No:**	AZD009004177
Interview Type: Form completed and sent via email after visit Location of Visit: OU-1 Integrated Groundwater Treatment Plant (IGWTP) Date: July 15, 2021 Time:			

Interviewers		
Name	**Title**	**Organization**

Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Leo Willson	GPI Environmental, Inc.	Treatment Plant Operator	602-790-7452	leo.w@gpimail.com
Jason S. Weed, PE	GPI Environmental, Inc.	O&M Project Engineer	602-234-0696 x150	jason.w@gpimail.com

Summary of Conversation

1) What is your overall impression of the project?

OU-1 treatment system has been in operation since 1992. The system continues to perform (with minimal downtime considering the age of the system) by removing VOC's from the influent water that is pumped to the Integrated Groundwater Treatment Plant (IGWTP) from the groundwater extraction well system.

2) Is the remedy functioning as expected? How well is the remedy performing?

An assessment of the performance of the remedy is outside the scope of the O&M services that GPI provides.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

Analytical results of water and air samples collected at the IGWTP show that the treatment system is operating to remove VOC's from influent water from the extraction well system. An assessment of contaminant level trends is outside the scope of the O&M services that GPI provides.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

The treatment plant is staffed during normal work hours Monday through Friday, with on-call alarm response outside normal hours. The treatment plant operator (Leo Willson) and alternate operator/technician perform normal operations and maintenance activities of the treatment plant and associated groundwater extraction wells, collect water and air samples, and perform reporting duties.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.

In the last five years there have not been any significant changes to the O&M requirements, maintenance schedules, or sampling routines. An assessment of the protectiveness of the remedy is outside the scope of the O&M services that GPI provides.

6) What are the annual operating costs for your organization's involvement with the site?

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.

The only unexpected O&M difficulty in the last five years was the attempted and failed removal of the liquid-phase granular activated carbon (LGAC) from the two carbon vessels (AC-501 & AC-503) that are not being used. The carbon had become cemented with scale and the carbon vendor was not able to removed the carbon from the vessels.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

There have not been any opportunities to optimize O&M or sampling efforts in the last five years. Several changes were made prior to five years ago and were discussed in the previous review.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy? An assessment of the protectiveness of the remedy is outside the scope of the O&M services that GPI provides. 10) Do you have any comments, suggestions, or recommendations regarding the project? None.
Additional Site-Specific Questions
[If needed]

Five-Year Review Interview Record			
Site: Motorola 52nd Street		**EPA ID No:**	

Interview Type: Email
Location of Visit: Email
Date: 7/29/21
Time: 4:00

Interviewers

Name	Title	Organization
Rachel Loftin	Project Manager	EPA

Interviewees

Name	Organization	Title	Telephone	Email
Julie Riemenschneider	City of Phoenix	Environmental Programs Coordinator	602-256-5681	Julie.riemenschneider@phoenix.gov

Summary of Conversation

1) What is your overall impression of the project?
ADEQ and EPA team work well together. There are several responsible parties conducting work in the three separate operable units (OU), maintaining several treatment systems to remediate the contamination. This is a large site that has multiple areas to manage.

2) Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.
The City of Phoenix has reviewed and approved numerous locations for sampling to occur in the City right of way, including traffic plans where appropriate.

3) Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
No, not to my knowledge.

4) Do you feel well informed about the site's activities and progress?
Yes. The City is invited to and attends the monthly EPA and ADEQ project manager meetings. The City also attends the yearly CAG meeting. The City always appreciates the facts sheets and any information about upcoming work that might affect the City or our community.

5) Do you have any comments, suggestions, or recommendations regarding the site's management or operation? It would be helpful if the website at both ADEQ and EPA would have the reports in electronic format and also if the websites were updated with the current status. It appears that recent soil vapor sampling in OU1, OU2 and OU3 is not discussed. No reports are online at ADEQ (the site refers the reader to the EPA site) and it appears only CAG presentations and fact sheets are online at EPA.

6) Do you have any comments, suggestions, or recommendations regarding the project? The City appreciates the hard work the regulator agencies and the responsible parties are doing to help remediate the contamination. Water is a very valuable resource in the desert and the City of Phoenix as a water provider, will need this resource in the future.

Additional Site-Specific Questions

[If needed]

Five-Year Review Interview Record			
Site:	Motorola 52nd Street Superfund Site	**EPA ID No:**	AZD009004177

Interview Type: *Questionnaire*
Location of Visit: Virtual
Date: 08/25/2021
Time: 13:00 MST

Interviewers

Name	Title	Organization
Rachel Loftin	Remedial Project Manager	EPA

Interviewees

Name	Organization	Title	Telephone	Email
B. McDaniel	ADEQ	Remedial Project Manager	602-771-0200	mcdaniel.brett@azdeq.gov
K. Harker	ADEQ	Manager, Federal Project Unit	602-771-0361	harker.karin@azdeq.gov
T. LePage	ADEQ	Manager, Remedial Projects Section	520-770-3127	lepage.tina@azdeq.gov
L. Malone	ADEQ	Manager, Waste Programs Division	602-771-4567	malone.laura@azdeq.gov

Summary of Conversation

1) What is your overall impression of the project?

The operable unit 1 (OU1) interim remedy - ADEQ is pleased with the responsible party's progress to contain and control the contaminant plume at OU1.

The OU2 interim remedy - ADEQ is concerned about absence of capture at the southern portion of the OU2 groundwater extraction system (GES), the resulting impact to OU3 and ultimately the West Van Buren (WVB) WQARF state cleanup site. The remedial enhancement implemented by the responsible parties (RPs) at OU2 is pending operation and testing. Regardless, review of the OU2 GES 2019 and 2020 Effectiveness Reports indicated that capture of the trichloroethene (TCE) groundwater plume is not complete, most notably south of the southern extraction well (EWS). As a result, the OU2 TCE plume is skirting the capture zone of the OU2 GES and impacting OU3.

Progress on the remedial investigation (RI) and feasibility study (FS) phases of the CERCLA process) have been burdened with inclusion of the vapor intrusion (VI) portion of the investigation at OU2. The importance of the VI investigation is understandable, however, remediation of groundwater and VI will likely involve independent remedial systems. ADEQ would prefer that the RI/FS for groundwater and VI be separated to help reach a final remedy (record of decision) for groundwater.

Our overall impression is that the EPA has done well to get OU1 and OU2 into the interim remedial phase of the CERCLA process but has failed to make remedy implementation a priority at OU3, as mentioned below.

2) Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

The ADEQ has been an active participant and facilitator with respect to ongoing communications and activities performed across the Motorola 52nd Street Superfund Site. Currently, ADEQ is the lead agency at OU1 and OU2 for interim remediation systems operation and maintenance (O&M) and groundwater monitoring phases of work. Thus, ADEQ promotes communication by hosting quarterly meetings for both OU1 and OU2. Site inspections have also occurred on an annual basis with exception to 2020, due to COVID-19 restrictions.

3) Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

Concerning operation of the interim remedies at OU1 and OU2, ADEQ has not received or needed to respond to, complaints or violations.

As part of the RI work in OU2, EPA and the RP conducted indoor air sampling at residences in the OU2 area in July 2019. Leading up to and during the sampling event, several residents called the City of Phoenix about the sampling. City representatives trying to respond to questions were caught off-guard and had no information to answer questions from the public. As a result, the City of Phoenix, EPA and ADEQ meet on a monthly basis to review activities planned or performed within the Motorola 52nd Street Superfund Site.

4) Do you feel well informed about the site's activities and progress?

Yes. ADEQ's participation in the site's ongoing management allows for very up-to-date knowledge of activities and progress.

5) Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

As mentioned above, ADEQ would prefer that EPA find methods to expedite the RI/FS process. At OU2, the RI/FS is pending completion of the VI investigation. The same holds for the FS at OU3. If EPA addressed groundwater and VI contamination separately, the RI/FS phase of the CERCLA process could progress and final groundwater remedies could be implemented in a timely manner. Ultimately, this will benefit groundwater quality conditions, which Arizonans will become increasingly more dependent upon.

6) Do you have any comments, suggestions, or recommendations regarding the project?

In 2018, the ADEQ requested that EPA extend the Motorola 52nd Street Superfund Site west of OU3 or establish a new NPL site (ADEQ, 2018). The EPA responded to this request indicating that the Motorola 52nd Street Superfund Site would not be extended (EPA, 2020), despite obvious and overwhelming evidence indicating that the Motorola 52nd Street Superfund Site contributes TCE impacted groundwater to the WVB area on a continual basis.

Although interim remedies are in place at OU1 and OU2, a remedy has not been implemented at OU3. Since the issuance of OU3 Administrative Order on Consent in 2008, which names the RPs, contaminants in groundwater have continued to migrate into the WVB WQARF (state funded cleanup) site. Still, OU3 is in the FS stage of the CERCLA process after 13 years. From the state's perspective, this is unacceptable. Considering that OU2 implemented an interim remedy within 9 years after the Motorola 52nd Street Superfund Site designation (in 1992), action is needed at OU3. The lack of action suggests that the contaminant plume in OU3 isn't a concern to the EPA. Considering that contaminants have been migrating from OU3 into the WVB site since identification of OU3 study area in 2001, the extent of impact to WVB is significant. By conservative estimates, the OU3 portion of the plume now extends to 19th Avenue, west of the arbitrary boundary of OU3 at 7th Avenue. In fact, ADEQ has provided EPA with ample evidence that the Motorola 52nd Street Superfund Site TCE plume extends west of 43rd Avenue (ADEQ, 2019). The ADEQ suggests the "arbitrary boundary" of OU3 be extended west of 7th Avenue to account for contamination that has since migrated into the WVB site.

In essence, the EPA has allowed the RPs of OU3 to continually pollute groundwater in the WVB WQARF site since OU3 has existed and has burdened Arizona with the impacted groundwater.

References:

ADEQ, 2018. Re: Expansion of the Motorola 52nd Street Superfund Site Boundary. Letter to Alexis Strauss, Acting Regional Administrator, EPA, from Misael Cabrera, Director, ADEQ. 7 p, Figures 1-4. April 24.

EPA, 2020. Re: EPA technical reply to ADEQ's request to expand the Motorola 52nd Street Superfund Site to include the West Van Buren Site, Phoenix, AZ. Letter to Misael Cabrera, Director, ADEQ, from John Busterud, Regional Administrator, EPA. 3 p. June 17.

Additional Site-Specific Questions
[If needed]

Five-Year Review Interview Record			
Site:		**EPA ID No:**	

Interview Type: *[e.g. Visit, Teleconference, etc.]*
Location of Visit:
Date: 2021 Motorola 52nd Street Site
Time:

Interviewers

Name	Title	Organization
Via e-mail during covid restrictions – Summer 2021 July		

Interviewees

Name	Organization	Title	Telephone	Email
Steve Brittle	DWAZ / M52 CIG			
Rene Chase Du-Fault	M52 CIG			
Todd Swartz	CIG			
Les Holland	CIG			

Summary of Conversation

1) What is your overall impression of the project?

It has failed. It has devolved into perpetrating a fraud that ignores community concerns and inputs, a sham, and ignores any credible information that contradicts what EPA wants to make the narrative. It ignores more recent ADEQ correspondence about actual amounts of TCE released, which does correlate with far more waste TCE being released at the site, considering mass balance calculations, than EPA's official story. It also ignores ADEQ's information and others' information that indicate that TCE has migrated well beyond the arbitrary and imaginary 7th Avenue boundary EPA has designated. The detection of 1, 4 dioxane and PFOS at 35th Avenue clearly indicate the 7th Avenue boundary is a fraud. EPA staff have become progressively hostile, condescending, and repressive towards the CIG, and it is clear that a certain, fraudulent, narrative is the "official" version being pushed by EPA, and that the EPA wants the CIG to assist in perpetrating this fraud. One wonders if this was the plan all along. It is dishonest, and it leaves the entire affected populace at an additional risk due to TCE fumes in the ambient air, especially fetal cardiac abnormalities. The years of data for the site have only just recently been restored to the website, further hampering community awareness and involvement, taken down just as the new, fraudulent narrative began. CIG requests to study alternative cleanup strategies were rudely and summarily rebuffed, with hostility, from EPA staff. Similarly, discussion and concerns about the TCE toxicity review and the suggestions from Region 10 that the TCE standards in water and ambient air should be reduced have been quashed. I have been involved for about 30 years now, and I have seen various project employees and how things were. Now, the CIG is just a prop for EPA's agenda. Maybe the EPA has realized that its approach to TCE cleanups, which involve most of the nation's Superfund sites, is a failure, and after decades, EPA is hoping/relying on the fact that people will age out or give up. Meanwhile, the public is not being protected or informed.

2) What effects have site operations had on the surrounding community?

Added risks and misinformation

3) Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
No one believes EPA is being responsive to community concerns: EPA has refused to allow in others on CIG telephonic meetings who are interested in participating in the annual phone calls, despite the CIG identifying these individuals and their personal contact information. EPA doesn't respond professionally, if at all, to CIG/community questions or concerns. You take the handful of people who are concerned enough to be and stay informed over the years, and treat them like second class citizens.
Also, it used to be EPA's duty to get information to the community, then suddenly, EPA decided it was up to the CIG, an unincorporated entity, to do EPA's responsibilities clearly mandated by Congress, about informing the community, then refused to let more interested people in the community be involved. All this despite reminders of CERCLA's specific requirement for EPA to involve affected communities and to communicate with them.
A physician on the CIG communicated a way to scientifically examine ways to track whether certain TCE-related diseases/afflictions/deaths could be tracked, after years of people asking for that. Naturally, he was ignored. EPA, protecting the PRPs and limiting PRP liability.

4) Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

Not sure why this question is here, as no responding agency would even notify me, only you or ADEQ.

5) Do you feel well informed about the site's activities and progress?

No, I know am being propagandized. Fortunately, I have found other ways to get information. I scoff at the notion that there has been real progress.

6) Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
Get a new team that is responsive to the community and start telling the truth. This goes all the way to the top of Region 9 Superfund administration.

7) Do you have any comments, suggestions, or recommendations regarding the project?

The pump and treat system in place will not work, won't ever solve the problem, and alternative technologies and approaches should be investigated.
There is ample scientific evidence that contaminants like PFOS from Sky Harbor Airport fire-fighting drills and activities, and 1,4 dioxane from semi-conductor facilities have been transported from the Motorola 52nd Street site well into the area of the West Van Buren WQARF site, and these have no other logical origin that the Motorola 52nd Street site and the Phoenix Sky Harbor Airport. The failure of EPA to face the truth about this and act appropriately and in a timely manner has caused the loss of extensive groundwater resources, which continues even now. The same problem that happened at the Tucson International Airport Area Superfund site where the co-mingling of these contaminants has caused their treatment and removal to become so costly that it ceased its operation. The ADEQ gave $2 million to assist and treatment resumed, but this West Van Buren WQARF site is a much larger area of contamination, with far more volume, and this will cost far, far more to clean up.
The Motorola 52nd Street Superfund site boundaries should be extended to match the reality, and these areas should be added to the NPL. Mass balance calculations are on the side of ADEQ's letter notifying EPA about how the ADEQ originally lied about all of this and requesting that EPA take over the WQARF site. (The CIG was not allowed to discuss this letter, despite EPA acknowledging it.) Back in the 1990s, before the mythical and arbitrary 7th Avenue boundary was determined, there were suggestions about pump and treat systems going all the way to 91st Avenue, instead of the usual, useless, plodding efforts seen in the Superfund/WQARF programs. If this had been implemented, the groundwater resources would have not been polluted with the three contaminants, as aggressive measures could have been taken. Now, it will cost taxpayers **many millions more**.
This is also an environmental justice issue. The West Van Buren WQARF site is also the only place in Arizona where uncontrolled TCE emissions are released into the ambient air from groundwater pumping, and of course, impact an ethic-minority population.

Additional Site-Specific Questions

[If needed]

Appendix G: Site Inspection Report and Photos

1. INTRODUCTION

a. Date of Visit: 15 July 2021

b. Location: Various locations, Phoenix, AZ

c. Purpose: A site visit was conducted to visually inspect and document the conditions of the remedy, the site, and the surrounding area for inclusion into the Five-Year Review Report.

d. Participants:

Matthew Masten	US Army Corps of Engineers, Env. Engineer	602-230-6873
Manfred Plaschke	Geologist, GHD	602-881-0655
Jenn McCall	Program Manager, NXP	480-628-6427
Jason Weed	Engineer, Gutierrez-Palmenberg	602-234-0696
Leo Willson	OU1 Operator, Gutierrez-Palmenberg	602-244-6317
Nicole Rubenstein	Engineer, GHD	480-450-0124
Dave Hilliard	GHD, OU2 Operator	602-513-6971

2. SUMMARY

A site visit to the Motorola 52nd Street Superfund Site, (M52) Operable Unit 1 (OU1) and Operable Unit 2 (OU2) was conducted on 15 July 2021. The inspection included visual observation of overall site conditions and inspection of various components of the remedy. The participants received an overview of the site and the remedial history. The inspection evaluated the various groundwater treatment systems, groundwater extraction wells, and groundwater discharge points.

3. DISCUSSION

On 15 July 2021, Mr. Masten arrived at the OU2 facility office in Phoenix, AZ at 0800 hrs. The team assembled in the facility office room. Mr. Plaschke presented the group with an overview of the site, the site history, remedial progress and future actions at the site. The senior OU2 full-time operator, Mr. Hilliard gave an overview of the treatment system and control console. The system consists of eighteen 18,000 lb. granular activated carbon (GAC) vessels (9 pairs) and an UVOX system. There is room for a 10th pair of GAC vessels. At this time, the facility is only using five pairs of GAC vessels for groundwater treatment. Four pairs of vessels run in a lead-lag configuration and a fifth is rotated in as carbon changes occur. The UVOX system is not being used, except for one day a year for testing. It was installed to treat vinyl chloride in groundwater which is no longer detected at concentrations requiring remediation. There are three extraction wells being pumped: EW-S at 200 gpm, EW-N at 400 gpm, EW-M at 800 gpm, for an approximate total flowrate of 1,400 gpm. Effluent is discharged to the Grand Canal through a concrete lined ductile iron pipe. Mr. Plaschke informed Mr. Masten that two injection wells, INJ-01 and INJ-02, were newly installed in May 2020 and became operational in December of 2020. They are downgradient, to the west of the site, with the intent to inject 300 to 600

gpm. These were installed due to lowered groundwater levels, and to enhance plume capture. He indicated that there have been corrosion issues, caused by naturally occurring gallionella bacteria, of the stainless-steel wells and reinjection system, and they were currently not in service. A disinfection plan was approved by EPA and is being implemented. The bacteria concern will be monitored closely, and a contingency plan is being developed to monitor and address this ongoing maintenance issue, if needed, as part of ongoing O&M for the site.

The team toured the GAC vessel facility. The weather was sunny, calm, and approximately 90 degrees Fahrenheit. Mr. Plaschke stated that the system has a 5,300 gallon per minute capacity but is currently running at 1,400 gallons per minute. Mr. Plaschke informed the team that there is an average of three to four carbon change outs per year. The change outs occur once there is break through into the effluent. The influent and effluent are sampled monthly. The spent carbon undergoes a custom reactivation by Evoqua Water Technologies. The carbon is non-hazardous. Over its lifetime, the system has 95-98% uptime. System data is logged and auto-downloaded weekly. The system can be remotely controlled, monitored, and alarmed.

Mr. Plaschke reported that OU2 has approximately 50 monitoring wells, and semi-annual reports are due to EPA and ADEQ. There is one permit for discharge of up to 25,000 gallons of wastewater per day to the city sewer. This wastewater consists of backwash with carbon fines and stormwater that accumulates in the on-site sump. A monthly discharge report is generated, the water is tested for pH and VOCs. The system is normally shut down for one month a year for canal maintenance. However, the new injection wells can continue discharge with a reduced flow.

O&M manuals, SOPs, Health and Safety Plans, and drawings were present on-site, all updated as necessary. Maintenance logs and daily reports were available. The oil from the two line-shaft turbines in the extraction wells is replaced and recycled yearly. There is a plan in place to update the automation and control system. The current system is outdated, and replacement parts have become hard to come by. The first phase of the update is planned to be completed by February of 2022. The air relief valves on the system are inspected and rebuilt or changed out as necessary. The intent is to replace all the air relief valves within the next year. Twelve of the GAC vessels had lining repairs completed in 2017. It was noted that having unused ‘spare’ GAC vessels provided for spare parts and greater operational flexibility. Mr. Plaschke indicated that all flowmeters on the system were calibrated yearly by a third party. The treatment system was well secured, with an attractive, functional fence. No signs of trespassing or vandalism were evident. In fact, the City of Phoenix Police Department have a small substation within a portion of the main building/facility, deterring any would-be vandals. Overall, the system appeared to be well maintained, in excellent condition and functioning correctly.

The team walked to monitoring well NW08-S, a shallow upgradient well. The flush mount cover was removed. The well head was secured and appeared to be in good shape. The intermediate and deep monitoring wells were adjacent. The newly installed injection well, INJ-02, was inspected next. The well vault was opened, the pump had been removed for disinfection. The valve control vault was inspected as well. The injection well and associated vaults were well secured and in good condition, as expected due to their recent installation. The team then drove by the middle extraction well. The wellhead and associated well house appeared to be well secured and in good working order. No

evidence of trespassing or vandalism was present. The team next traveled to the pipeline discharge for the treated water into the Arizona Grand Canal near Roosevelt and 32nd Street. Salt River Project maintains the canal sidewall where the treated water is discharged.

The team arrived at the OU1 facility at 1200 hrs. Mr. Weed gave an overview of the site, the site history, remedial progress, and future actions at the site. The system consists of two single pass air strippers, two liquid phase carbon adsorption vessels and a vapor phase carbon adsorption vessel. Mr. Weed stated that the system was constructed in 1990 and came online in 1991. It was noted that there were originally four liquid phase 'polishing' carbon adsorption vessels in use, but two of the four are permanently offline due to internal scaling. However, only two are needed, and there is no plan to refurbish the offline vessels. Mr. Weed stated that the system is meeting all substantive requirements; no major changes have occurred in the past five years. Vapor phase carbon change outs occur approximately every 180 days. The system is discharging treated water to the Crosscut Canal rather than the City of Phoenix wastewater system. This has resulted in beneficial reuse of the water and a cost-savings of permitting fees to the City of Phoenix. During the Salt River Project (SRP) maintenance 'dry out' where the canals are drained, the facility discharges to the City of Phoenix through a Class A wastewater permit. Mr. Weed indicated that SRP has remote shut-off capability should they need to stop discharges to the canal. Mr. Willson informed Mr. Masten that all record keeping (maintenance logs, stormwater inspection forms/checklists, hazardous waste inspection forms) are in electronic format, as of March 2020. The O&M Manual, Health and Safety Plan, and Emergency Response and Contingency Plan were all updated in July 2021.

Mr. Weed noted that after the air stripper system was switched to single pass from a closed loop system, scale inhibitor was added. Sodium hexametaphosphate is being used. Packing balls are checked periodically for scaling. The system uses one blower, operating at 5,500 cubic feet per minute. A dehumidifier is used prior to the vapor phase carbon unit, the condensate is recycled back into the treatment system. The vapor phase GAC unit is a 10,000 lb. roll-off and is sampled monthly for breakthrough. The waste vapor phase carbon is shipped offsite with non-hazardous waste shipping papers, approximately twice yearly. No air permit is required, and no hazardous waste is leaving the site except from time to time, a drum of groundwater with high concentrations of VOC recovered from manually pumping groundwater well MP-3 is shipped off-site to a TSDF. The liquid phase GAC vessels consist of two 20,000 lb. vessels, their effluent is sampled twice monthly. Carbon change out occurs when breakthrough is detected. According to Mr. Weed, change out is infrequent, because the air strippers remove 99%+ of VOCs. The system is in a secure facility, no trespassing or vandalism was apparent or likely.

It was pointed out that the AD Building on the former Motorola Plant complex is now fenced off, and it is scheduled to be demolished. This will affect extraction wells and the extraction well pipeline in the area. These will be relocated, and the formerly used SVE system will be removed and may be replaced.

The team traveled to view extraction well 301, extraction well 302 and a representative monitoring well. The wells appeared to be well secured and in good working order. The well field and discharge point adjacent the Crosscut Canal was inspected next. It was noted that the well vaults had protective sliders over the locks, all vaults were accessible and functional. No damage to the well heads, SRP

discharge meter or associated piping was evident. There was some graffiti along the canal and the wall beside the well vaults; the Old Crosscut Canal area including the walls is maintained by the Maricopa Flood Control District. The discharge point was functioning normally.

All components of the remedial action for M52 Operable Unit 1 and Operable Unit 2 appear to be in good condition and are currently operating as intended. All systems and wells were found to be well secured and free from vandalism.

Matthew Masten, P.E.

Environmental Engineer

US Army Corps of Engineers, LA District

Site Photos – Motorola 52nd Street Site OU1 and OU2 Five Year Review Site Inspection

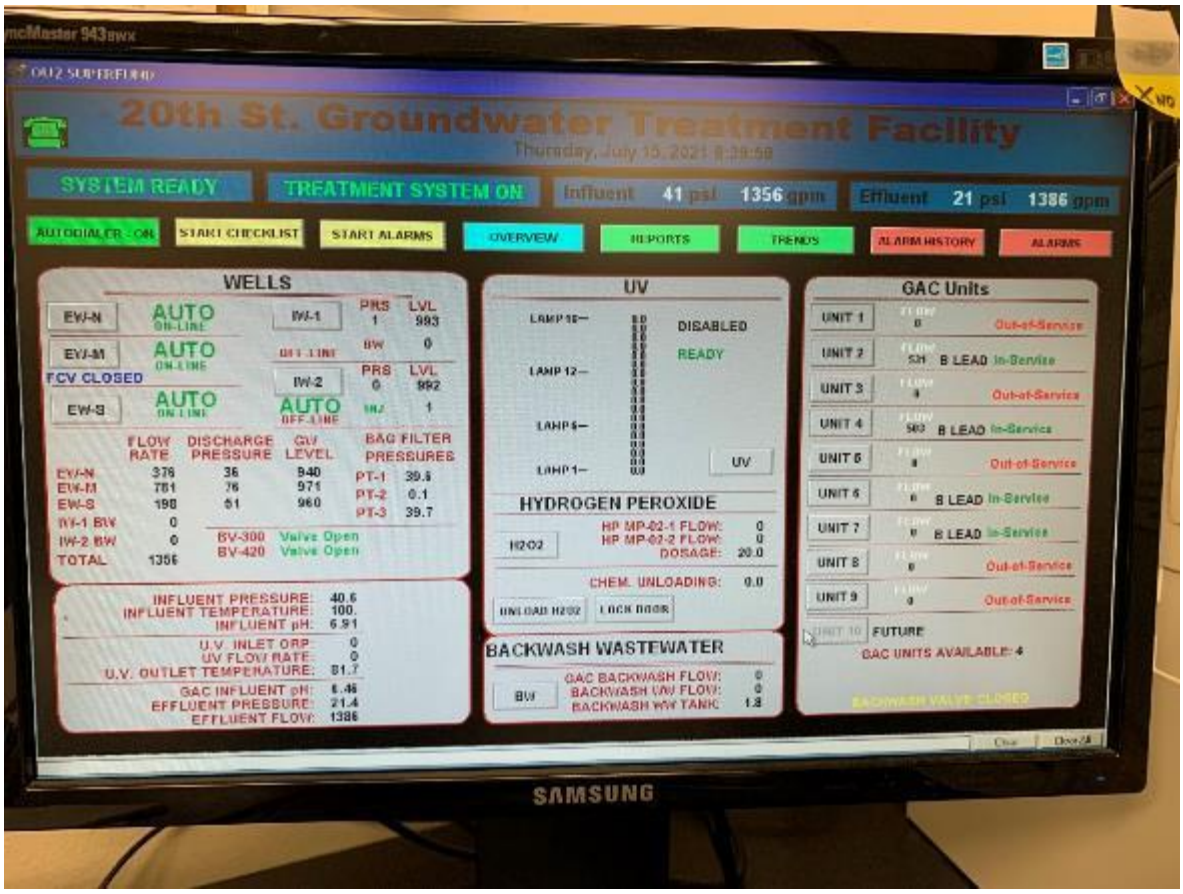


Figure 14- OU2 Treatment Facility control console

Figure 15-OU2 UVOX system

Figure 16-OU2 piping for injection well backwashing and bag filters

Figure 17-OU2 injection well bag filter interior, showing corrosion to be milled off

Figure 18-Pressure tank for on-site irrigation

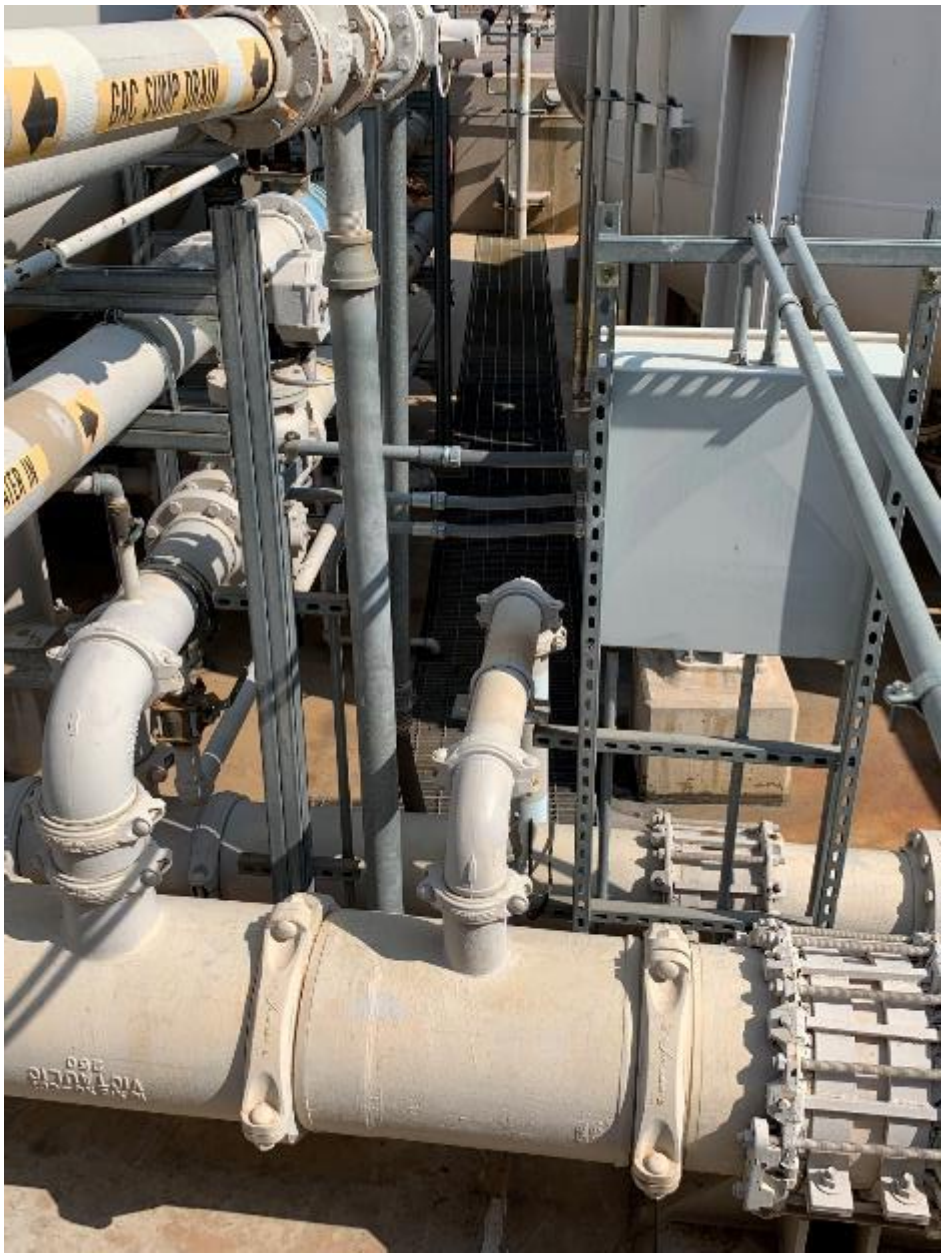


Figure 19-OU2 sump (in center) pumped to backwash wastewater tank then sent to City sewer

Figure 20-OU2 GAC vessels, facing southwest

Figure 21-Unused GAC vessel marked EMPTY

Figure 22-OU2 South extraction well with sand filter

Figure 23-Monitoring well NW-8 (shallow, intermediate, deep)

Figure 24-Injection Well 2, from street, facing west

Figure 25-Injection well 2 vault, pump removed

Figure 26-Injection well 2 valve control vault

Figure 27-Electronics cabinets for injection wells

Figure 28-OU2 Discharge point

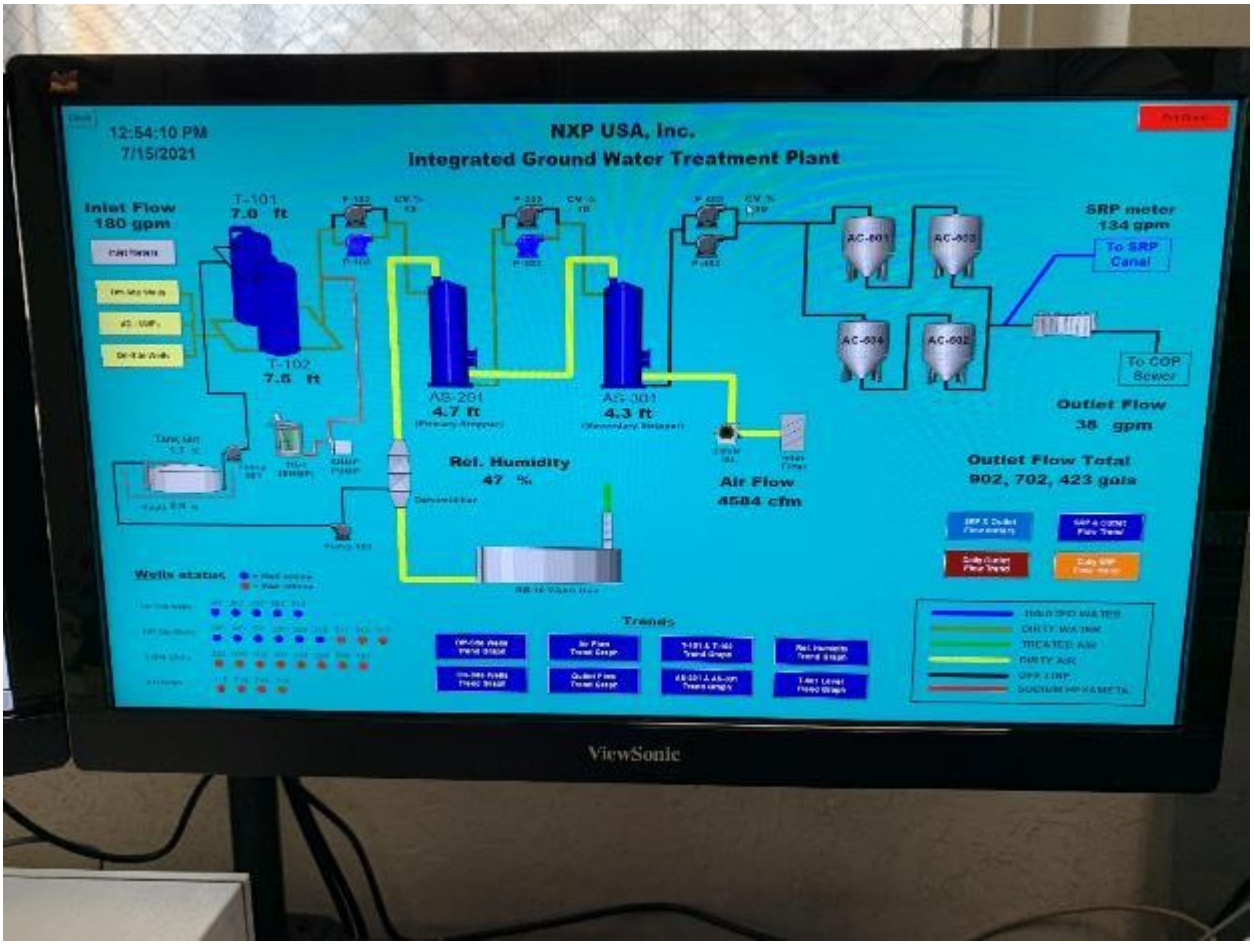


Figure 29-OU1 control console

Figure 30-OU1 PLC cabinet

Figure 31-OU1 influent piping

Figure 32-OU1 Feed storage tank

Figure 33- OU1 Air stripper towers

Figure 34- OU1 Liquid GAC vessels

Figure 35- OU1 VGAC vessel

Figure 36-OU1 Filter box for air intake

Figure 37- OU1 Scale inhibitor mixing point

Figure 38- Crosscut Canal discharge point, facing south