2016 FIVE-YEAR REVIEW REPORT FOR

MOTOROLA 52nd STREET SUPERFUND SITE

PHOENIX, MARICOPA COUNTY, ARIZONA

PREPARED BY

U.S. Army Corps of Engineers

Seattle District

FOR

U.S. Environmental Protection Agency

Region IX

Approved by:

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Date:

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Executive Summary

This is the 2016 Five-Year Review (FYR) of the Motorola 52nd Street Superfund Site (Site), located in the city of Phoenix, in Maricopa County, Arizona,. The purpose of this FYR is to review relevant information to determine if the selected interim remedies, which primarily consists of groundwater containment, extraction and treatment, is currently and will continue to be protective of human health and the environment.

The Site was placed on the U.S. Environmental Protection Agency (EPA) National Priorities List (NPL) in 1989. Investigations in the 1980s revealed contamination of groundwater with volatile organic compounds (VOCs) at the 52nd Street facility and to the west. Since that time, the Site has expanded into three Operable Units (OUs) that are principally defined geographically. Multiple regulating agencies, community representatives, and Potentially Responsible Parties (PRPs) are participating in various investigation, assessment, and remediation activities to address contamination the Site. Currently, the Arizona Department of Environmental Quality (ADEQ) is the lead agency for OU1 and OU2 groundwater, where interim remedial actions are ongoing. EPA is the lead agency for OU1 and OU2 vapor intrusion, and all activities for OU3 where a Remedial Investigation/Feasibility Study (RI/FS) is ongoing and no remedial actions have been selected at this time. The entire Site is generally defined by the extent of a trichloroethene (TCE) plume of contaminated groundwater that underlies a 7-mile stretch of a highly urbanized region in east-central Phoenix, Arizona and spans from downtown Phoenix at 7th Avenue to just east of Sky Harbor Airport around 52nd Street. The three OUs include: OU1, which is the easternmost portion of the groundwater plume; OU2, which is adjacent to the western boundary of OU1; and OU3, which is the westernmost portion of the groundwater plume, and is not included in this review. The groundwater basin in this area is not currently used for drinking water, but is a potential future drinking water source. Two interim groundwater remedies have been implemented to protect human health and the environment in order to prevent further contamination of downgradient areas that may be used in the future for drinking water purposes.

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

- 1988 ROD for OU1: Soil gas and groundwater containment of VOCs, recovery and treatment.
- 1994 ROD and 1999 ESD for OU2: Contain and extract contaminated groundwater and establish a capture zone across the entire width and depth of the TCE plume.

Groundwater contamination in both OU1 and OU2 is being remediated by extraction for the containment and removal of contamination and the subsequent treatment of contaminated groundwater by respective centralized treatment plants. Groundwater from the OU1 extraction wells is treated at the OU1 Integrated Groundwater Treatment Plant (IGWTP) and then primarily discharged by a pipeline to the Old Crosscut Canal (OCC). Treated water is be discharged to the City's sanitary sewer when discharge to the OCC is

not allowed by the Salt River Project (SRP), such as during routine canal maintenance "dry up" periods. Groundwater from the OU2 extraction wells is treated at the OU2 centralized treatment facility (the 20th Street Groundwater Treatment Facility). At OU1 and OU2, groundwater is treated to remove VOCs (primarily TCE, tetrachloroethene [PCE], 1,1,1-trichloroethane [1,1,1-TCA], and associated degradation products) from the extracted groundwater to meet the federal Maximum Contaminant Levels (MCLs).

Based on a review of the OU1 remediation, the system is generally functioning as intended by the interim remedy and groundwater extraction is largely controlling migration beyond the OU1 boundary. Decreasing concentrations in downgradient sentinel wells indicate a lateral hydraulic capture zone in the alluvial aquifer. However, contamination in the bedrock is not being completely controlled by the extraction system. The interim remedy does not include addressing contamination in the bedrock, but limited extraction of the dense non-aqueous phase liquids (DNAPL) in the bedrock is being implemented and evaluated in the ongoing RI/FS. Fully addressing the DNAPL in bedrock is expected to improve the likelihood of continued containment in the alluvium, decrease risk of future vapor intrusion issues, and shorten the time to cleanup. Evaluation of the potential for vapor intrusion was a high priority in OU1 because groundwater is encountered at a shallow depth (20 feet below ground surface [bgs]), elevated TCE concentrations in soil vapor and groundwater, and the occurrence of DNAPL in bedrock at a shallow depth. Indoor air vapor intrusion investigations have been completed, and sub-slab depressurization mitigation systems have been successfully implemented where vapor intrusion has been found. With mitigation in place, there are no known current vapor intrusion exposures in OU1. A soil gas investigation is ongoing to determine if long-term soil vapor remediation, is warranted. Operations and Maintenance (O&M) of the IGWTP has been effective, as indicated by the high level of operational uptime and the production of treated water compliant with EPA's MCLs. However, a lowering groundwater table has led to decreased extraction well flow rates, which is expected to affect the extent of plume capture over time and may result in inefficient IGWTP operation.

No other significant changes in known exposure pathways, toxicity, or other contaminant characteristics occurred during the current FYR period that would impact the protectiveness of the OU1 interim remedy. No changes in risk assessment methods occurred during the current FYR period that would impact the protectiveness of the OU1 interim remedy. No information identifying new contaminants or sources of contamination has emerged during the FYR period.

Based on the review of the OU2 remediation, the OU2 20th Street Groundwater Treatment Facility is functioning as intended by the 1994 interim ROD and the 1999 ESD. The extraction and treatment system provides hydraulic capture across the width and depth of the alluvial Salt River Gravel plume near Interstate I-10 freeway (I-10) and treats the extracted water to applicable water quality standards. The vertical containment in the Basin Fill plume at the OU2/OU3 boundary and lateral containment at the southern portion of the plume needs to be evaluated and augmented, if warranted.

The potential for exposure through the vapor intrusion pathway is a concern in OU2 although the Site conditions differ from OU1. In OU2, groundwater is encountered at deeper depths (80 feet bgs), TCE concentrations in groundwater are significantly lower than in OU1, and data does not indicate the presence of DNAPL in bedrock. VOC vapors are present in soil gas samples at OU2. During the Trace

Atmospheric Gas Analyzer (TAGA) mobile lab sampling event in February 2014, TCE was detected in the soil gas at thousands of micrograms per cubic meter ($\mu g/m^3$), and PCE was detected at hundreds of micrograms per cubic meter. This indicates the potential for migration of those vapors into nearby structures. The OU2-wide vapor intrusion (VI) investigation will begin in 2016 and VI will be included in the ongoing OU2-wide RI/FS.

No other significant changes in known exposure pathways, toxicity, or other contaminant characteristics occurred during the current FYR period that would impact the protectiveness of the OU2 interim remedy. No changes in risk assessment methods occurred during the current FYR period that would impact the protectiveness of the OU2 interim remedy. No information identifying new contaminants or sources of contamination has emerged during the FYR period.

The OU1 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, 52nd Street campus soil cleanup, and vertical containment specifically due to the presence of 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.

A protectiveness determination at the OU2 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 (GWTF), and evaluate effects of the declining groundwater table. For long-term protectiveness, OU2 is undergoing an RI/FS evaluation which will need to look at groundwater restoration and the potential for vapor intrusion as part of the final OU2 remedy.

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List of Abbreviations

ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
ARAR	applicable or relevant and appropriate requirement
ATP	Acid Treatment Plant
AWQS	Ambient Water Quality Standards
BF	Basin Fill
bgs	below ground surface
BR	Bedrock
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CO	Consent Order
COC	contaminants of concern
COPC	contaminants of potential concern
1,1-DCA	1,1-dichloroethane
1,1-DCE	dichloroethene
DNAPL	dense non-aqueous phase liquid
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
Freescale	Freescale Semiconductor, Inc.
FS	Feasibility Study
FYR	Five-Year Review
GAC	granular activated carbon
gpm	gallons per minute
GWTF	Groundwater Treatment Facility
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HHSLs	human health screening levels
Honeywell	Honeywell International
HSU	hydrostratigraphic unit
I-10	Interstate 10
IGWTP	Integrated Groundwater Treatment Plant
LAU	Lower Alluvial Unit
LOD	Letter of Determination
MAU	Middle Alluvial Unit
MCL	Maximum Contaminant Level
µg/m^3	micrograms per cubic meter
µg/L	micrograms per liter
mg/L	milligrams per liter
NCP	National Contingency Plan

NPL	National Priorities List
NXP	successor company to Freescale
O&M	operation and maintenance
OCC	Old Crosscut Canal
OU	operable unit
PCE	tetrachloroethene
PQGWWP	Poor Quality Groundwater Withdraw Permit
PRP	Potentially Responsible Party
PTP	Pilot Treatment Plant
RAA	Remedial Alternatives Analysis
RAO	Remedial Action Objectives
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Responsible Party
RSL	Regional Screening Level
SGHHSLs	Soil Gas Human Health Screening Levels
Site	Motorola 52nd Street Superfund Site
SRG	Salt River Gravel
SRP	Salt River Project
SVE	soil vapor extraction
SWPL	Southwest Parking Lot
TBC	To-Be-Considered
1,1,1-TCA	trichloroethane
TCE	trichloroethene
TAGA	Trace Atmospheric Gas Analyzer
UAO	Unilateral Administrative Order
UAU	Upper Alluvial Unit
UU/UE	unlimited use/unrestricted exposure
UV	ultraviolet
VC	vinyl chloride
VI	vapor intrusion
VOC	volatile organic compound
WSRV	West Salt River Valley

1. Introduction

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

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

This is the seventh FYR for the Motorola 52nd Street Superfund Site (Site). Six prior FYRs were completed as several FYRs were conducted for individual Operable Units (OU): three for OU1 only, two for OU2 only, and the 2011 FYR combined OU1 and OU2 in one report. The triggering action for this policy review is the completion date of the previous FYR in September 2011. The FYR has been prepared since hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of three OUs; two of which are addressed in this FYR. OU1 is the easternmost operable unit and includes the former Motorola 52nd Street electronics manufacturing facility (Motorola facility). OU2 is adjacent to the western boundary of OU1 and the eastern boundary of OU3 and includes the Honeywell 34th Street manufacturing facility and other facilities. OU3 is the westernmost OU and includes the Arizona Public Service facility and other facilities. OU3 is in the RI/FS phase and does not yet have a ROD; therefore it is not evaluated in this FYR.

The Motorola 52nd Street Superfund Site FYR was led by the EPA. Participants included EPA, Arizona Department of Environmental Quality (ADEQ), Army Corps of Engineers, Motorola, Honeywell, and contractors representing the Potentially Responsible Parties (PRPs). The review began at a project kickoff meeting on 10/28/2015.

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
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: Arizona Department of Environmental Quality		
Author name: Rachel Loftin, Remedial Project Manager		
Author affiliation: U.S. Environmental Protection Agency		
Review period: 10/28/2015 - 9/28/2016		
Date of site inspection: 2/10/2016		
Type of review: Policy		
Review number: 7 including prior FYRs completed: 3 OU1-only, 2 OU2-only, 2011 Sitewide FYR combined OU1 and OU2.		
Triggering action date: 9/28/2011		
Due date *(five years after triggering action date)*: 9/28/2016		

1.1. Background

The Motorola 52nd Street Superfund Site is located in the city of Phoenix, in Maricopa County, Arizona. Motorola Semiconductor Products Sector (Motorola) owned and operated the 52nd Street facility (referred to as Motorola in this report; Motorola's successor party responsible for site cleanup is now NXP) from 1956 to 1999. As part of its electronics manufacturing operation, Motorola used solvents, including volatile organic compounds (VOCs) such as trichloroethene (TCE), tetrachloroethene (PCE), and 1,1,1-trichloroethane (1,1,1-TCA) to clean and degrease parts and equipment. Investigations in the 1980s revealed groundwater contamination at the 52nd Street Facility and to the west. In 1989, the Site was added to the Superfund National Priorities List (NPL).

1.2. Physical Characteristics

The Site is generally defined by the extent of contaminated groundwater that underlies a 7-mile stretch of a highly urbanized region in east-central Phoenix, Arizona, and spans from downtown Phoenix at 7th Avenue to just east of Sky Harbor Airport around 52nd Street. Figure 1 presents the boundaries of the three Site OUs, developed to designate study areas where remedial investigation and/or response activities are occurring. 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 52nd Street 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 OU1 and the eastern boundary of OU3. It is primarily located south of State Route 202 and north of Sky Harbor Airport. OU2 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.

Groundwater extracted from the Site is not used as a source of public drinking water. The city of Phoenix provides potable water (sourced from supplies outside the Site) to area residents. There are currently two known water supply wells located within the Site that are not associated with the cleanup. These are the privately owned Morgan Well 4626G, which is used for domestic, non-potable purposes, and Salt River Project (SRP) Well 18E-5N, an irrigation supply well that discharges into the Grand Canal. Both wells

operate on an intermittent basis in response to demand. As was the case in 2011, the only known use of groundwater at OU1 is for landscaping by a private owner, and this has remained unchanged since the time the 1988 Letter of Determination (LOD) by ADEQ and the interim ROD were prepared.

Land use at the Site has not significantly changed since contamination was first discovered at the former Motorola 52nd Street Facility in 1982. Land use is comprised of a mixture of residential, commercial, and industrial uses. OU1, which contains the former Motorola 52nd Street Facility, is located immediately adjacent to residential properties to the west, commercial property to the north, the Arizona National Guard facility (Papago Park Military Reservation) and Papago Park to the east, and industrial property to the south. OU2 generally consists of industrial and commercial property surrounding Sky Harbor Airport, including the Honeywell 34th Street Facility, the ITT Cannon property and D-Velco property, and various industrial, commercial, and residential properties to the north of the airport. The Arizona State Hospital and State Correctional Facility are located north of the airport at the corner of Roosevelt and 24th Streets. OU3 includes a fairly mixed use region in the western portion of the OU and the downtown Phoenix area where major attractions such as Chase Field, the US Airways Center, and the Arizona Center are located. Industrial facilities are predominantly situated in the southern portion of OU3.

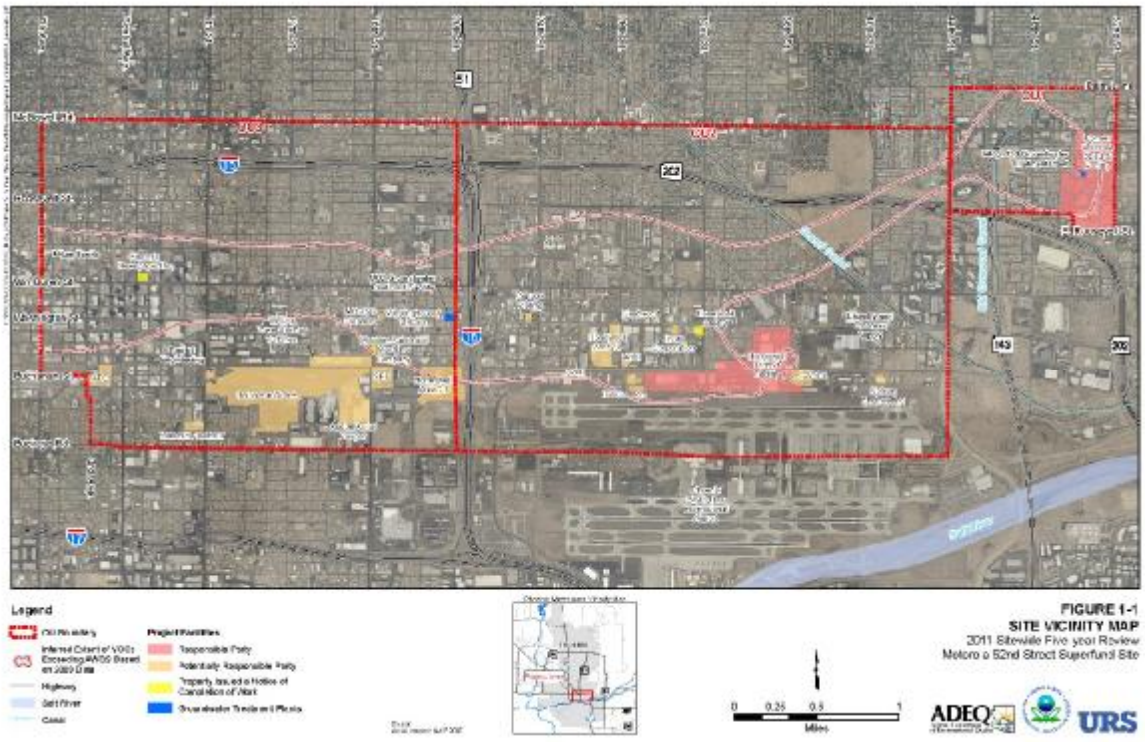


Figure 1. Detailed Map of the Motorola 52nd Street Superfund Site

1.3. Local Surface Water Setting

The Salt River is a dominant surface water feature in the vicinity of the Site and is located approximately one to two miles south of the Motorola 52nd Street Superfund Site OU boundaries (see Figures 2 and 3 for features at OU-1 and OU-2, respectively). The Salt River flows on an intermittent basis in response to significant rainfall events and/or releases from upstream dams. The direction of 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 the Site:

- The Old Crosscut Canal (OCC) is located in OU1 between 44th and 46th Street (adjacent to State Route 143) and connects the Grand Canal to the Arizona Canal. It 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 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.

These canals serve as regional reference locations and receive treated water from the remedies selected for the Site.

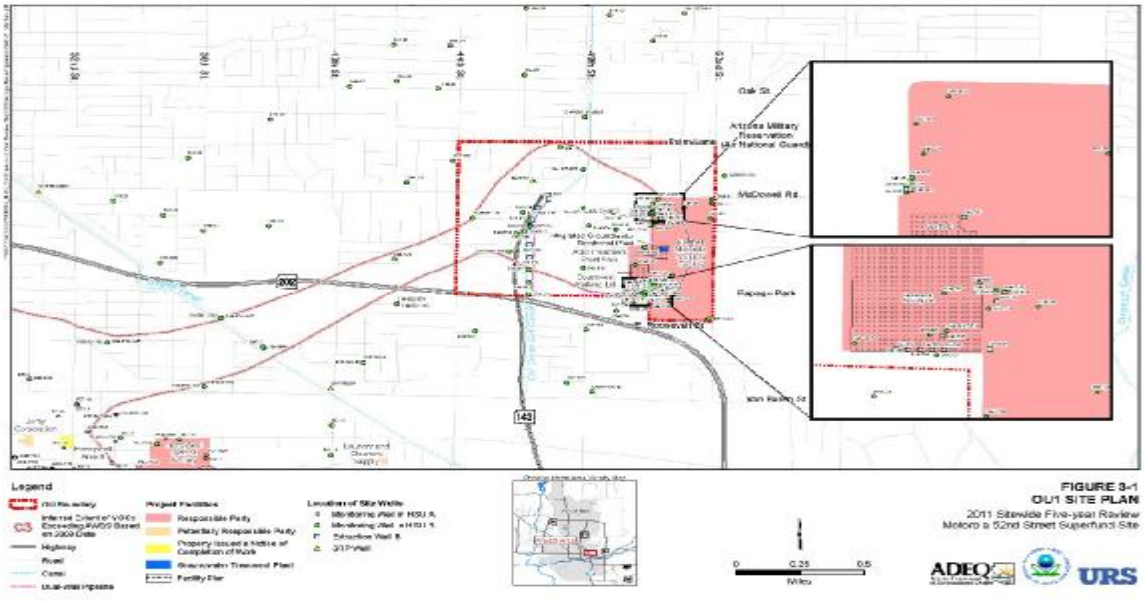


Figure 2. Shows the location of surface water features at OU-1

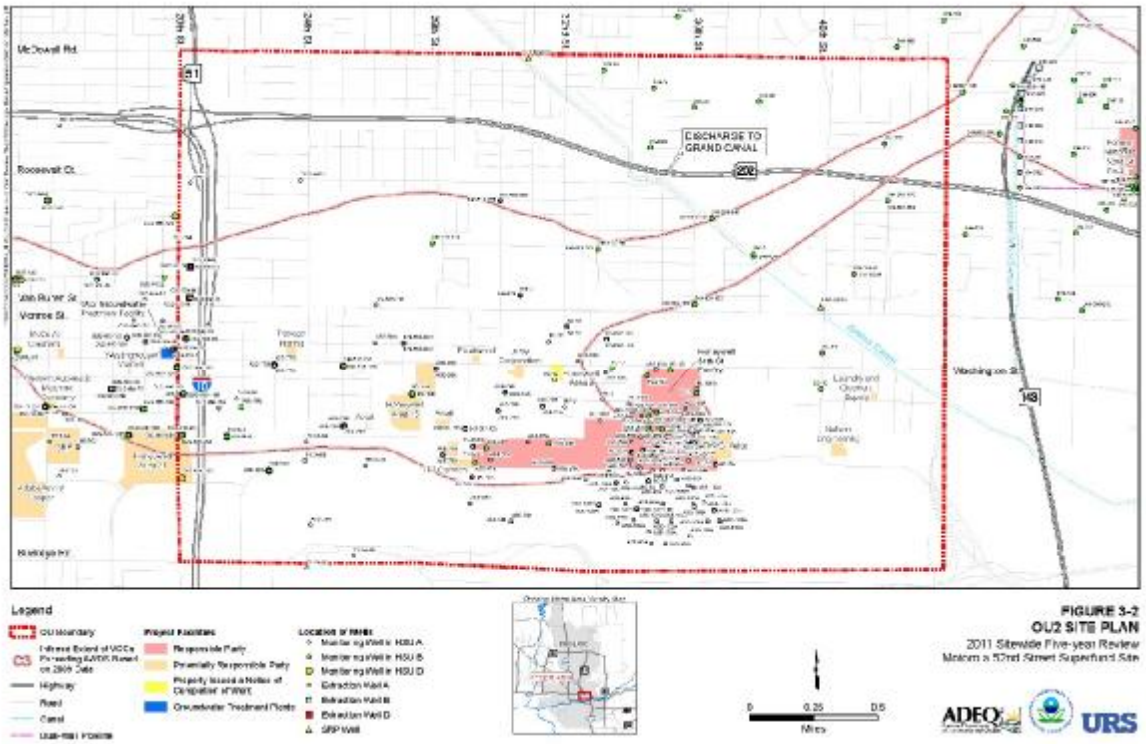


Figure 3. Shows the location of surface water features at OU-2

1.4. Geology/Hydrology

Groundwater at the Motorola 52nd Street Superfund Site occurs within the unconsolidated sedimentary deposits and underlying bedrock of the West Salt River Valley (WSRV) 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 (LAU), Middle Alluvial Unit (MAU), and Upper Alluvial Unit (UAU). The UAU near the eastern boundary of the WSRV is the primary focus of the Motorola 52nd Street Superfund Site contaminant investigation and is comprised of the following Motorola 52nd Street Superfund Site hydrostratigraphic units (HSUs):

- ***Salt River Gravels.*** This HSU represents 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 Salt River Gravels are not present in OU1, and present in central and western OU2 and OU3. They are also referred to as HSU A or the Shallow Zone (S) HSU.

- ***Upper Basin Fill.*** This HSU includes interbedded coarse and fine-grained deposits with gravels that are similar to the Salt River Gravels. The Upper Basin Fill is present in all three OUs and is also referred to as HSU B or the Intermediate Zone (M) HSU. Some site reports further define two portions of Upper Basin Fill that are referred to as the First and Second Intermediate Zones. These zones are separated by a fine-grained layer at the base of the First Intermediate Zone.

- ***Lower Basin Fill.*** This HSU is relatively more consolidated than either HSU A or B and includes a fine-grained layer underlain by interbedded fines (silt) and sand. The Lower Basin Fill is not present in OU1, and present in OU2 and OU3. It is also referred to as HSU D or the Deep Zone (D) HSU.

For purposes of the following discussion, the upper and lower Basin Fill HSU will not be segregated and will be referred to collectively as Basin Fill.

A fourth Motorola 52nd Street Superfund Site HSU (HSU C) is the underlying bedrock, consisting of Precambrian (Proterozoic) metarhyolite and granite, as well as Tertiary volcanics and indurated sediments. The bedrock was included as a HSU because groundwater contamination is known to move between the alluvium and fractured bedrock where present (predominantly in OU1). The dissolved groundwater contaminants are predominantly transported across the Site within the Basin Fill and Salt River Gravels HSUs. Figure 4 shows a schematic cross-section of the HSUs throughout the Site.

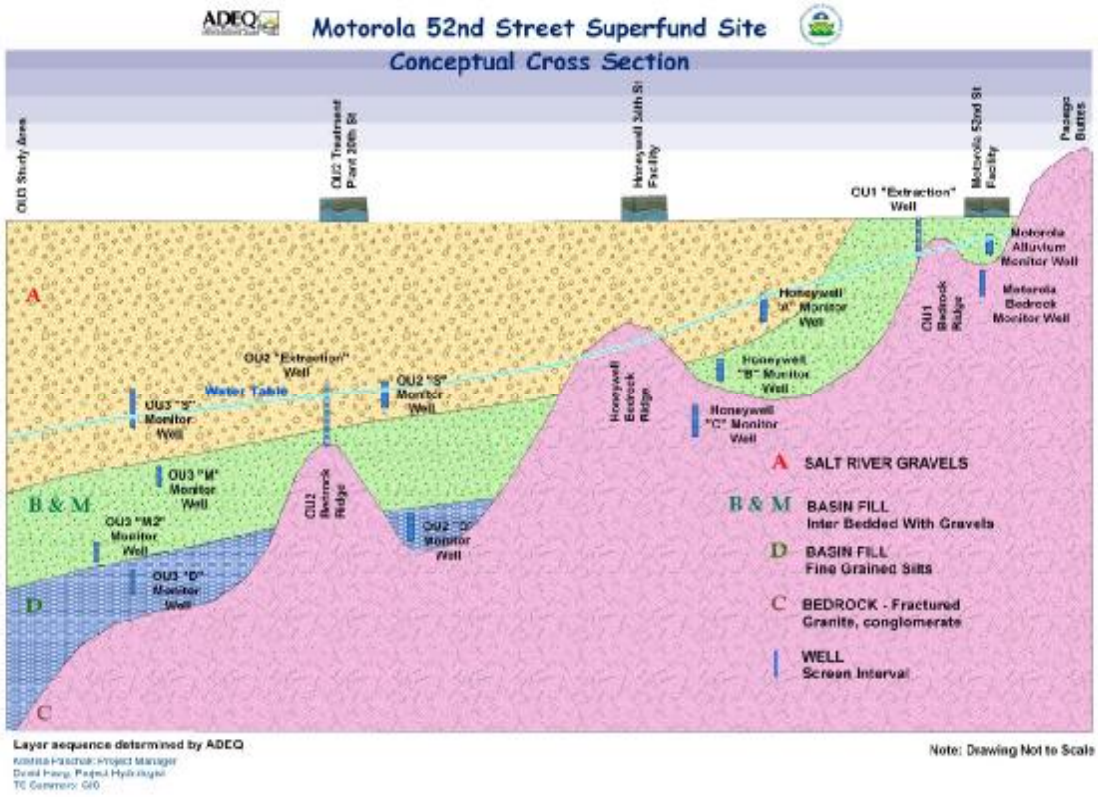


Figure 4. Shows schematic cross-section of the HSUs and bedrock ridges

In the OU1 area, the thickness of Basin Fill varies from less than 20 feet at the former Motorola 52nd Street facility to approximately 150 feet to the west of the facility at about 40th Street. The Basin Fill is unconfined and groundwater was encountered at depths between approximately 25 and 75 feet below ground surface (bgs) across OU1 in 2015 (Clear Creek Associates, 2015[1]). The hydraulic conductivity of the Basin Fill in the OU1 area 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 52nd Street facility and off-site in the vicinity of the Old Crosscut Canal. Groundwater flow in the Basin Fill is also influenced by the presence of lower permeability bedrock ridges that penetrate the Basin Fill. Hydraulic conductivity in the bedrock is strongly influenced by the presence, frequency and interconnectedness of open fractures. Fracture densities measured in rock core samples from boreholes within the OU1 area 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 the OU2 area from the vicinity of North 34th Street to the eastern boundary, the Basin Fill is the shallowest HSU. 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 Salt River Gravels HSU is encountered west of North 34th Street and thickens toward the west. At the western OU2 boundary, the Salt River Gravels are up to 145 feet thick, with the underlying Basin Fill ranging from 80 to 95 feet thick. Depths to groundwater in the Salt River Gravels HSU ranged from about 80 feet in central OU2 to about 102 feet at the western boundary in 2015 (GHD Services, Inc., 2015[2]). The groundwater flow direction is impacted locally 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 Salt River Gravels ranges from around 200 to 450 feet/day (Honeywell, 2005[3]). Two bedrock rises are found in OU2, including the Honeywell Bedrock Ridge and the OU2 Bedrock Ridge, that penetrate through the Basin Fill and the saturated portion of the Salt River Gravels and intercept and divert groundwater flow in both HSUs.

Groundwater recharge to the Basin Fill and Salt River Gravels HSUs 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 water levels and flow directions in the immediate vicinity of the river (i.e., near the Honeywell 34th Street Facility in OU2).

[1] OU1 Effectiveness Report 2015
[2] OU2 September to November 2015 Groundwater Monitoring Report
[3] Final Focused Remedial Investigation Report, December 2005

2. Remedial Actions Summary

2.1. Basis for Taking Action

Contaminants found in groundwater, soil, and soil gas at the Motorola 52nd Street Superfund Site include TCE, 1,1,1-TCA, 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), and PCE. These contaminants have been detected in groundwater within OU1 and OU2 and over 3 miles west of the Motorola 52nd Street Facility at levels greater than their respective EPA maximum contaminant levels (MCLs). The groundwater basin in this area is not used for drinking water, but is a potential future drinking water source.

2.2. Remedy Selection

2.2.1. OU1 Interim Remedy Selection

The OU1 ROD, issued by the EPA in September 1988, accompanied by ADEQ's 1988 Letter of Determination (LOD), serve as EPA 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 VOCs in alluvium groundwater at the OCC at 46th Street and at the Courtyard/50th Street area, and 2) treat the extracted groundwater to a level which will meet State/Federal standards for the specific uses of the water and water use restrictions. The interim remedy also requires soil/soil gas evaluation and soil gas remediation at the former Motorola 52nd Street Plant source areas: Acid Treatment Plant (ATP), Courtyard, and Southwest Parking Lot (SWPL). Although not explicitly stated as remedial action objectives (RAOs), the actions selected in the OU1 LOD are intended only as a partial solution for the cleanup of contamination at the Site.

The major components of the OU1 interim remedy selected in the LOD and ROD include the following:

- Containment, extraction and treatment of groundwater from the Courtyard/50th Street area at the Motorola 52nd Street Facility.
- Extraction and treatment of vapor phase organic contaminants from soils at the Courtyard/50th Street, ATP and SWPL areas of the Site.
- Extraction of groundwater designed to contain contaminant migration in alluvium groundwater (east of) at the OCC.
- Treatment at the former Motorola 52nd Street plant property of groundwater extracted from the OCC containment system.
- Use of all treated groundwater at the former Motorola 52nd Street plant to replace water purchased from the city of Phoenix.

The total groundwater extraction and treatment flow rate identified in the LOD was approximately 810 gallons per minute (gpm). The OU1 interim remedy did not select restoration of the aquifer as a remedial action objective; however, the LOD explained that compliance with an aquifer restoration applicable or relevant and appropriate requirement (ARAR) would be revisited in the final ROD. The remedy was designed to meet the substantive requirements of applicable permits.

2.2.2. OU2 Interim Remedy Selection

In July 1994, EPA and ADEQ issued a ROD selecting the interim groundwater remedy for OU2. The purpose of the OU2 interim remedy is to provide additional containment of contaminated portions of the groundwater downgradient of OU1. The OU2 interim remedy is intended to be a partial remedy, and a final remedy for OU2 was anticipated to be selected within five years of the selection of the OU2 interim remedy.

The OU2 ROD identified the following RAOs:

- 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 additional control of the contaminant plume. The OU2 ROD specifies that groundwater be treated to levels at or below MCLs.

In September 1999, EPA and ADEQ issued 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 RAOs for the OU2 interim remedy as modified by the 1999 ESD include the following:

- Extraction of groundwater designed 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 (UV) oxidation for vinyl chloride, and discharge of treated water to the SRP Grand Canal.

2.3. Remedy Implementation

2.3.1. OU1 Interim Remedy Implementation

On June 20, 1989, Motorola signed a Consent Order (CO) with ADEQ to implement the interim groundwater and soil remedy for OU1. Motorola (formerly Freescale now NXP) was identified as a responsible party. In accordance with the CO, Motorola is required to implement the OU1 LOD and ROD, specifically to contain and control alluvial groundwater migration, reduce the concentrations of contaminants in the groundwater, and implement soil vapor extraction at the former Motorola 52nd Street plant source areas.

2.3.1.1 Description of OU1 Groundwater Remedy

From 1984 to 1986, Motorola installed a Pilot Treatment Plant (PTP) at the former Motorola 52nd Street Facility to treat extracted groundwater from the Courtyard source area via air stripping. Motorola operated the PTP from September 1986 through July 1992, when the Integrated Ground Water Treatment Plant (IGWTP) began operating on the Facility property. The IGWTP interim remedy includes: 1) installing extraction wells along the eastern bank of the OCC to contain migration of contamination downgradient of the facility; 2) constructing a pipeline to convey groundwater from the OCC extraction wells to the new IGWTP; 3) constructing a pipeline to convey groundwater from the Courtyard area wells to the IGWTP; and 4) treating groundwater at the IGWTP via air stripping, polishing with liquid-phase granular active carbon (GAC) and treating the off-gas with vapor-phase GAC.

All OU1 groundwater extraction wells were completed at the bedrock/alluvium interface. As of 2015, the treated groundwater is discharged at the OCC and used for irrigation purposes.

Dense non-aqueous phase liquid (DNAPL) is recovered on a weekly to biweekly basis by bailing and/or pumping a DNAPL 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 (PQGWWP) issued by the ADWR, which requires quarterly water level monitoring and annual sampling of extraction wells with semi-annual reporting. There currently is no air permit for OU1 treatment operations, but the operations meet substantive requirements of Maricopa County's air permit for emissions.

2.3.1.2 Description of OU 1 Soil Remedy

According to the OU1 ROD and LOD, three source areas on the former Motorola 52nd Street plant campus (Courtyard, ATP, SWPL) were to be addressed via 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 2 years after the pilot test was completed showed 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 VOC mass. ADEQ denied Motorola's request, based on the success of the pilot test and the fact that the pilot system did not meet the requirement of the CO. 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 area has occurred to date. EPA, ADEQ, and NXP (formerly Motorola, then Freescale) are conducting a soil gas investigation of ATP soils as part of the ongoing final RI/FS and facility soil gas and vapor intrusion to indoor air evaluation activities.

- 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 VOC contamination in the SWPL area. A full-scale SVE system that operated from November 1996 through April 1997 was designed to produce an effective radius of influence from 30 to 40 feet. The air-sparging system was designed to produce an effective radius of approximately 90 feet. In 2002, ADEQ determined that the soil cleanup in the SWPL Area required in the LOD was complete. This area is also being evaluated as part of the ongoing soil gas and vapor intrusion to indoor air evaluation.

2.3.2. OU2 Interim Remedy Implementation

In October 1996, ADEQ entered into a Consent Decree with Motorola (now NXP) and the City of Phoenix for the design of the 20th Street Groundwater Treatment Facility (GWTF). In 1998, EPA issued a Unilateral Administrative Order (UAO) to Motorola and Honeywell (OU2 Companies) for construction, start up, and two years of Operations and Maintenance (O&M) of the 20th Street GWTF. EPA issued an amended UAO in 2003 requiring continued O&M of the OU2 interim remedy. In 2010, when Honeywell, Freescale (OU2 Companies) and other parties entered into a CD with ADEQ for continued operation of the OU2 interim remedy, EPA terminated its 2003 UAO.

2.3.2.1 Description of OU2 Groundwater Remedy

Construction of the 20th Street GWTF began in March 2000 and was completed in September 2001. The treatment system became fully operational on December 31, 2001.

Three groundwater extraction wells located along 20th Street supply groundwater to the 20th Street GWTF. The extraction wells are designed to provide hydraulic containment east of I-10. There are also 59 monitoring wells that constitute the OU2 treatment system monitoring network. The 20th Street GWTF is designed to treat approximately 5,300 gallons per minute (gpm). In 2015, the treatment system was operated at approximately 1,354 gpm due to the ongoing dewatering of the alluvium.

The 20th Street GWTF consists of:

- 18 GAC vessels (water pumped directly through the vessels without exposure to air in an equalization tank)
- 3 groundwater extraction wells
- UV oxidation system

Groundwater from the extraction wells is pumped to the treatment plant and through four pairs of GAC vessels connected in series. The UV 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.

Occasional slow flow back-flushing of the GAC 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 GAC is returned to the supplier for regeneration and then is returned to the treatment plant.

Pumps used in the OU2 extraction network include two line-shaft vertical turbine pumps and one submersible pump (in EW-S). Extracted groundwater is conveyed to the treatment plant in a 16- to 24-inch diameter (depending on location), thermally welded, high density polyethylene subgrade piping network.

2.4. Operation and Maintenance (O&M)

This section presents O&M information for the OU1 IGWTP and the 20th Street GWTF in OU2. The Courtyard SVE and SWPL SVE systems for OU1 remained shut down during the current FYR period.

2.4.1. O&M Manual

Motorola last updated the OU1 O&M Manual for the IGWTP in May 2014. The O&M Manual consists of basic system design criteria, operation and maintenance requirements of major system components, and monitoring and reporting requirements. The groundwater monitoring program was optimized and updated in 2014 along with the O&M Manual. The manual also establishes site-specific health and safety requirements necessary for safe and efficient operation of the groundwater treatment system. The O&M Manual is intended to be used in conjunction with the OU1 Health and Safety/Emergency Response Plan (HASP). The OU1 HASP is revised as needed to reflect changes in equipment, operations, and procedures, or as additional projects are implemented. The vapor intrusion O&M Manual is planned for an update in 2016.

Daily maintenance activities at OU2 are performed in accordance with the updated 2011 Revised Final Operation and Maintenance Manual, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona. Pertinent sections of the O&M Manual are updated as needed, with the most recent update made to Section 7.4.2 in April 2014. The monitoring plan is also outlined in the revised O&M Manual; groundwater quality monitoring is performed semiannually (March and September) for the process sampling at the three extraction wells. However, a subset of wells are

monitored on a quarterly basis as described in the Effectiveness Reports for the hydraulic (water level) measurements.

2.4.2. Operational Issues

OU1 groundwater treatment has been relatively continuous since 1992 when the IGWTP started operation. Air stripper off-gas was recirculated as a closed loop system prior to replacement of the vapor phase GAC treatment vessels in 2003. After installation of the "roll-off" type of GAC unit, process operations were reconfigured to discharge the air stripper off-gas after treatment. This process change resulted in the generation of scale in the air strippers, which has since required batch treatment with acid. Scale is currently controlled with the addition of sodium hexametaphosphate as a chemical amendment. The groundwater extraction and treatment system is aging and will require diligent inspection and maintenance to keep the system running and minimizing shutdowns. An additional issue is that selected monitoring wells require redevelopment because of screen clogging.

For OU1 and OU2, the decreasing water table causes lower flow rates in the extraction wells due to decreased saturated thickness in the wells, which eventually may decrease the capture zone.

For OU2, the decreasing groundwater table has required complex monitoring and adjustment of the extraction and treatment system. Over this FYR period, two extraction wells (EWN and EWS) were modified with a variable drive frequency pump to allow a water level transducer in the extraction well to manage the groundwater flow in response to the groundwater table. This alteration requires less effort by the operator than throttling the fixed rate pump in individual extraction wells to ensure maximum groundwater extraction rates while avoiding air entrainment issues. This change maintains a safe operational water level in the extraction well and maximizes groundwater capture. Based on this improvement to the operations of the extraction wells, a variable drive frequency pump should be installed in the remaining extraction well, EWM.

A boron mixing zone was established for the OU2 groundwater plume during this FYR period. This and the annual dry-up period for the SRP Grand Canal (treated effluent discharge point) also influence OU2 treatment system operations.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statements from the 2011 FYR for the Motorola 52nd Street Superfund Site stated the following:

2011 OU1 Protectiveness Statement:

> *A protectiveness determination of the interim remedy at Motorola 52nd Street Superfund Site OU1 cannot be made until further information is obtained. Further information will be obtained by completing a soil gas and vapor intrusion to indoor air investigation on the former Motorola facility. It is expected that this investigation will be completed no later than the next FYR. When the investigation is complete, a protectiveness determination will be made. This FYR also identified other issues that may affect long term protectiveness: the presence of DNAPL in the bedrock at the Motorola facility; the need fora new beneficial end-use for groundwater treated at the IGWTP; declining groundwater levels that may affect extraction rates; and the age and condition of IGWTP equipment, which may lead to future operational issues.*
>
> *A number of issues were identified during the FYR that may affect whether the OU1 interim remedy is protective in the long-term. To address issues with the potential to affect long-term protection, the following actions need to be taken:*
>
> - *Continue review and investigation of approaches to mitigate the DNAPL present in bedrock at and near the Motorola facility.*
> - *Select a demonstrated beneficial end use for groundwater treated at the IGWTP and issue a decision document modifying the end use defined in the ROD/LOD.*
> - *Where increased groundwater extraction could potentially promote increased containment of contamination, take measures to increase groundwater extraction.*
> - *Conduct an engineering review of IGWTP operations to improve efficiency and better document operations.*

2011 OU2 Protectiveness Statement:

> *A protectiveness determination of the interim remedy at the Site OU2 cannot be made until further information is obtained. Further information will be obtained by completing a soil gas and vapor intrusion to indoor air investigation within the OU2 area. It is expected that this investigation will be completed no later than the next FYR. When the investigation is complete, a protectiveness determination will be made. The interim remedy provides hydraulic containment across the width and depth of the VOC plume in groundwater near I-10. However, because of the*

potential for the plume to migrate west and outside the current capture zone, a long-term protectiveness statement cannot be made.

The 2011 FYR included six issues and recommendations for OU1 and two issues and recommendations for OU2. Each recommendation and the current status is discussed below.

Table 2: Status of Recommendations from the 2011 FYR

OU #	Previous FYR Issue #	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1	1	Investigate approaches to mitigate the DNAPL present in bedrock.	Ongoing	DNAPL is currently extracted from one well. DNAPL in bedrock will be addressed in the RI/FS.	n/a
1	2	Implement a final beneficial end-use for IGWTP and modify decision document.	Ongoing	Implemented in 2015 with an interim end-use comprised of discharge to the Old Crosscut Canal. This will be evaluated as a potential final end-use in the current RI/FS.	n/a
1	3	Increase groundwater extraction to promote containment.	Ongoing	Performance optimization will be evaluated and addressed in the RI/FS.	n/a
1	4	Conduct an engineering review of IGWTP operations.	Ongoing	Will be addressed in the RI/FS.	n/a
1	5	Conduct additional studies/investigations regarding soil cleanup activities.	Ongoing	Will be addressed in the RI/FS.	n/a
1	6	Evaluate VI studies/ investigations.	Completed	Residential VI was completed and reports with data are on the M52 website. Final report is being prepared. The facility VI sampling was conducted Dec 2015 to August 2016. The April 20, 2016 presentation with data is posted on the M52 website. Aug 2016 sampling confirms vapor intrusion is not occurring The facility VI report is being written.	Aug 2016
2	1	Develop workplan to address contaminants southeast of the 20th Street GWTF.	Ongoing	More groundwater wells were installed. Additional well installations are planned.	n/a
2	2	Develop approach to evaluate VI pathway for OU2 area	Completed	OU2-wide VI Administrative Order on Consent and Scope of Work was finalized May 2016; the VI work will begin in 2016.	May 2016

Work Completed at the Site During this Five Year Review Period

The following tables summarize the work that has been completed at OU1 and OU2 since the 2011 FYR.

Table 3: Summary of Work at OU1 since the 2011 FYR

Event	Date
2011	
ON-Semiconductor ended manufacturing at the former Motorola 52nd Street facility and could no longer accept the OU1 treated water. OU1 began discharging treated groundwater to the City of Phoenix sanitary sewer system under a Class A Wastewater Permit.	November 1, 2011
Freescale submitted Validated Indoor Air and Sub-Slab Data for July 2011 Sampling Event to EPA.	November 22, 2011
ADEQ approved Freescale's request to discharge remediated water to OCC for the interim discharge.	December 14, 2011
2012	
Freescale submitted Validated Indoor Air and Sub-Slab Data for October 2011 Sampling Event to EPA.	February 2, 2012
Freescale submitted the 2011 Operations OU1 Effectiveness Report to ADEQ and EPA.	March 2012
Freescale submitted Addendum to Vapor Intrusion Mitigation Work Plan.	March 23, 2012
Freescale submitted Addendum to "Freescale Semiconductor Sub-Slab & Indoor Air Sampling Work Plan of Residential Structures Neighboring the Former Motorola 52nd St. Facility" dated August 11, 2011.	April 2, 2012
Freescale submitted Indoor Air, Sub-Slab and Outdoor Air Data for July 2011 through February 2012 Sampling Events to EPA.	May 17, 2012
Freescale submitted Revised Final Soil Gas Sampling Report, Soil Gas Sampling Investigation to EPA.	June 4, 2012
Freescale submitted a Technical Memorandum – Evaluation of DM312 and DM313 Groundwater Sampling, Motorola 52nd Street Superfund Site, Operable Unit 1 Area.	July 2, 2012
EPA and Freescale entered into an Amendment to the Administrative Order on Consent (CERCLA Docket No. 2010-06, Soil Gas and Vapor Intrusion to Indoor Air Evaluation Motorola 52nd Street Superfund site, Operable Unit 1) to mitigate certain residential and commercial buildings in the off-facility areas of former Motorola 52nd Street Facility.	September 19, 2012
2013	
Technical Memorandum - Plan for Semi-Volatile Organic Compounds Screening, Operable Unit 1 Area, Motorola 52nd Street Superfund Site. Provided to Wayne Miller, ADEQ and EPA.	February 22, 2013
Freescale submitted Residential Vapor Intrusion Mitigation Work Plan to EPA.	March 18, 2013
Freescale submitted the 2012 Operations OU1 Effectiveness Report to ADEQ and EPA.	March 2013
Freescale submitted Indoor Air, Sub-Slab and Outdoor Air Data for July 2011 through February 2013 Sampling Events to EPA.	April 24, 2013
Freescale submitted final Monitor Well Installation Work Plan to ADEQ and EPA.	August 2013
Freescale submitted Residential Vapor Intrusion Mitigation System Operations and Maintenance Plan for the OU1 area to EPA.	August 20, 2013
2014	
Freescale submitted Boron Mixing Zone Request for Grand Canal, Motorola 52nd Street Superfund Site OU1 Integrated Groundwater Treatment Plant Facility to ADEQ.	January 13, 2014
EPA conducted soil gas and indoor air sampling at selected locations and structures in OU1 using mobile Trace Atmospheric Gas Analyzer equipment.	February 2014

Event	Date
Freescale submitted a letter regarding estimated timeline with Explanations and Assumptions with estimated timeline to complete a final RI/FS to ADEQ and EPA.	February 18, 2014
Freescale submitted Draft Final Remedial Investigation Work Plan to ADEQ and EPA.	March 2014
Freescale submitted the 2013 Operations OU1 Effectiveness Report to ADEQ and EPA.	March 2014
ADEQ approved Boron Mixing Zone for OU1 Discharge to Grand Canal.	July 3, 2014
Freescale submitted Well Installation Report, 52nd Street Superfund Site OU1 to ADEQ and EPA.	August 2014
Freescale submitted letter explaining Groundwater monitoring program modifications, Sampling and Analysis Plan to ADEQ and EPA.	November 12, 2014 - ADEQ final approval date March 23, 2015
Freescale submitted DRAFT Sampling and Analysis Plan (SAP), Groundwater and Soil Vapor Monitoring Plan to ADEQ and EPA.	November 2014; final submitted March 2015
Freescale submitted a revised letter regarding estimated timeline with Explanations and Assumptions with estimated timeline to complete a final RI/FS to ADEQ and EPA.	November 24, 2014
2015	
Freescale submitted final approved Conveyance Pipeline Construction Work Plan for remediated water discharge pipeline from 52nd Street Facility OU1 Integrated Groundwater Treatment Plant (IGWTP) to the Old Crosscut Canal (OCC) to ADEQ and EPA.	February 2015
ADEQ conditional approval of the Response to Comments to the SAP, QAPP, and Groundwater and Soil Vapor Monitoring Workplan dated February 26, 2015.	March 23, 2015
Freescale submitted final approved Sampling and Analysis Plan, Groundwater and Soil Vapor Monitoring Plan, Motorola 52nd Street Superfund Site OU1.	March 2015
Freescale submitted the 2014 Operations OU1 Effectiveness Report to ADEQ and EPA.	March 2015
EPA and Freescale entered into a Second Amendment to the Administrative Order on Consent to conduct a vapor intrusion investigation at the former Motorola 52nd Street facility.	May 5, 2015
Freescale submitted Final Remedial Investigation Work Plan to ADEQ and EPA.	September 2015
EPA issued a Letter of Determination of Completion of the Residential Soil Vapor to Indoor Air Investigation and Mitigation.	October 15, 2015
ADEQ issues letter of agency approval to Freescale for Final Remedial Investigation Work Plan submitted November 4, 2015.	November 24, 2015
Freescale submitted DRAFT - Residential Vapor Intrusion to Indoor Air Evaluation Report to EPA.	December 7, 2015
Freescale completed construction of remediated water discharge pipeline and began discharging to the OCC. Discharge is sent to City of Phoenix under the Industrial Discharge Permit when the OCC cannot accept the water (e.g. during canal maintenance over capacity, emergency situations).	December 2015
EPA letter approving the Industrial Vapor Intrusion to Indoor Air Evaluation Work Plan, Former Motorola 52nd Street Facility Property (October 2015).	December 8, 2015
2016	
Freescale submitted Conveyance Pipeline Construction Report.	January 6, 2016
Freescale submitted Building Inventory Report, Former Motorola, Inc. 52nd Street Facility.	January 2016
Freescale submitted the 2015 Operations OU1 Effectiveness Report to ADEQ and EPA.	March 2016
Freescale submits Well Installation Report, Motorola 52nd Street Superfund Site OU1 Area.	June 2016
Freescale submits Validated Indoor Air Data Reports for 52nd St Campus July-Aug sampling.	August 2016

Table 4: Summary of Work at OU2 since the 2011 FYR

Event	Date
2011	
OU2 Companies submitted the Revisions to the Revised Hydrostratigraphic Unit Designations.	October 18, 2011
EPA/ADEQ/URS issue the M52 Five Year Review Report signed 9/30/11.	October 24, 2011
OU2 Companies submitted the Revised 2010 Effectiveness Report for OU2.	January 3, 2012
2012	
OU2 Companies submitted Comments on the September 2011 ADEQ/EPA Five-Year Review Report.	April 24, 2012
OU2 Companies submitted the Revised 2011 Effectiveness Report for OU2.	December 10, 2012
2013	
OU2 Companies submitted the Quarterly Remedial Progress Reports.	2013
2014	
OU2 Companies submitted the Work Plan to Install Groundwater Monitor Wells.	January 16, 2014
OU2 Companies submitted the Revised 2012 Effectiveness Report for OU2.	February 19, 2014
EPA conducted a vapor intrusion investigation in selected areas of OU2 with its mobile lab (TAGA -Trace Atmospheric Gas Analyzer).	February, 2014
OU2 Companies submitted the Revised Work Plan to Install Groundwater Monitor Wells.	April 28, 2014
OU2 Companies submitted the Revised 2013 Effectiveness Report for OU2.	September 17, 2014
OU2 Companies submitted the Addendum to the Construction Completion Report Results of Additional Groundwater Monitoring Wells (NW21-S, NW22-S/D, NW23-S/D, NW24-S/D and NW25-S, NW26) Installations.	September 24, 2014
EPA published the Final Vapor Intrusion Investigation Report, Mobile Laboratory Monitoring of Temporary Soil Vapor Wells.	September, 2014
2015	
ADEQ and OU2 Companies entered into an Administrative Order on Consent with ADEQ (Docket No RP-08-15-F) to conduct a final RI/FS.	February 9, 2015
OU2 Companies submitted the Revised Addendum to the Construction Completion Report Results of Additional Groundwater Monitoring Wells (NW21-S, NW22-S/D, NW23-S/D, NW24-S/D and NW25-S, NW26) Installations.	July 17, 2015
OU2 Companies submitted the Revised 2014 Effectiveness Report for OU2.	August 21, 2015
The holding companies of Freescale and NXP merged; Freescale will continue to operate under its name until it changes to NXP USA, Inc. in summer of 2016.	December 7, 2015
2016	
OU2 Companies submitted the 2015 Effectiveness Report for OU2.	March 31, 2016
OU2 Companies submitted the Quality Management Plan for the OU2-wide VI Investigation.	August 2016
OU2 Companies submitted the Soil Gas Sampling Workplan for the OU2-wide VI Investigation.	August 2016

4. Five-Year Review Process

4.1. Community Notification, Involvement and Site Interviews

A public notice was made available by mailing and emailing a flyer notification on February 2016, announcing that there was a FYR underway and inviting the public to submit any comments to EPA (Appendix E). During a public community webinar in April 2016, EPA solicited input from the Community Information Group for this FYR. The results of the FYR and the report will be made available at the Site information repositories located at Burton Carr Public Library and the Saguaro Library, both in Phoenix, Arizona.

The report will also be available online at http://azdeq.gov/environ/waste/sps/phxsites.html#mot52a and at: http://www.epa.gov/Motorola

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The results of these interviews are summarized below.

4.1.1. OU1 Interviews

For OU1, five interviews were conducted in-person and by email for this FYR to provide insight into the general perception of the cleanup and the operations associated with the remedy. Of the five total interviews, three in-person interviews of various contractors and a representative of NXP (formerly Freescale/Motorola) were conducted at the Motorola OU1 site (Appendix F).

The interviews indicated that the general impression of the project is favorable, that the treatment system is in good condition, and that the treatment system is maintained and upgraded regularly. Those interviewed suggested that the remedy appeared to be functioning as intended. Monitoring indicates that VOCs are being removed from the aquifers, groundwater is being successfully treated, and hydraulic containment of the alluvium TCE plume is occurring, with the possible exception of the northern portion of the OU1 alluvial plume. This will be addressed in the upcoming 2016 RI/FS report. There is a continuous O&M presence, with either on-site personnel, or by on-call personnel who perform remote monitoring of the system and have the ability to shut down the system remotely if necessary. A significant change indicated during the interviews is that ON Semiconductor (now located at the former Motorola 52nd St Plant) stopped receiving treated water in 2011, meaning that another beneficial use for IGWTP water needed to be identified to meet the objectives of the interim remedy. Also, during the FYR review period the IGWTP's treated water delivery system was modified so that treated water could be discharged directly to the OCC or to the city of Phoenix sewer system during canal maintenance periods. No unexpected O&M difficulties have been reported in the past five years; however, treatment plant sampling was optimized, resulting in a decrease in the number of samples collected. None of the interviews resulted in any indication that changes in Federal, state, county, or local laws or regulations have changed and/or would affect the protectiveness of the remedy. Depending on the results of the final RI/FS, appropriate enhancements to the groundwater extraction system may be necessary.

4.1.2. OU2 Interviews

For OU2, three interviews were conducted in-person and by email. Of the three total interviews, one in-person interview was conducted at the Motorola OU2 site, at the 20th Street Groundwater Treatment Facility, and another was conducted later by the ADEQ (Appendix F).

The overall impression of the OU2 project is very positive, with good collaboration between all participants. The containment and capture of VOC contaminated groundwater using extraction wells is believed to be adequate, and while the southern extraction well could be performing better, the interim remedy is believed to be performing as designed and containing the full width and depth of the VOC plume at 20th Street. Monitoring data demonstrates that upgradient and contaminated groundwater is being captured and that downgradient concentrations in the Salt River Gravel (SRG) and Basin Fill (BF) continue to decrease. The ADEQ and EPA are notified of all shutdowns for planned and unplanned maintenance. There is an operator on-site 40 hours per week, and an operator is always available. New wells were added in 2014 to monitor the upgradient plume, and there have been no significant changes to the O&M plan. In 2012, variable speed drives were installed on extraction wells in the north and south to better control flows based on groundwater levels. There have been no O&M difficulties in the last five years, but there is an ongoing concern that groundwater levels in the southern groundwater extraction well are low enough to cause concern that the pump may run dry. Opportunities for optimization are addressed in annual monitoring reports. Savings have been realized unexpectedly, as declining groundwater levels have reduced groundwater availability and the associated volume of groundwater being treated.

None of the interviews resulted in any indication that changes in Federal, state, county, or local laws or regulations have changed and/or would affect the protectiveness of the remedy. As part of the final RI/FS, the OU2 Companies are looking at optimizing the 20th Street GWTF groundwater monitoring network and evaluating low flow, or using passive sampling rather than traditional 3 well volume purging, especially as the water level decline continues.

4.2. Data Review

The data review section presents a summary of data collected during this FYR period and focused on data collected in 2015. A more detailed assessment is included in Appendix B of this report. The data presented in this FYR highlights and summarizes the evaluations presented in the OU1 and OU2 2015 annual Effectiveness Reports. This summary also includes recommendations made as part of the data collection and analyses for chemicals of potential concern (COPCs) that EPA and ADEQ have been conducting since 2013.

4.2.1. OU1 Data Review

During 2015, 23 groundwater extraction wells were operated within the Motorola 52nd Street Superfund Site OU1 area.

The OU1 remedy had an operational uptime of 87.6 percent for 2015. Approximately 96.5 million gallons (296.0 acre feet) of contaminated groundwater were extracted in 2015. An estimated 589 pounds of VOCs

were removed from the groundwater and disposed of as hazardous waste. Through 2015, approximately 3.74 billion gallons (11,490 acre feet) of water have been extracted and treated, and an estimated 24,852 pounds of VOCs have been removed. In spite of this, the current flow rate processed by the IGWTP is lower than the design flow rate due to lowering of the water table, meaning that the system must be operated on an intermittent basis.

Based on the slow, gradual decline of the average flow rates, and the minimal drawdown observed year to year, potential dewatering of the alluvial aquifer remains an issue and will be examined as part of the ongoing efforts to develop a final OU1-wide RI/FS. Water level elevation contour maps show that alluvial groundwater flow in an area wider and deeper than the observed plume that originated from the Motorola facility is directed towards the extraction wells.

Decreasing concentrations in downgradient sentinel wells indicate a lateral hydraulic capture zone in the alluvial aquifer. The areal extent of the plumes with TCE concentrations in excess of 100 µg/L in the alluvium at the Courtyard, the northern part of the OCC extraction well field, and the bedrock within the OU1 area have not changed significantly; however, the areal extent of the plumes with TCE concentrations in excess of 1,000 µg/L in the alluvium have decreased. The persistence of the observed TCE contamination is attributed to the presence of DNAPL, the complexity of the fracture network, and the very low permeability of the bedrock groundwater system.

Although, the alluvium contamination appears to be adequately captured by the groundwater extraction systems, the groundwater plume in the bedrock is not being captured by the extraction wells which are installed at the alluvium/bedrock interface. A groundwater well screened within the bedrock just within the capture zone (DM-063-170) contains elevated levels of TCE at 2,600 micrograms per liter (µg/L). Two new bedrock wells, located downgradient of DM 063-170 and outside the capture zone, contain TCE at concentrations up to 121 µg/L at DM628 and 76.2 µg/L in well DM629-B, which suggests that capture in the bedrock is not achieved laterally. The interim remedy does not include addressing contamination in the bedrock, but limited extraction of DNAPL from one bedrock well is being implemented; DNAPL in bedrock is also being evaluated in the ongoing RI/FS. Fully addressing the DNAPL in bedrock is expected to improve the likelihood of continued containment in the alluvium, decrease risk of future vapor intrusion issues, and shorten the time to cleanup.

The overall pattern of TCE concentrations in groundwater remained consistent with the pattern observed in previous years, with the exception of an area northwest of the Courtyard area. TCE concentrations in well DM602 began increasing in 2004 from below the MCL to a maximum of 1,230 µg/L in 2015. Additionally, well DM620 was installed near DM602 to the northeast and TCE concentrations in DM620 were as high as 4,850 µg/L in 2014. The elevated and relatively stable VOC concentrations in the alluvium and bedrock in the Courtyard area and upgradient of the OCC demonstrate the extended timeframes required to see a reduction in TCE concentrations.

The evaluation of the potential for vapor intrusion was a high priority in OU1 because of the shallow depth to groundwater at 20 feet below ground surface, known elevated TCE concentrations in groundwater and in soil vapor at the Courtyard and SWPL areas, and the presence of DNAPL in bedrock.

In 2010, EPA Region 9 developed a Motorola 52nd Street (M52) Framework for Vapor Intrusion Investigation and Mitigation (Framework). This Framework includes a sampling approach and chemical-specific health-based screening levels for indoor air and subsurface soil gas samples. As EPA risk screening levels are updated, the M52 Framework is updated. The current Framework was updated in August 2015 and applies to the entire M52 site. Additionally, EPA established an M52 interim action level for trichloroethene (TCE) of 1 ug/m3 for indoor air in residential settings and between 3 ug/L and 8 ug/m^3 for TCE in indoor air in commercial settings. Mitigation is required for buildings meeting or exceeding these interim action levels. The OU1 vapor intrusion investigation began in 2010. The indoor air investigation is complete while the soil vapor investigation is in progress. Sixteen indoor air mitigation systems have been installed. EPA has addressed all immediate risks for vapor intrusion by this investigation and mitigation work, and is evaluating remedies to address long-term remediation.

Additional efforts relating to vapor intrusion include:

- Evaluation of vapor intrusion at the former Motorola 52nd Street facility (OU1):
- 41 soil gas probe samples.
  - 8 detections of trichloroethene, with 5 at or over the industrial screening level for soil gas.
  - 10 detections of tetrachloroethylene, with 2 at or over the industrial screening level for soil gas.
- Winter 2016 indoor air results from 10 enclosed structures were all non-detect, except for one sample in the basement of one of the buildings.
  - TCE was detected in only one of several samples there, in excess of the industrial screening level for air.
  - TCE was not detected during re-sampling in this area.
  - PCE was detected in a duplicate sample (but not the primary sample) at a concentration that did not exceed the industrial screening level.

- Summer 2016 indoor air results from 10 enclosed structures were all non-detect with the exception of TCE at two locations that were re-sampled after stored chemicals were removed. The re-sampling data did not detect TCE.

The initial detection in the maintenance shop in the basement of Building D has been determined to be from an interior source. No detections were noted in an additional round of samples taken after such products were removed from the maintenance shop. The completed vapor intrusion investigation efforts resulted in installation of sixteen mitigation systems where vapor intrusion was found to be occurring, and indicate vapor intrusion is not occurring at the former Motorola 52nd Street Facility campus. With mitigation efforts in place, it appears that there are no current exposures through the vapor intrusion pathway in OU1 based on the validated data reports. Ongoing monitoring and establishment of institutional controls to ensure against potential future exposure need to be developed for OU1. The ongoing soil vapor investigation efforts will promote protectiveness by more fully identifying the soil vapor concentrations of TCE and PCE, and evaluating whether additional, long-term soil vapor remedial measures are warranted.

Since 2013, EPA has conducted data collection and analyses of chemicals of potential concern (COPCs) to identify if there are additional site related chemicals that should be considered for cleanup. As part of

these analyses, the COPCs for further sampling and data evaluation in OU1 are: hexavalent chromium, 1,4-dioxane, arsenic, flouride, and the addition of 1,2-dichlorobenzene and 1,2,4-trichlorobenzene to the routine groundwater monitoring program.

4.2.2 OU2 Data Review

Approximately 712 million gallons (2,184 acre feet) of water was treated in 2015 by the 20th Street GWTF, and all of the treated water met the discharge water quality standards for VOCs during 2015. The 20th Street GWTF removed approximately 289 pounds of VOCs in 2015, and total VOC concentrations in the 20th Street GWTF influent water have decreased from time of start-up to December 2015.

Since the September 2001 baseline water level measurements, water levels have declined by an average of 17.8 feet in monitoring wells in the OU2 Area due to operations of the 20th Street GWTF and the continuing regional drought. The September 2015 water elevation contour maps depict a cone of depression in the Salt River Gravel HSU (also referred to as Shallow HSU) and Basin Fill that center on the 20th Street GWTF, with the resulting capture zone extending beyond the width of the observed plume in SRG. The 20th Street GWTF is capturing the full width and depth of the Salt River Gravel HSU groundwater plume in the OU2 Area.

However, the Basin Fill wells NW14-D, NW07-D and NW09-D indicate that the treatment system may not entirely capture the extent of the Basin Fill plume in the south. These wells are downgradient of the capture zone, have shown increasing concentrations since 2011, and are all above the MCL. At the OU2/OU3 boundary, Basin Fill well NW14-D also suggests the plume capture may not be entirely contained vertically. Currently, NW14D, which is downgradient of NW19D and just outside the OU2 capture zone, has shown an increasing TCE concentration trend since 2011 that peaked at 12.1 µg/L in September 2015 and was slightly lower in March 2016 (11.4 µg/L). The well suggests that mass upgradient of this well may not always be captured and higher concentrations in the future may occur in this area. Plans are underway for additional data collection and capture analyses at the southern Basin Fill plume and at the OU2/OU3 boundary.

The expected trend in concentrations varies by location. A temporary increase in VOC concentrations is observed in a number of wells upgradient of the 20th Street GWTF, and there has been a reduction in TCE concentrations in monitoring wells from baseline conditions in 1992 in both alluvial subunits downgradient of the 20th Street GWTF, due to the hydraulic capture zone created by the 20th Street GWTF pumping.

Finally, a reduction in plume width is observed in the vicinity of the 20th Street GWTF. TCE plume width reduction since the startup of the 20th Street GWTF is expected because of the localized groundwater flow direction changes due to 20th Street GWTF pumping, and the decrease in dissolved-phase concentrations due to extraction and treatment of the groundwater. This plume width reduction shows that VOC concentrations are continuing to decline in the OU2 Area groundwater monitoring well network, and that the TCE plume width continues to decrease, to the north of the 20th Street GWTF, reflecting the hydraulic capture/cut-off of the plume.

The 20th Street GWTF does not have air emissions as it is a closed loop system.

To address concerns regarding potential vapor intrusion, the evaluation of the vapor intrusion to indoor air pathway throughout OU2 is scheduled to begin in 2016. Conditions in OU2 differ than conditions in OU1 because OU2 groundwater is first encountered at a much deeper depth (80 feet below ground surface), groundwater TCE concentrations are much lower in OU2 (< 200 µg/L), and DNAPL is not present in bedrock in OU2. The vapor intrusion investigation is expected to be completed within a year with a contingency to mitigate any indoor air exposures in the short term, if encountered.

Since 2013, EPA has conducted data collection and analyses of COPCs to identify if there are additional site related chemicals that should be considered for cleanup. For OU2, the COPCs for further sampling and data analyses are hexavalent chromium, 1,4-dioxane, naphthalene and 2-methylnaphthalene.

4.3. Site Inspection

The inspection of the Site was conducted on 2/10/2016. Site inspections were conducted by the U.S. Army Corps of Engineers (USACE) with agency representatives, project managers, and project engineers present. The completed Site inspection forms are included in Appendix G, and a trip report is included in Appendix H. The purpose of the inspection was to assess the protectiveness of the remedy.

Site inspections were conducted at the two groundwater treatment systems serving OU1 and OU2. The project engineers were in attendance and provided response to the USACE interviewer. Relevant documents, including O&M manuals, as-built drawings, maintenance logs, health and safety plans, emergency response plans, O&M and Occupational Safety and Health Administration (OSHA) training records, air and effluent discharge permits, groundwater monitoring records, leachate extraction records, and security records, were all on site and readily available. O&M costs were also provided. In all cases, institutional controls were deemed to be adequate, there were no visible signs of vandalism, and access roads were adequate. Groundwater extraction wells, pumps, plumbing, and treatment systems were all in good working order, and all chemicals were properly stored.

5. Technical Assessment

The following is a technical assessment of the Site based on the findings of FYR activities. This assessment answers three basic questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

5.1. OU1 Technical Assessment

The following subsection provides the technical assessment of the interim remedy for OU1.

5.1.1. Question A: Is the Remedy Functioning as Intended by the Decision Documents?

Yes; based on a review of Site data, available documentation, and the results of the OU1 site inspection, the system is generally functioning as intended by the interim remedy LOD and interim ROD. Decreasing concentrations in downgradient sentinel wells are indicative of the establishment of a lateral hydraulic capture zone in the alluvial aquifer. However, contamination in the bedrock is not being controlled by the extraction system. The interim remedy does not include addressing contamination in the bedrock, but limited extraction of DNAPL from one bedrock well is being implemented; DNAPL in bedrock is also being evaluated in the ongoing RI/FS. Fully addressing the DNAPL in bedrock is expected to improve the likelihood of continued containment in the alluvium, decrease risk of future vapor intrusion issues, and shorten the time to cleanup. The persistence of the observed TCE contamination is attributed to the presence of DNAPL, the complexity of the fracture network, and the very low permeability of the bedrock groundwater system. The following conclusions about the functioning of the remedy are as follows:

During the current FYR period, O&M of the IGTWP has been effective as indicated by the high level of operational uptime of the treatment system and the production of treated water compliant with MCLs. However, a decreasing groundwater table has led to decreased extraction well flow rates, which will likely affect the extent of plume capture and results in inefficient IGWTP operation. Also, the age and condition of IGWTP equipment and the high level of operational complexity required make it difficult to maintain treatment effectiveness. The IGWTP currently treats only a portion of the original design flow and is significantly less cost efficient than the original design intended.

Air emissions data from the OU1 groundwater treatment system indicates that the removal efficiency of the system is meeting the substantive air permit emissions requirements under Maricopa County Rules for the IGWTP.

The extraction and treatment of VOCs from source area soils at the former Motorola facility is not currently being implemented. SVE treatment of soil in the Courtyard and SWPL areas was conducted prior to the current Five-Year Review period. Although ADEQ determined that soil cleanup in the SWPL Area was complete in 2002, some soil gas concentrations exceed the current Soil Gas Human Health Screening Levels (SGHHSLs) and this area requires re-evaluation as part of the ongoing RI/FS. The Courtyard and ATP source areas also require additional investigation and evaluation to determine the appropriate next steps. The Courtyard, ATP and SWPL source area soils are being evaluated as part of the RI/FS.

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

There are no cleanup levels established for restoration of the aquifer; however, remedial goals established in the interim ROD for OU1 are generally identified as containment of the VOCs groundwater plume at the OCC, and treatment of groundwater to meet the state and federal standards for the treated water use. The treated groundwater meets the MCLs. There has been no change to the MCLs for trichloroethene, tetrachloroethene, 1,1,1-trichloroethane. The implemented remedy does not specify quantitative cleanup goals for comparisons to toxicity data.

As was the case in 2011, the only known use of groundwater at OU1 is for landscaping by a private owner, and this has not changed since the time the LOD and interim ROD were prepared. ADEQ regularly samples the private well and provides the results to the property owner. The most recent results from the 2016 sampling event showed no detection of VOCs in this well.

The LOD does not contain ARARs (Appendix C), but states that the remedy will meet the substantive requirements of permits. The OU1 interim remedy meets other requirements of the PQGWWP permit issued in 2005. It also meets the substantiative requirements for Maricopa County permitting of air emissions.

With one exception, there are no concerns with respect to changes in land use, physical site characteristics, hydrogeology, or exposure pathways. While vapor intrusion is being mitigated where found in OU1, the long-term remedy and institutional controls for vapor intrusion need to be addressed in the RI/FS.

Freescale has been conducting investigations and ongoing mitigation efforts to address the soil gas to indoor air vapor intrusion pathway under a separate agreement with EPA. Sub-slab depressurization systems have been successfully implemented at sixteen structures in the OU1 area to address potential risk associated with the vapor intrusion to indoor air pathway. While indoor air has been addressed in OU1, the ongoing soil vapor investigation efforts will promote protectiveness by more fully identifying the soil vapor concentrations of TCE and PCE, and evaluating whether additional remedial measures are warranted as part of the ongoing RI/FS.

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

No; no new information has come to light that calls into question the protectiveness of the remedy.

5.2. OU2 Technical Assessment

The following subsection provides the technical assessment of the interim remedy for OU2.

5.2.1. Question A: Is the Remedy Functioning as Intended by the Decision Documents?

Yes; based on the review of the Site data, available documentation, and FYR interviews, the OU2 20th Street Groundwater Treatment Facility is functioning as intended by the interim OU2 ROD and ESD. The treatment system provides hydraulic capture of the alluvial plume (Salt River Gravel) plume near I-10 as established by the RAOs identified in the OU2 ROD and ESD (GHD, 2016). However, the vertical containment in the Basin Fill at the OU2/OU3 boundary and lateral containment at the southern portion of the plume needs to be evaluated more fully and augmented, if needed. The 20th Street GWTF does not have air emissions as it is a closed loop system.

The operation and maintenance of the system has been effective as indicated by the high operational uptimes. During the non-operational periods created by the annual SRP shutdown, required major and minor maintenance on the system is completed. The system currently operates in accordance with the interim ROD as a containment remedy. The results of discharge monitoring indicate that the 20th Street GWTF treats TCE, PCE , 1,1,-TCA to meet the federal MCLs and all of the extracted groundwater to below the treated groundwater discharge standards for VOCs prior to discharging into the Grand Canal.

5.2.2. Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of Remedy Selection Still Valid?

The OU2 interim remedy meets the RAOs and cleanup levels of reducing upgradient concentrations of TCE, PCE, 1,1,1-TCA and breakdown products to meet the federal Maximum Contaminant Levels. The MCLs have not changed during the current FYR period. The OU2 ARARs appendix (Appendix C) attached to this document includes the ARARs established in the OU2 ROD. No significant changes in land use within the OU2 boundaries occurred during the current FYR period.

There are concerns about the potential vapor intrusion to indoor air pathway in OU2. Efforts to consider vapor intrusion have been undertaken during the FYR period, which include:

- A limited vapor intrusion sampling event using the TAGA mobile lab in 2014, indicated the need to expand the investigation efforts.
- Operation of a soil vapor extraction system since 2014 continues at the Joray/Kachina facility at 30th Street and Washington (OU2). Soil gas concentrations at that location have diminished from 39,000 µg/m^3 to one location exceeding the industrial screening levels, with the system running.
- A soil gas investigation that is planned as part of the focused RI of Honeywell Area 21 (OU2).

- Vapor intrusion sampling site-wide is underway at OU2, as part of the RI.

VOC vapors are present in soil gas samples at OU2. During the TAGA sampling event in February 2014, trichloroethene was detected in the soil gas at thousands of micrograms per cubic meter, and tetrachloroethene was detected at hundreds of micrograms per cubic meter. This indicates the potential for migration of those vapors into nearby structures. The OU2-wide VI investigation will begin in 2016 and VI will be included in the ongoing OU2-wide RI/FS.

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

No; no new information has come to light that calls into question the protectiveness of the remedy.

6. Issues/Recommendations

Several recommendations were made during the previous FYR that addressed VOC contamination in bedrock, VI evaluations, soil contamination, and O&M. Many of these issues have been addressed by ongoing investigations, the results of which will be thoroughly reported and evaluated in the RI/FS investigations currently under development for OU1 and OU2. These respective RI/FS reports should be finalized before the next FYR and will be used to develop final RODs for the OUs. The issues and recommendations made in the previous FYR are reiterated in Table 5.

Table 5. Issues and Recommendations Identified in the FYR

OU1	**Issue Category: Other**			
	Issue: DNAPL present in bedrock at and near the former Motorola 52nd Street 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.			
	Recommendation: 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.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/28/2021
OU1	**Issue Category:** Other			
	Issue: The OU1 Interim Remedy is less efficient than originally expected in the LOD/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.			
	Recommendation: Evaluate remedy performance optimization.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/28/2021
OU1	**Issue Category:** Other			
	Issue: The IGWTP equipment is aging. Also, the level of operational complexity to maintain the effectiveness of the IGWTP 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			
	Recommendation: Conduct an engineering review of IGWTP operations to optimize the system. Update O&M manual to improve efficiency and require better documentation of operations.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/28/2021

OU1	**Issue Category:** Other			
	Issue: The soil vapor extraction operations identified in the ROD/LOD have ceased; the effectiveness of completed soil cleanup activities has not been adequately evaluated. Soil cleanup in the ATP area as required by the ROD/LOD has not been conducted.			
	Recommendation: Evaluate residual soils contamination in the Courtyard, ATP and SWPL areas, and the past and potential future effectiveness of the SVE operations as part of the upcoming RI/FS.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/28/2021
OU1	**Issue Category:** Other			
	Issue: 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.			
	Recommendation: Evaluate VI, in light of current investigations and mitigation, throughout the OU as part of the upcoming RI/FS.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/28/2021
OU1	**Issue Category:** Other			
	Issue: 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 the effectiveness and long-term sustainability of the OU1 IGWTP.			
	Recommendation: Finalize the OU1-wide RI/FS and select a final remedy by 2019.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/28/2019
OU2	**Issue Category:** Other			
	Issue: Contamination in the area southeast of the 20th St GWTF exceeds the MCLs and follows a flow path outside the area of capture for the 20th St GWTF. The current interim remedy would not capture this contamination.			
	Recommendation: Evaluate the 20th St GWTF in light of the flow of the groundwater contamination to the southeast.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/28/2021
OU2	**Issue Category:** Other			
	Issue: 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 20th Street GWTF.			
	Recommendation: Finalize the OU2-wide RI/FS and select a final remedy by 2019.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**

No	Yes	PRP	EPA/State	9/28/2019
OU2	**Issue Category:** Other			
	Issue: Initial assessment for vapor intrusion in OU2 was conducted with EPA's TAGA mobile lab, and several areas were identified for further investigation where VI may be of concern. Honeywell and Freescale are currently conducting a VI investigation in these areas to determine whether and where there may be the potential for VI, and to implement mitigation if VI is found to be occurring.			
	Recommendation: Continue to evaluate VI pathway in OU2 and include long-term VI in current OU2 RI/FS.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	PRP	EPA/State	9/30/2017

6.1. *Other Findings*

In addition, the following finding and recommendation was identified during the FYR to improve assessment of remedy performance, but does not affect current and/or future protectiveness.

ON Semiconductor ceased manufacturing operations at the former Motorola 52nd Street Facility in 2011 and no longer accepts the IGWTP treated groundwater as specified by the interim ROD. This requires that the beneficial end-use for groundwater treated at the IGWTP be formally modified in a decision document. The current interim end-use is discharge to the OCC for irrigation. If the final end-use is different than the current interim end-use, construction/implementation of the new end-use would also be required. Beneficial end-use for treated groundwater from the IGWTP should be evaluated as part of the OU1 RI/FS, including the current interim end-use of discharge to the OCC.

7. Protectiveness Statements

This section provides protectiveness statements with respect to the interim remedies for OU1 and OU2. There is no protectiveness statement for OU3 because OU3 does not have a remedy in place and the OU3-wide RI/FS is currently in progress.

Table 6. Protectiveness Statement

Protectiveness Statement(s)		
Operable Unit: 1	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* NA
Protectiveness Statement: The OU1 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, 52nd Street campus soil cleanup, and vertical containment specifically due to the presence of 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.		
Operable Unit: 2	*Protectiveness Determination:* Deferred	*Planned Addendum Completion Date:* 9/28/2018
Protectiveness Statement: A protectiveness determination at the OU2 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 GWTF, and evaluate effects of the declining groundwater table. For long-term protectiveness, OU2 is undergoing an RI/FS evaluation which will need to look at groundwater restoration and the potential for vapor intrusion as part of the final OU2 remedy.		

8. Next Review

The next five-year review report for the Motorola 52nd Street Superfund Site is required by September 2021.

Appendix A: List of Documents Reviewed

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*.

ADEQ and LFR, 2006. Third Five Year Review, Operable Unit 1, Motorola 52nd Street Superfund Site, Phoenix, Arizona. Dated September 25, 2006.

ADEQ and LFR, 2006. Second Five Year Review, Operable Unit 2, Motorola 52nd Street Superfund Site, Phoenix, Arizona. Dated September 25, 2006.

ADEQ. 2011. *2011 Site wide Five-Year Review Report, Motorola 52nd Street Superfund Site, Phoenix, Arizona*. Prepared by Arizona Department of Environmental Quality, U.S. Environmental Protection Agency, and URS Corporation. September 2011.

Clear Creek Associates. 2012. *Operable Unit No. 1 Effectiveness Report 2011 Operations Motorola 52nd Street Superfund Site*. March 2012.

Clear Creek Associates. 2013. *Operable Unit No. 1 Effectiveness Report 2012 Operations Motorola 52nd Street Superfund Site*. March 2013.

Clear Creek Associates, 2014. *Operable Unit No. 1 Effectiveness Report 2013 Operations Motorola 52nd Street Superfund Site*. March 2014.

Clear Creek Associates. 2015. *Operable Unit No. 1 Effectiveness Report 2014 Operations Motorola 52nd Street Superfund Site*. March 2015.

Clear Creek Associates, 2016. *Operable Unit No. 1 Effectiveness Report 2015 Operations Motorola 52nd Street Superfund Site*. March 2016.

Conestoga-Rovers & Associates. 2012. *Effectiveness Report – 2011, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area Phoenix, Arizona*. March 2012.

Conestoga-Rovers & Associates. 2013. *Effectiveness Report – 2012, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. March 2013.

Conestoga-Rovers & Associates. 2014. *Effectiveness Report – 2013, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. March 2014.

Conestoga-Rovers & Associates, 2015. *Effectiveness Report – 2014, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Phoenix, Arizona*. March 2015.

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 Region 9, 2011. Update regarding the evaluation of potential vapor intrusion to indoor air risk at OU1. Transmitted by email on April 27, 2011.

GHD. 2016. *Effectiveness Report – 2015, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. March 2016.

Appendix B: Data Review

APPENDIX B

DATA REVIEW

1. Data Review

This appendix describes the data review for the Motorola 52nd Street Superfund Site (Site) 2016 Five-Year Review (FYR) report.

1.1. OU1 Data Review

This section describes the data review for Operable Unit 1 (OU1). Much of the information, including figures, for this review was taken directly from the 2015 OU1 Effectiveness Report (Clear Creek Associates, 2016).

1.1.1. OU1 Remedial Action Objectives (RAOs)

The remedial action objectives (RAOs) in the 1988 Record of Decision (ROD) are:

- Contain the migration of high concentrations of volative organic compounds (VOCs) in groundwater at the Old Crosscut Canal (OCC).
- Use all of the treated water at the former Motorola 52nd Street Facility (Motorola facility).
- The design and operation of groundwater extraction system shall also have a beneficial impact on the quality of groundwater within the bedrock

1.1.2. Treatment Systems

During 2015, 23 groundwater extraction wells were operated within the OU1 area. Five onsite extraction wells are located within the Courtyard area of the Motorola facility, twelve extraction wells are located in the Southwest Parking Lot (SWPL) area and six offsite extraction wells are located along the Old Crosscut Canal.

The OU1 remedy had an operational uptime of 87.6 percent for 2015. Approximately 96.5 million gallons (296.1 acre feet) of contaminated groundwater were extracted. The extracted water was treated and used on site by ON Semiconductor for process water until November 1, 2011. Treated water was subsequently discharged to the City of Phoenix sanitary sewer under a wastewater discharge permit. The average flow rate in 2015 was slightly higher than in 2014; however, it was lower than the average flow rate in recent previous years. An estimated 584 pounds (48 gallons) of VOCs were removed from the groundwater and disposed of as hazardous waste. Since inceptionthrough 2015, approximately 3.74 billion gallons (11,490 acre feet) of water have been extracted and treated and an estimated 24,852 pounds (2,041 gallons) of VOCs have been recovered.

In 2015, about 229 gallons of groundwater at saturated VOC concentrations of about 1,100 parts per million (ppm) (equivalent to 2.8 pounds of VOCs) were extracted from monitoring wells MP03-D (including minor amounts from MP03-B and MP03-C); an additional 225 milliliters (ml) (equivalent to 0.7 pounds) of free product dense non-aqueous phase liquid (DNAPL) was recovered from MP03-D in 2015. These liquids were disposed of as hazardous waste together with the solvent waste from the Integrated Groundwater Treatment Plant (IGWTP).

Since November 2011, Freescale discharged the treated groundwater from the IGWTP to the City of Phoenix sanitary sewer pursuant to the Arizona Department of Environmental Quality (ADEQ) approval (letter dated July 14, 2009) and a City of Phoenix wastewater discharge permit. In December 2011, ADEQ approved a request by Freescale to discharge to the Old Crosscut Canal. Freescale identified and received approval of a pipeline route from the IGWTP to the OCC along an alignment that follows Culver Street to 49th Place to Roosevelt Street in City of Phoenix right-of-way, then along Roosevelt Street adjacent to Arizona Department of Transportation (ADOT) right-of-way, and then along the bank of the OCC to a discharge point, under an agreement with the Salt River Project (SRP). Freescale's contractors completed design and construction permitting of the pipeline, and construction activities began in early November 2014. Construction and operational testing were completed by November 2015, and discharge to the OCC began on December 1, 2015.

Discharge to the city sanitary sewer is available when discharge to the OCC is not available, such as times of "dry up" for routine canal maintenance, or when low flow is anticipated where there are mixing zone requirements that cannot be achieved, or when SRP canal operations necessitate no additional flow to allow for additional capacity from stormwater events.

1.1.3. Drawdown

Total drawdown on the order of 20 to 30 feet has been measured in the alluvium and bedrock at or near the OCC. Observed drawdowns in the bedrock were of the same order of magnitude as drawdowns in the alluvium. Total drawdown refers to both regional decline from the multi-year drought and drawdown caused by OU1 pumping. Although total drawdown since the start of operations is over 30 feet in some wells near the OCC due to operations of the OU1 system and the regional water level decline, the amount of drawdown observed year to year is much smaller. Based on the slow, gradual decline of the average flow rates, and the minimal drawdown observed year to year, potential dewatering of the alluvial aquifer remains an issue and will be examined as part of the ongoing efforts to develop a final 2016 Remedial Investigation and Feasibility Study (RI/FS) for the OU1 area.

1.1.4. Capture Zone Determination

Groundwater contours resulting from operation of the OU1 system were used to define the zone of capture for 2015 (Figure 30). Water level elevation contour maps show that groundwater flow in an area wider and deeper than the observed plume that originated from the Motorola facility is directed towards the extraction wells.

Per EPA guidance, the extent of capture was also estimated using a numerical groundwater model (a revised groundwater flow model under development by Clear Creek). Numeric modeling shows a larger capture zone than a previous analytical model; however, the modeled extent of capture does not fully capture the northernmost extent of the plume which has low levels of trichloroethene (TCE) contamination (Figure 30). Furthermore, using the best estimate of the average saturated thickness through the OU1 area, the flow rate required to capture the plume calculated using this method indicates that the 2015 average flow rate of the OCC extraction wells is less than the rate calculated using the EPA preferred safety factor of 1.5.

One reason for this is that the predicted water levels in monitoring wells located in the area north and northwest of the OCC water levels are too low. This results in a groundwater flow direction in this area that is slightly more west than south. This under-prediction of water levels reduces the extent of the predicted capture zone to the north of the OCC. The groundwater flow model will continue to be refined and calibrated. As part of the OU1 final RI/FS, the estimated extent of capture in the model may also require refinement. Numeric modeling indicates that capture encompasses alluvial groundwater with higher levels of TCE, as well as the full extent of the plume at depth in bedrock. The addition of bedrock extraction well DM314 (Figure 30) has been effective in increasing the vertical extent of capture onsite and in increasing mass removal. Nevertheless, additional evaluation of the bedrock data needs to be conducted to verify the full depth of the plume in bedrock and whether the interim remedy requires modification to achieve complete capture.

1.1.5. TCE Concentrations in Groundwater

The areal extent of the plumes with baseline TCE concentrations in excess of 10 and 100 µg/L in the alluvium downgradient of the OU1 capture zone have significantly decreased over time (Figures 32 through 37). Decreasing concentrations in these downgradient sentinel wells are indicative of the establishment of a hydraulic capture zone. The areal extent of the plumes with TCE concentrations in excess of 100 µg/L in the alluvium at the Courtyard, the northern part of the OCC extraction well field, and the bedrock within the OU1 area have not changed significantly; however, the areal extent of the plumes with TCE concentrations in excess of 1,000 µg/L in the alluvium have decreased.

A reduction in the areal extent of the plumes with bedrock TCE concentrations in excess of 10, 100, and 1,000 µg/L is observed at and downgradient of the OCC as a result of containing the plume (Figures 32 through 37). While TCE concentrations in selected OU1 wells has decreased over time concentrations in other wells have either not changed or have even increased (Figure 41). However, the 10, 100, and 1,000 µg/L concentration contours in bedrock in 2015 in the OU1 area upgradient of the OCC are generally the same as baseline TCE concentrations. The persistence of the observed TCE contamination is attributed to the presence of dense non-aqueous phase liquid (DNAPL), the complexity of the fracture network, and the very low permeability of the bedrock groundwater system. This persistence of elevated TCE concentrations, despite over 29 years of onsite remediation and over 23 years of remediation offsite, indicates that attaining concentration reductions to established aquifer water quality levels is, under current operations and conditions, not practicable in the foreseeable future.

The overall pattern of TCE concentrations in groundwater remained consistent with the pattern observed in previous years. Back diffusion of adsorbed contaminants and from low flow zones may account for the low but persistent TCE concentrations observed in several downgradient monitoring wells. The elevated and relatively stable VOC concentrations in the alluvium and bedrock in the Courtyard area and upgradient of the OCC demonstrate the extended timeframes required to see a reduction in TCE concentrations despite the mass that has been removed from over 29 years of remedial operations onsite and over 23 years of remediation offsite. In addition, the PRP believes that elevated PCE migrating around the north end of the OCC capture zone indicates contributions from another source.

1.1.6. OU1 Treatment System Air Emissions

Since 2007, monthly OU1 air emissions sampling data has been reported in the OU1 Annual Effectiveness Reports. In 2013, EPA and ADEQ requested a review of the air emissions data to confirm that the IGWTP was meeting the substantive air permit requirements under Maricopa County Rules for the IGWTP. The substantive requirements consist of meeting a minimum of 90 percent VOC removal efficiency at all times and ensuring that total air emissions, after controls, are no greater than three pounds per day of VOCs. The IGWTP vapor phase is treated through granular activated carbon prior to discharge. The OU1 treatment system monitoring includes monthly sampling of effluent vapors and reporting of the air emissions results in the yearly OU1 Effectiveness Reports.

To address this request, Freescale calculated the total Potential to Emit (PTE) using the total VOC concentrations (excluding PCE and 1,1,1-TCA as specified by County rules) measured in groundwater samples collected from each extraction well for each month in 2013. The 2013 PTE results indicated a range of between 1.8 and 2.3 pounds per day of VOC emissions with an annual average of 2.1 pounds per day. EPA's consultant independently calculated the PTE and verified Freescale's calculations. Additionally, EPA's consultant calculated the PTE using the total VOCs including PCE and 1,1,1-TCA to ensure that no more than 3 lbs per day were emitted when these chemicals of concern were included in the emissions.

Freescale's approach used average flow rates and calculated an average daily mass. EPA's consultant used the yearly total flow by well divided by 365 to calculate a daily total. Under the EPA consultant's method, the average daily concentration was slightly higher (2.022 versus 1.85 pounds/day). Adding in the TCA and PCE resulted in an increase to 2.213 pounds per day. Under both approaches, the daily mass is well below the 3 pounds/day substantive requirement under the Maricopa County air rule. Using the EPA consultant's approach indicates it would take a 50% increase in either flow or concentration to exceed the 3 pounds per day limit.

The 2015 PTE results indicated the VOC removal efficiency of greater than 90 percent and an average monthly emission of 0.115 pounds per day or less. The PTE data indicates that the IGWTP has at a minimum been meeting the substantive Maricopa County air permit requirements since 2013.

1.1.7. Vapor Intrusion

In 2010, EPA Region 9 developed the Motorola 52nd Street (M52) Framework for Vapor Intrusion Investigation and Mitigation (Framework). This Framework includes a sampling approach and chemical-specific health-based screening levels for indoor air and subsurface soil gas samples. As EPA risk screening levels are updated, the Framework is updated. The current Framework was updated in August 2015 and applies to the entire M52 site. Additionally, EPA established an M52 OU1 interim action level for trichloroethene (TCE) of 1 ug/m^3 for indoor air in residential settings and between 3 ug/L and 8 ug/m^3 for TCE in indoor air in commercial settings. Mitigation is required for buildings meeting or exceeding these interim action levels.

Operable Unit 1 - Neighborhood Surrounding the Former M52 Plant Footprint - 2011-2016

- 79 soil vapor sample points (26 original and 53 step-out) were installed throughout OU1 and 77 of these points were sampled.
- When soil vapor data exceeded the health-based M52 Soil Gas Human Health Screening Levels, sub-slab and indoor air samples were collected during a cool season and a warm season.
- Cool and warm season indoor air was sampled at 115 residences, 4 schools and 7 commercial buildings.
- 15 outdoor air samples were collected.
- Where detected indoors, TCE ranged from 0.48 – 24 ug/m3.
- Indoor air mitigation systems (sub-slab depressurization) were installed if indoor air data was above the interim action level.
- Using this criteria, 17 homes have been mitigated (one building is a duplex).
- 1 vacant commercial building will be mitigated when it becomes ready for occupancy

Operable Unit 1 - 90 Acre Former Motorola 52nd St Facility Property Investigation - 2016

- 89 cool season soil gas samples were collected from 41 sample points installed.
- 46 cool season indoor air samples were collected from 10 buildings.
- 7 outdoor air samples were collected
- A maintenance area was resampled because an indoor air source caused elevated results. The indoor air source was removed and the area was resampled.
- Resample data indicates the area is not experiencing vapor intrusion.
- Indoor air results indicate vapor intrusion is not occurring at the former M52 Plant Property.
- Warm weather confirmatory indoor air sampling was conducted in July and August 2016.
- The summer 2016 data results indicates vapor intrusion is not occurring and the OU1 vapor intusion investigation is complete.

For OU1, EPA has addressed all immediate risks for vapor intrusion by this investigation and mitigation work, and is evaluating remedies to address long-term remediation.

1.1.8. Conclusions

Overall, the reduction in TCE concentrations in the alluvium and bedrock at and downgradient of the OCC indicates that continuous pumping of the OU1 is generally effective in capturing the majority of the width and depth of the plume and has had a beneficial effect on water quality. TCE concentration trends in select wells do, however, suggest that the northernmost extent of the plume may not be fully contained. EPA also has concerns that the full depth of the plume in bedrock may not be captured. An evaluation of the air emissions data from the OU1 groundwater treatment system indicates that the removal efficiency of the system is meeting the substantive air permit requirements under Maricopa County Rules for the IGWTP.

Vapor intrusion and mitigation work completed during the past 5 years have been addressed for immediate risks and long term remedies will be addressed in the future. A final RI/FS for the OU1 area is currently underway, including identifying any modifications to the existing OU1 remedy that may be necessary based on the ongoing RI/FS. The Remedial Investigation for OU1 is expected to be completed along with the human health risk assessment and feasibility study by 2019.

1.2. OU2 Data Review

This section describes the data review for OU2. Much of the information, including figures, for this review was taken directly form the 2015 OU2 Effectiveness Report (GHD. 2016).

1.2.1. OU2 Remedial Action Objectives (RAOs)

The remedial action objectives (RAOs) from the 1994 ROD as modified by the 1999 ESD are:

- Establish a capture zone across the entire width and depth of the contaminant plume near I-10.
- Reduce concentrations of contaminated groundwater within the alluvial aquifer upgradient of the extraction wells.
- The ESD remedy includes treatment of extracted groundwater via carbon adsorption VOCs, ultraviolet (UV) oxidation for vinyl chloride, and discharge of treated water to the SRP Grand Canal.

1.2.2. Treatment System

Approximately 712 million gallons (2,184 acre-ft) of water was treated in 2015 by the OU2 Area groundwater extraction system (GES). From startup in 2001 through 2015, over 14.9 billion gallons (45,588 acre-ft) of water has been treated by the OU2 Area GES and discharged to the Salt River

Project's (SRP) Grand Canal for irrigation purposes and beneficial re-use. All of the treated water met the discharge water quality standards for VOCs during 2015. The concentration for boron at the downstream monitoring point met the discharge criteria.

The OU2 Area GES removed approximately 289 pounds of VOCs in 2015 (0.41 pounds per million gallons) and has removed a calculated total of 14,718 pounds since startup (1.0 pounds per million gallons). Total VOC concentrations in the OU2 GES influent water have decreased from time of startup to December 2015. In December 2001, the baseline combined influent VOC concentration was 295.9 µg/L. In December 2015, the combined decreased influent VOC concentration was 53.2 µg/L. The annual amount of VOCs removed from the influent water has decreased from 3,674 pounds at the end of 2002 to 289 pounds in December 2015.

1.2.3. Drawdown

Since September 2001 (Baseline), water levels declined on average by 17.8 ft in monitoring wells in the OU2 Area due to operations of the OU2 Area GES and the continuing regional drought. Greater declines, up to 25 ft, are observed in select OU2 monitoring wells located in close proximity to the OU2 Area extraction wells. The principal decline in water levels occurred from 2001 through approximately 2004.

From 2005 through 2010, water levels were generally increasing, although the recovered water level elevations were lower than the 2001 baseline elevations. From 2010 through 2015, water levels declined again, consistent with regional observations. Despite the variability in the regional water level elevations from 2001 through 2015, the regional groundwater flow direction remains unchanged in the OU2 Area away from the GES, with groundwater generally flowing from east to west, with localized variations due to local hydrogeologic conditions.

Away from the OU2 Area GES, both upgradient and downgradient, the magnitude and direction of the hydraulic gradients were similar to baseline conditions. In the immediate vicinity of the GES, hydraulic gradients have increased, and these gradients have been locally reversed to the west of the OU2 Area GES. The September 2015 water elevation contour maps depict a cone-of-depression in the Salt River Gravel (SRG) and Basin Fill (BF) that center on the OU2 GES, with the resulting capture zone extending beyond the width of the observed plume in SRG and BF (Figures 3.7 through 3.9).

1.2.4. Capture Zone Determination

An evaluation of capture zones (EPA, 2008) was utilized to evaluate the capture zone of the OU2 GES. The interim remedy objective of the OU2 GES and the Target Capture Zone (TCZ) is to contain the entire north-south width and depth of the VOC plume, namely TCE, (the primary COC) above the maximum contaminant level (MCL) within the alluvial aquifer in the area of Interstate 10 (I-10); the TCZ has already been identified (Figures 3-7 and 3-8).

Water budget and capture zone calculations and evaluation of 2015 potentiometric surface maps all conclude that that the full width of the plume is hydraulically contained by the OU2 groundwater remedy system. Additionally, decreasing contaminant concentration trends downgradient of the OU2 GES and

decreasing trends along flow paths showthat hydraulic containment of the SRG and the BF is achieved at the TCZs. However, EPA has concerns regarding capture at the southern edge of the plume in the BF due to decreasing flow in the OU2 GES extraction wells. Capture in the southern portion of the BF is not likely sufficiently robust. TCE concentrations above the MCL have been observed in wells NW14-D, NW09-D and NW07-D since 2011. These wells are located downgradient of the capture zone and indicate that the there may be leakage in the capture zone and capture of the entire plume extent may be less likely to continue with further water level reductions due to drought and dewatering. While the concentrations are relatively low in these three wells, wells located upgradient of these three wells have higher TCE concentrations and have shown increasing concentration trends. Operation of the OU2 Area GES is improving water quality.

In general, converging lines of evidence from multiple evaluation techniques of the water level and water quality data indicate that the OU2 Area GES is capturing the full width and depth of the groundwater plume in the OU2 Area. All lines of evidence, outlined in the capture zone evaluation, support the conclusion that hydraulic containment is being provided by the OU2 Area GES wells beyond the plume boundary to the north. The September 2015 water elevation data and converging lines of evidence, including water elevation changes and VOC concentration trends at monitoring wells in the vicinity and downgradient of the OU2 Area GES, corroborate the conclusion that the capture zone extends across the southern plume boundary in SRG and appears to the case for BF.

1.2.5. TCE Concentrations in Groundwater

The expected trend in concentrations varies by location. As expected, a temporary increase in VOC concentrations, attributable to an additional mass of VOC moving past a specific well location, is observed in a number of wells upgradient of the OU2 Area GES. Also, as expected, there has been a reduction in TCE concentrations in monitoring wells from baseline conditions in 1992 (Figure 3.16 through 3.18) to 2015 (Figure 3.22 through 3.25), in both alluvial subunits downgradient of the OU2 Area GES, due to the establishment and maintenance of the hydraulic capture zone by the OU2 Area GES pumping. Trends of TCE concentrations (Figures D3 and D4) generally show decreases over time with the exception of monitoring wells NW16-M and NW16-D, which have fluctuated significantly. A number of wells, including NW09-D, NW14-D, and NW19-D since 2011, indicating that the capture in the southern portion of OU2 is may not be as robust.

For example, in 2001 the maximum TCE concentrations in the Salt River Gravel (SRG), Basin Fill (BF) and Bedrock (BR) were 470 µg/L at monitoring well NW03, 870 ug/L at monitoring well DM509, and 320 µg/L at monitoring well ASE22-B, respectively. By 2015, the TCE concentrations at the same wells were 28.7 ug/L at NW03, 452 ug/L at DM509 and 2.8 ug/L at ASE22-B. While TCE concentrations were higher in 2015 at other monitoring wells, the wells with higher 2015 TCE concentrations were either not sampled in 2001 or not installed in 2001.

Finally, a reduction in plume width is observed in the vicinity of the OU2 Area GES. TCE plume width reduction since the startup of the OU2 Area GES is expected because of the localized groundwater flow

direction changes due to OU2 Area GES pumping, and because of the decrease in dissolved-phase concentrations due to extraction and treatment of the groundwater.

1.2.6. OU2 Treatment System Air Emissions

The OU2 Treatment system does not have air emissions as it is a closed loop system.

1.2.7. Conclusions

The 2015 O&M of the 20th Street Groundwater Treatment Facility continued with no significant issues. The discharged water met all discharge standards for VOCs and the system is operating as intended, and is expected to continue to perform as required by the 1996 Consent Decree. In addition to maintaining capture of the OU2 Area groundwater plume, indicators of the effectiveness of the OU2 Area GES, as detailed earlier in this report, are summarized as follows:

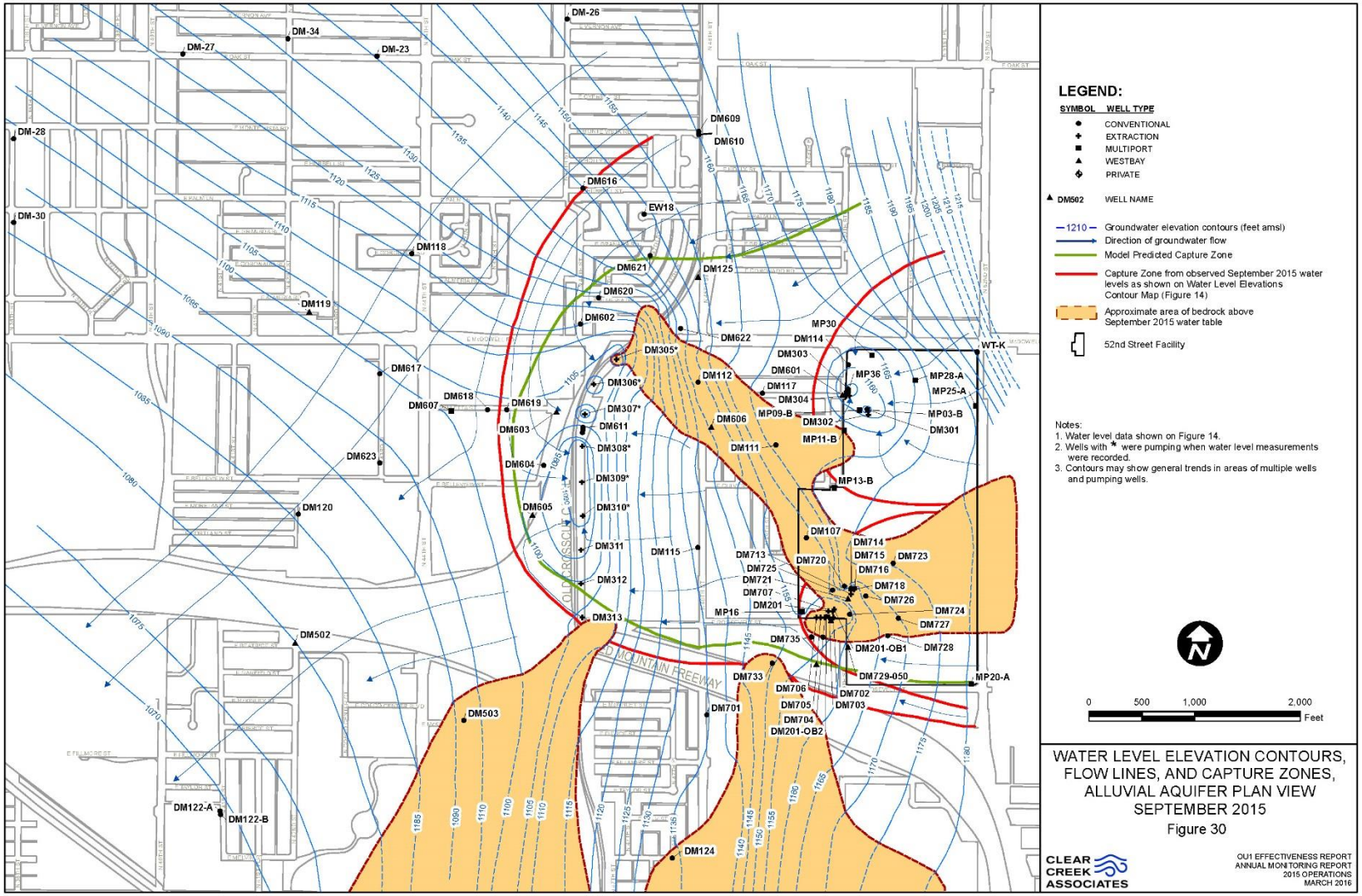
- A comparison of TCE concentrations and other VOCs between the Baseline period (September 2001) and September 2015, and between September 2006 (Second Baseline) and September 2015, shows an overall decrease in concentrations of TCE and other VOCs in the groundwater in each of the subunits downgradient of the OU2 Area GES.

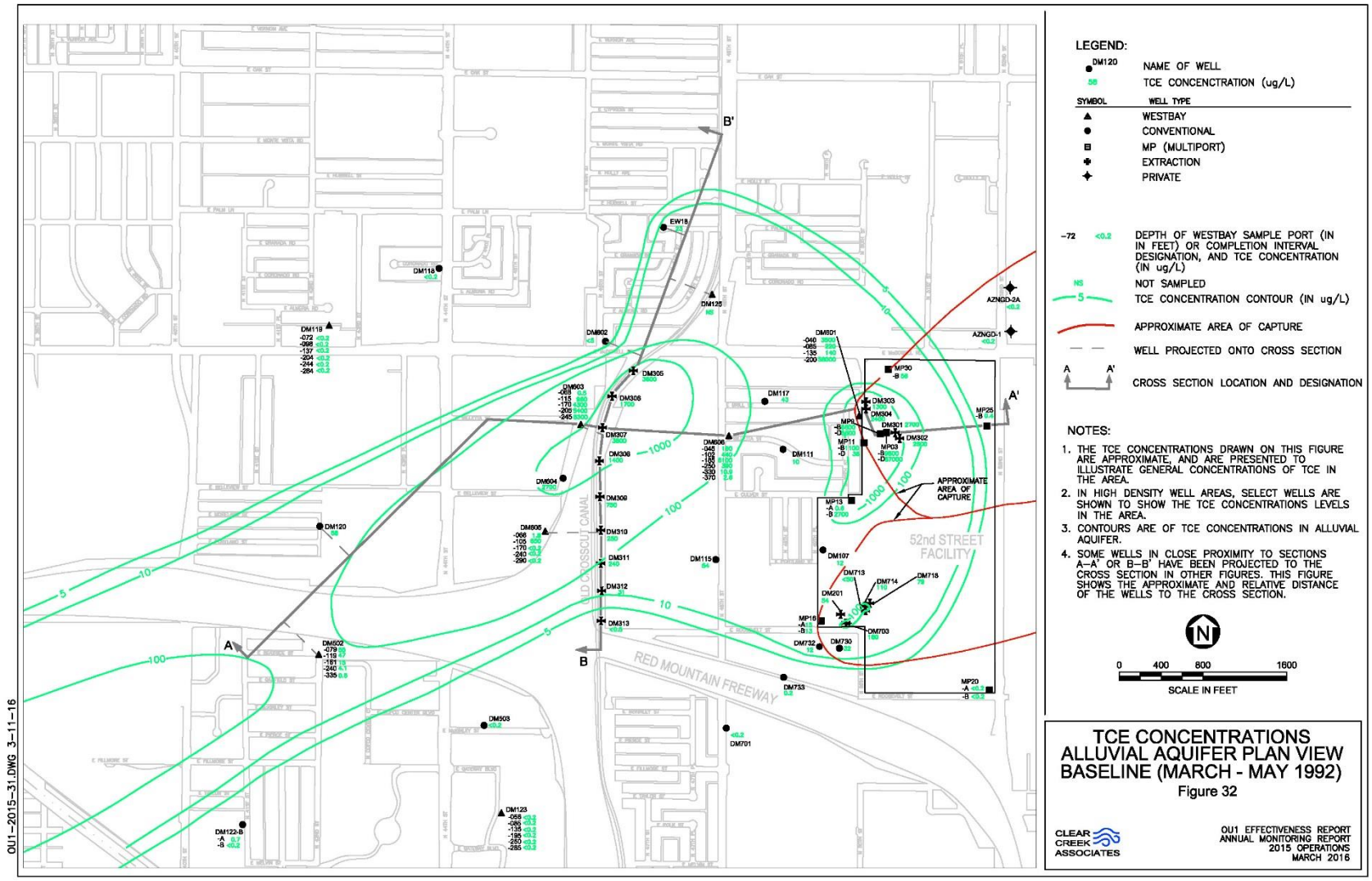
- A comparison of TCE concentrations from Baseline (September 2001) to September 2015 shows a decreasing TCE plume width in the vicinity of the OU2 Area extraction well locations.

- The OU2 Area GES is effectively removing VOCs from the groundwater, as documented by the groundwater analytical results for the combined influent to the treatment system, and the declining VOC concentrations in monitoring wells located in the vicinity of the OU2 Area GES.

- The OU2 Area treatment system is effectively treating the extracted groundwater to the specified discharge standards for VOCs, as documented by the groundwater analytical results for the treatment facility discharge and the discharge to the SRP Grand Canal.

Overall, the available data from multiple lines of evidence support the conclusion that the OU2 Area GES is functioning effectively and is positively affecting the entire width of the OU2 Area groundwater plume.


LEGEND:
SYMBOL WELL TYPE
CONVENTIONAL
EXTRACTION
MULTIPORT
WESTBAY
PRIVATE
DM502 WELL NAME
1210 Groundwater elevation contours (feet amsl)
Direction of groundwater flow
Model Predicted Capture Zone
Capture Zone from observed September 2015 water levels as shown on Water Level Elevations Contour Map (Figure 14)
Approximate area of bedrock above September 2015 water table
52nd Street Facility
Notes:
1. Water level data shown on Figure 14.
2. Wells with * were pumping when water level measurements were recorded.
3. Contours may show general trends in areas of multiple wells and pumping wells.
0 500 1,000 2,000
Feet
WATER LEVEL ELEVATION CONTOURS, FLOW LINES, AND CAPTURE ZONES, ALLUVIAL AQUIFER PLAN VIEW SEPTEMBER 2015
Figure 30
CLEAR CREEK ASSOCIATES
OU1 EFFECTIVENESS REPORT
ANNUAL MONITORING REPORT
2015 OPERATIONS
MARCH 2016

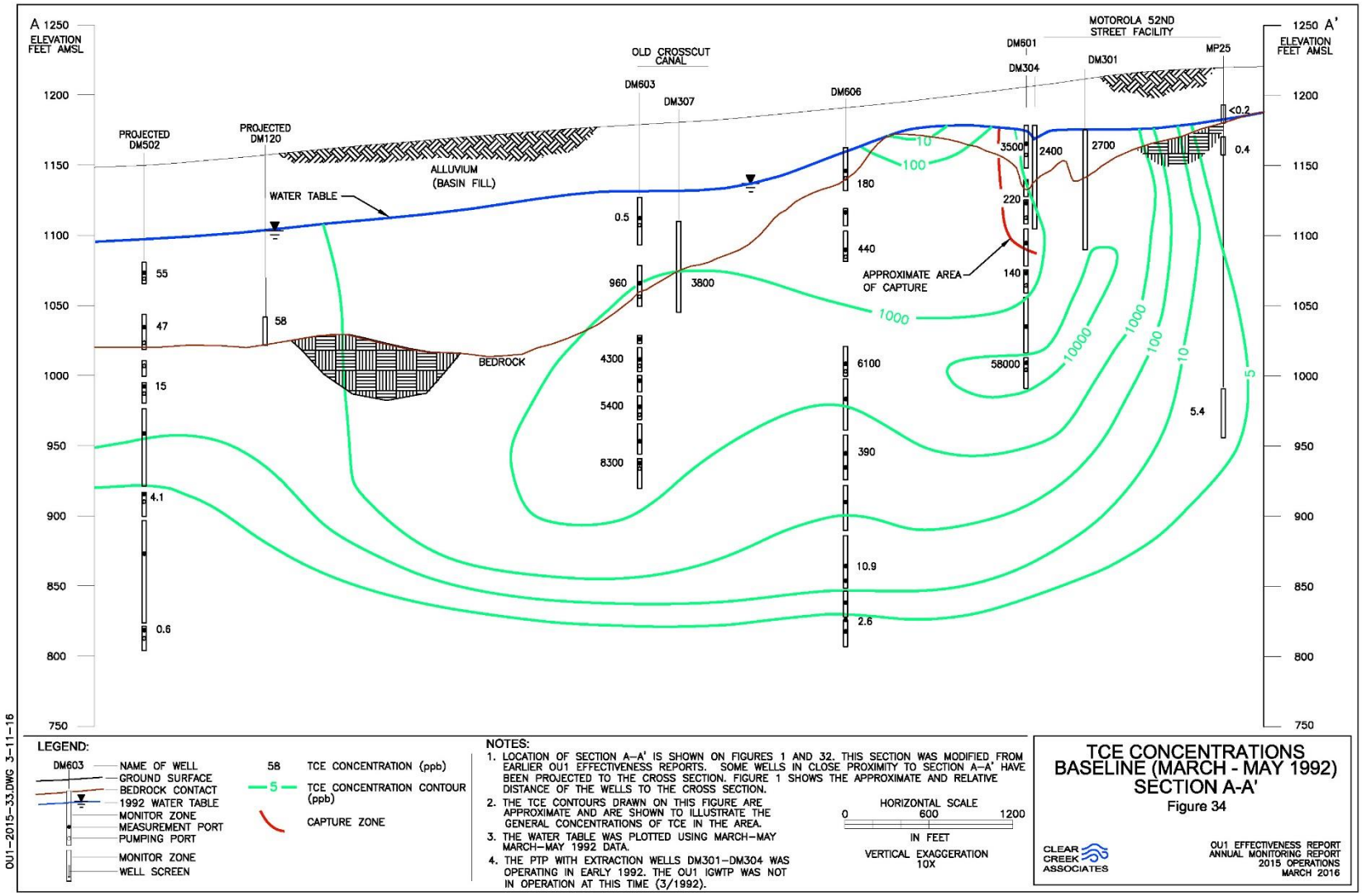


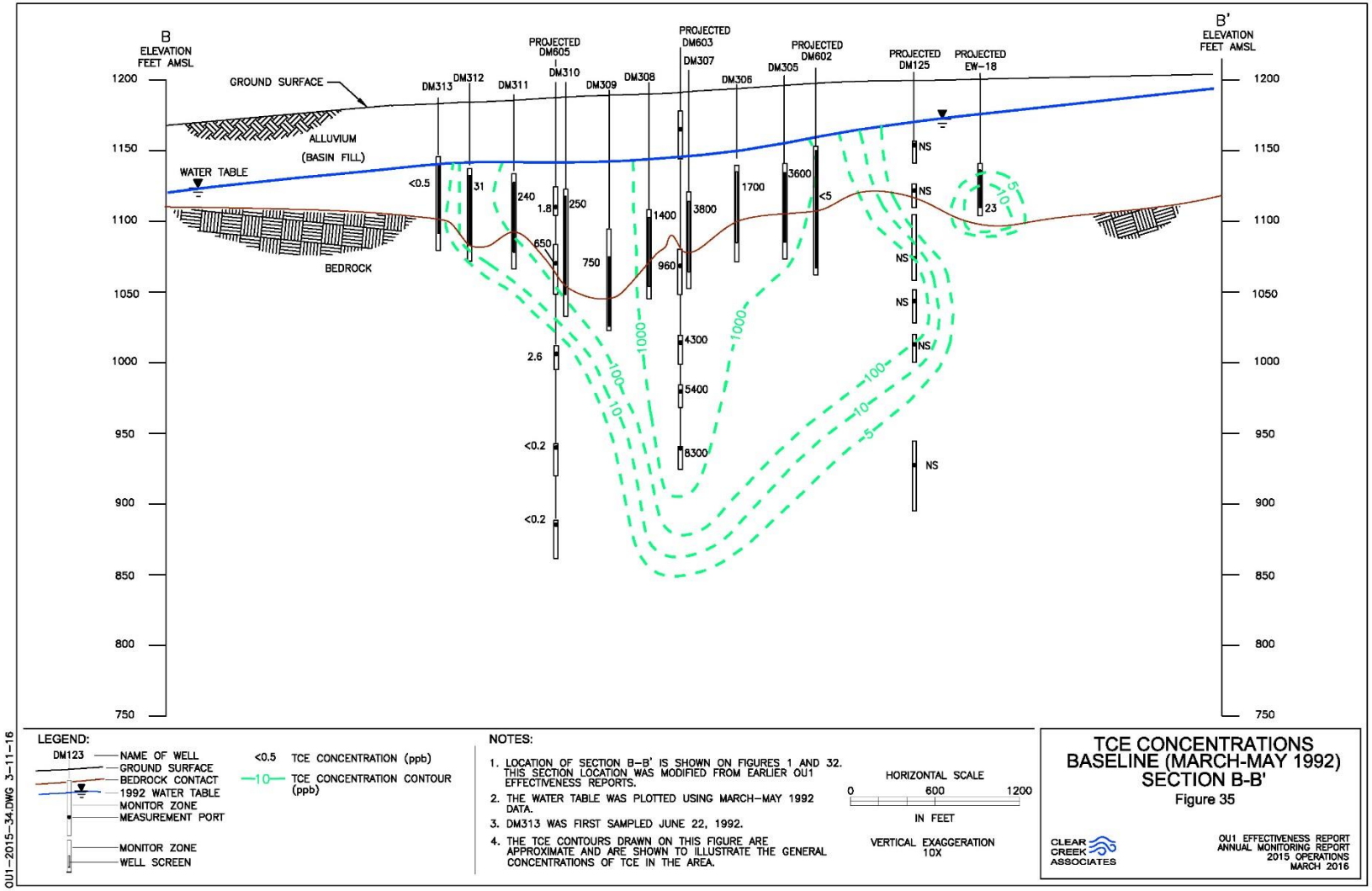
TCE CONCENTRATIONS ALLUVIAL AQUIFER PLAN VIEW BASELINE (MARCH - MAY 1992)

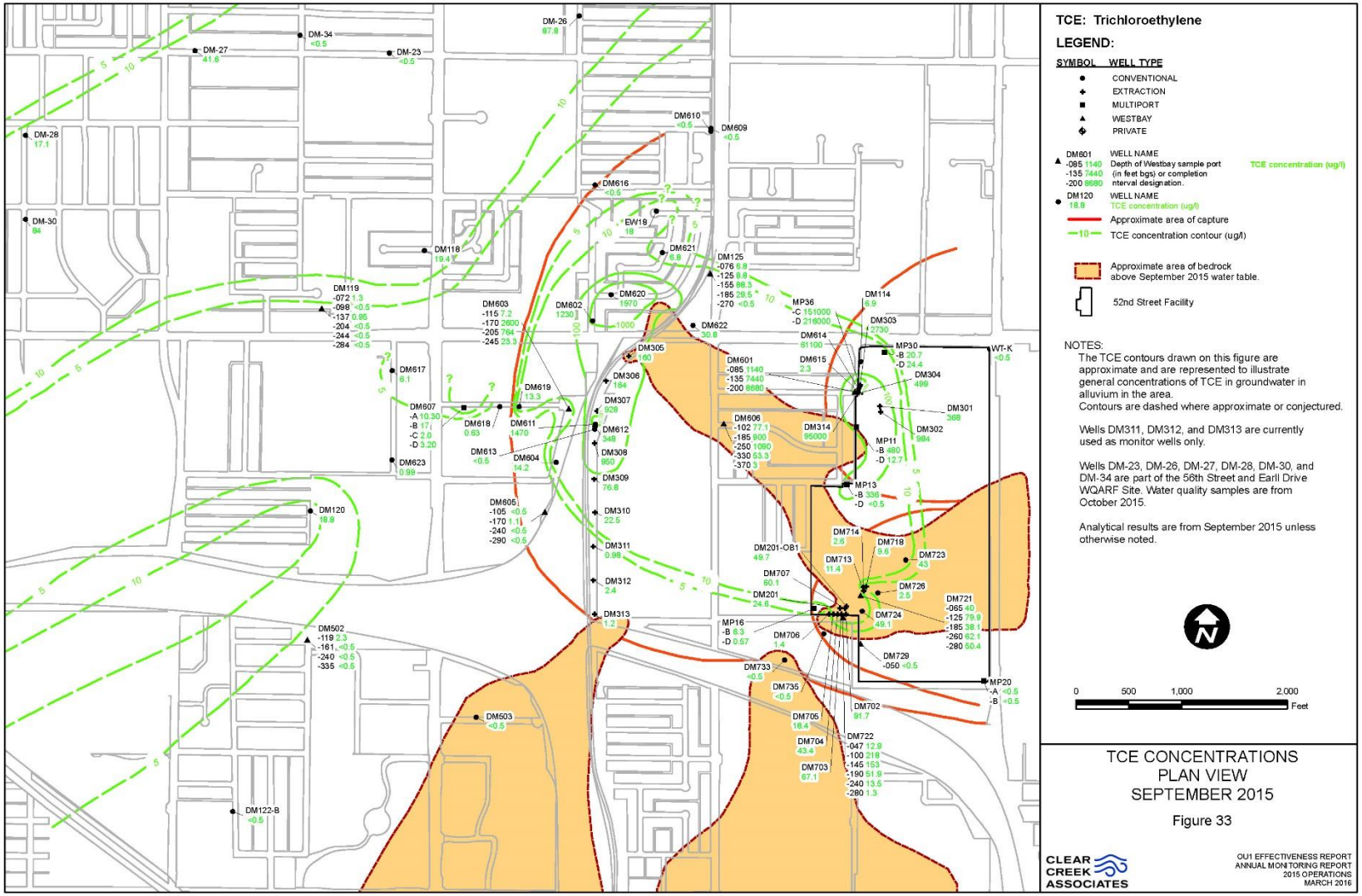
Figure 32

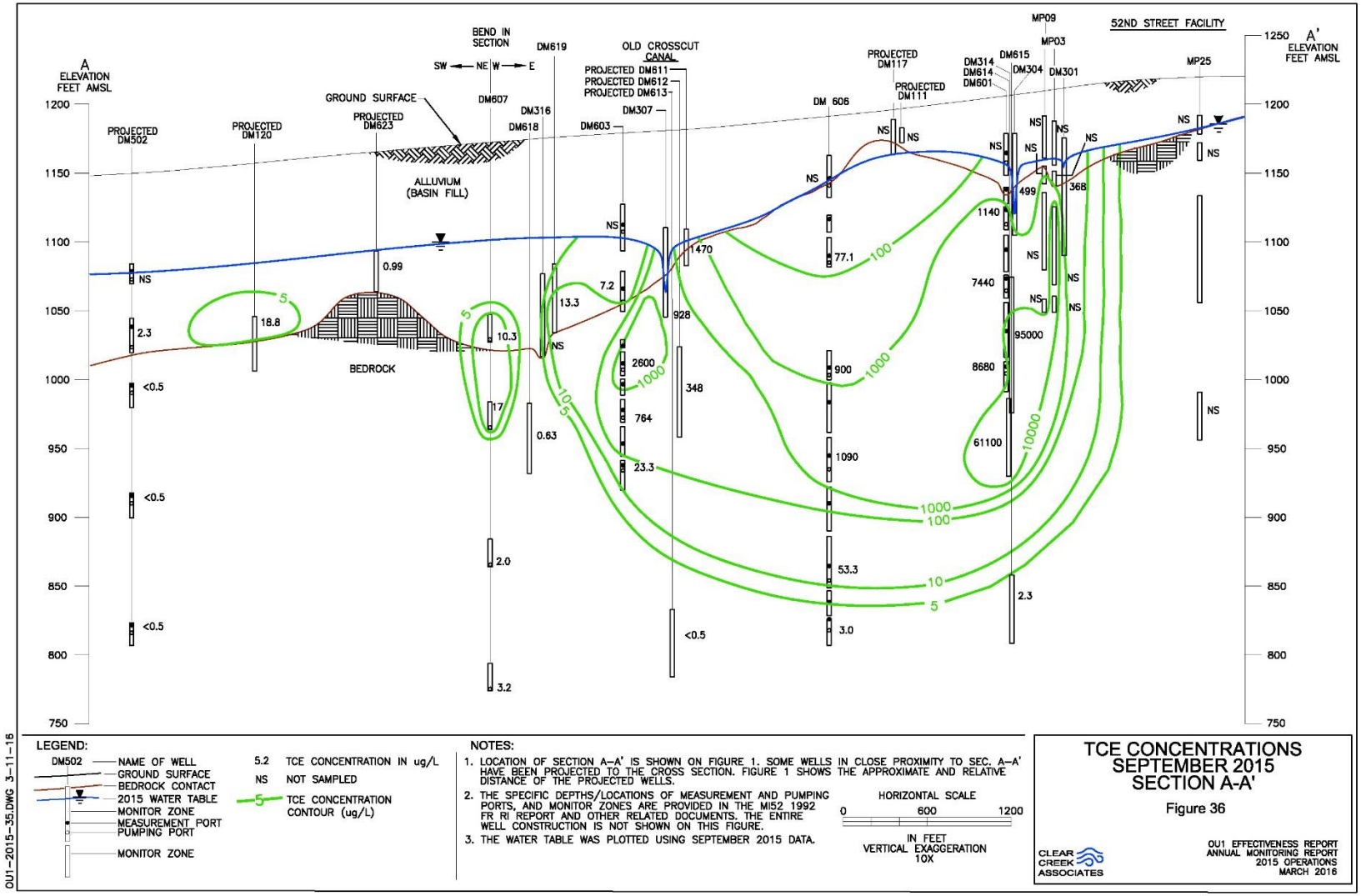
CLEAR CREEK ASSOCIATES

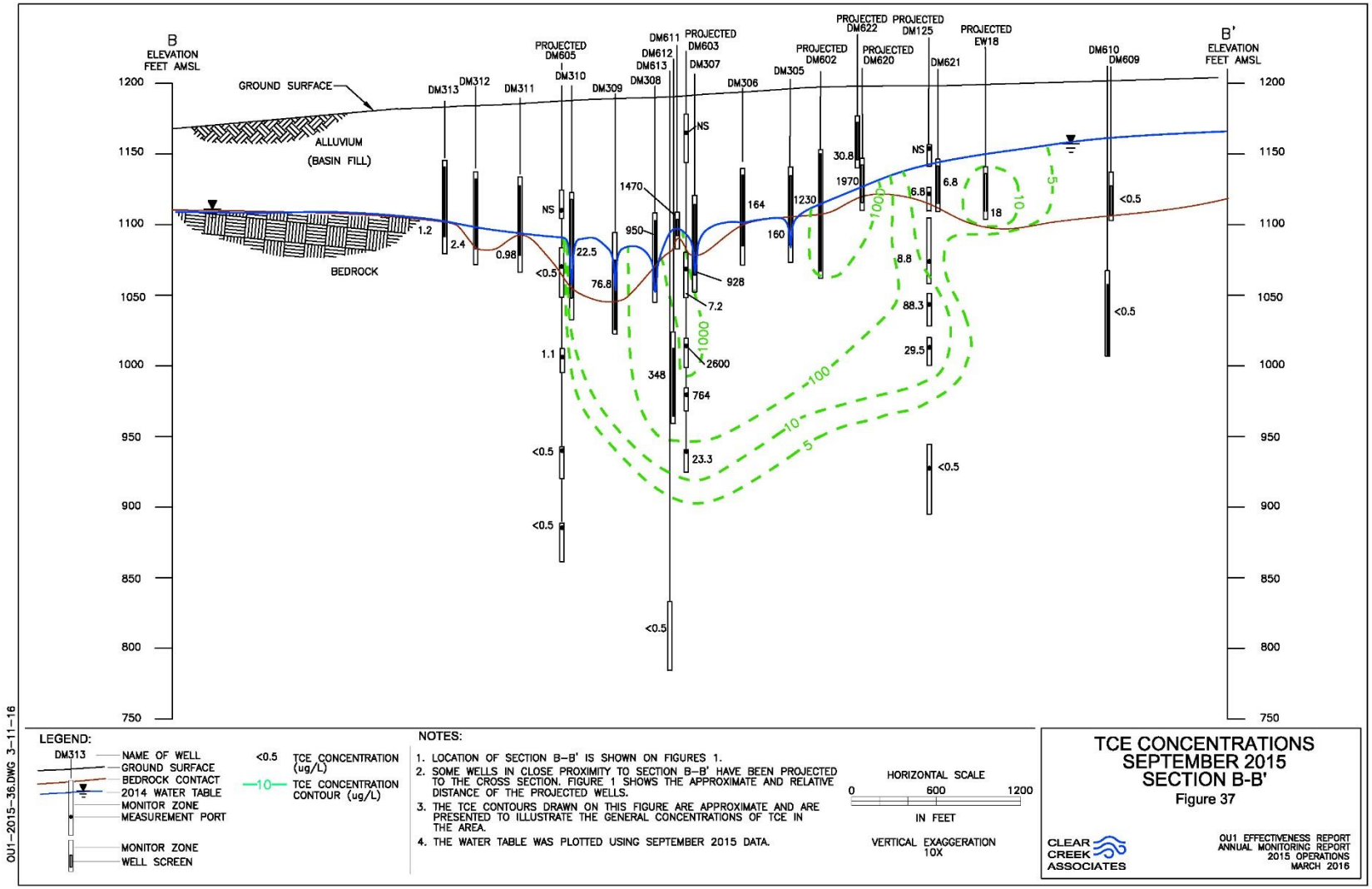
OU1 EFFECTIVENESS REPORT
ANNUAL MONITORING REPORT
2015 OPERATIONS
MARCH 2016

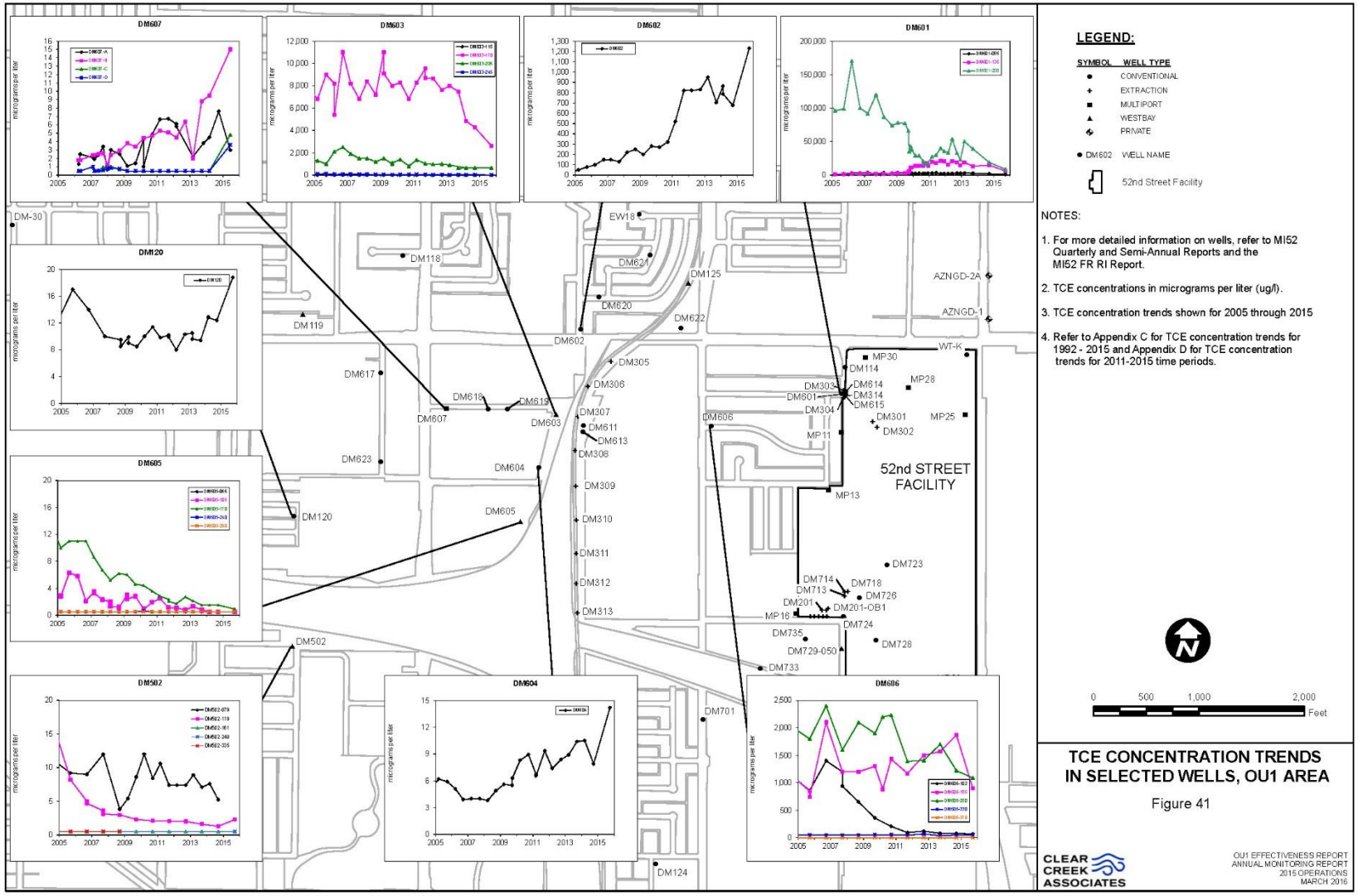

A
1250
ELEVATION FEET AMSL
1200
1150
1100
1050
1000
950
900
850
800
750
A'
PROJECTED DM502
PROJECTED DM120
OLD CROSSCUT CANAL
DM603
DM307
DM606
DM601
DM304
DM301
MOTOROLA 52ND STREET FACILITY
MP25
ALLUVIUM (BASIN FILL)
WATER TABLE
BEDROCK
APPROXIMATE AREA OF CAPTURE
55
47
15
4.1
0.6
58
0.5
960
4300
5400
8300
3800
180
440
6100
390
10.9
2.6
3500
2400
2700
220
140
58000
<0.2
0.4
5.4
10
100
1000
10000
5
LEGEND:
DM603
NAME OF WELL
GROUND SURFACE
BEDROCK CONTACT
1992 WATER TABLE
MONITOR ZONE
MEASUREMENT PORT
PUMPING PORT
MONITOR ZONE
WELL SCREEN
58
TCE CONCENTRATION (ppb)
5
TCE CONCENTRATION CONTOUR (ppb)
CAPTURE ZONE
NOTES:
1. LOCATION OF SECTION A–A' IS SHOWN ON FIGURES 1 AND 32. THIS SECTION WAS MODIFIED FROM EARLIER OU1 EFFECTIVENESS REPORTS. SOME WELLS IN CLOSE PROXIMITY TO SECTION A–A' HAVE BEEN PROJECTED TO THE CROSS SECTION. FIGURE 1 SHOWS THE APPROXIMATE AND RELATIVE DISTANCE OF THE WELLS TO THE CROSS SECTION.
2. THE TCE CONTOURS DRAWN ON THIS FIGURE ARE APPROXIMATE AND ARE SHOWN TO ILLUSTRATE THE GENERAL CONCENTRATIONS OF TCE IN THE AREA.
3. THE WATER TABLE WAS PLOTTED USING MARCH–MAY MARCH–MAY 1992 DATA.
4. THE PTP WITH EXTRACTION WELLS DM301–DM304 WAS OPERATING IN EARLY 1992. THE OU1 IGWTP WAS NOT IN OPERATION AT THIS TIME (3/1992).
HORIZONTAL SCALE
0
600
1200
IN FEET
VERTICAL EXAGGERATION
10X
TCE CONCENTRATIONS
BASELINE (MARCH - MAY 1992)
SECTION A-A'
Figure 34
CLEAR CREEK ASSOCIATES
OU1 EFFECTIVENESS REPORT
ANNUAL MONITORING REPORT
2015 OPERATIONS
MARCH 2016
OU1-2015-33.DWG 3-11-16

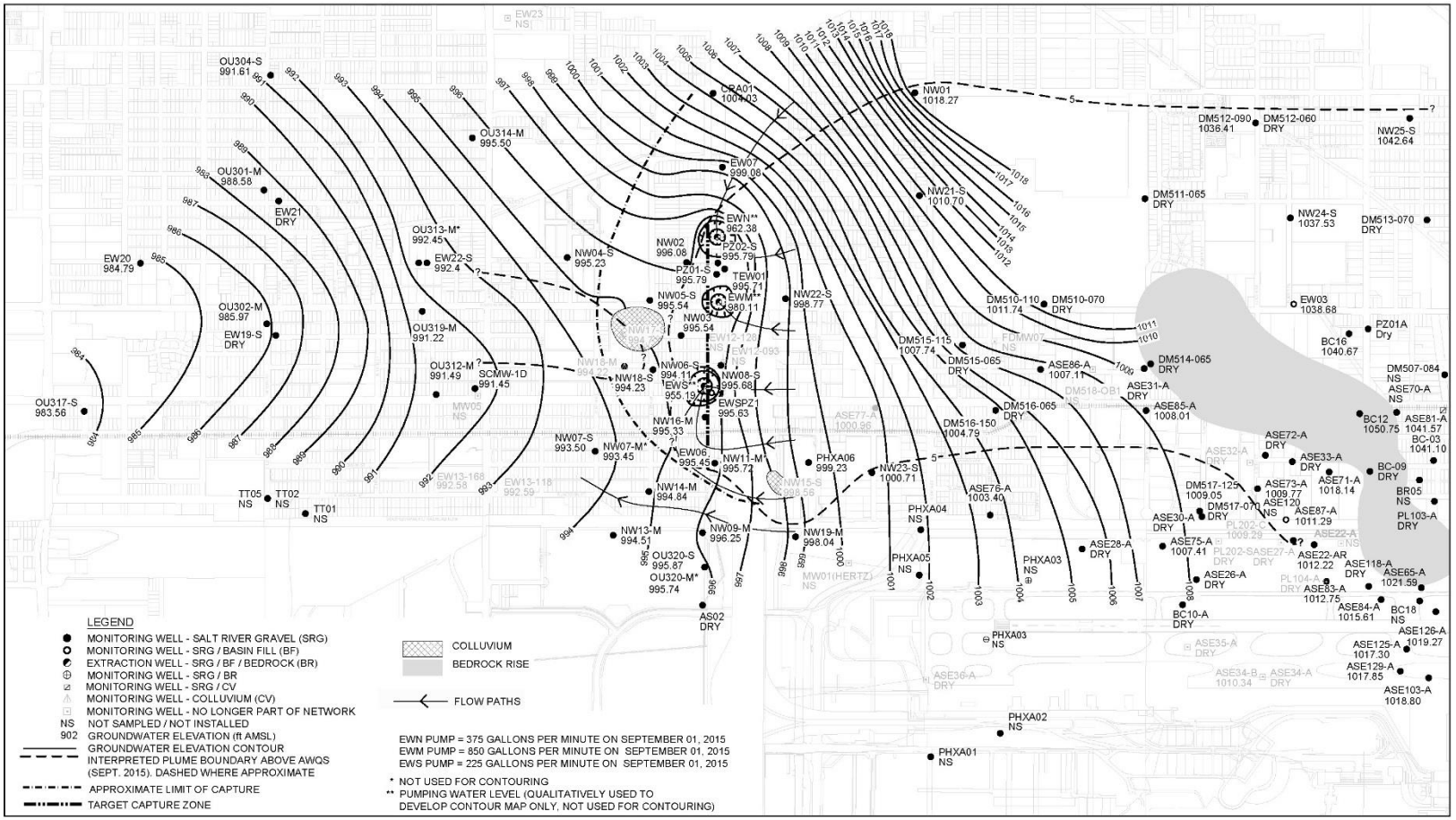

B
ELEVATION
FEET AMSL
B'
ELEVATION
FEET AMSL
GROUND SURFACE
ALLUVIUM
(BASIN FILL)
WATER TABLE
BEDROCK
DM313
DM312
DM311
PROJECTED DM605
DM310
DM309
DM308
PROJECTED DM603
DM307
DM306
DM305
PROJECTED DM602
PROJECTED DM125
PROJECTED EW-18
1200
1150
1100
1050
1000
950
900
850
800
750
<0.5
31
240
1.8
250
650
750
1400
960
3800
1700
3600
<5
2.6
4300
5400
8300
<0.2
<0.2
NS
NS
NS
NS
NS
NS
23
1000
100
10
5
LEGEND:
DM123 NAME OF WELL
GROUND SURFACE
BEDROCK CONTACT
1992 WATER TABLE
MONITOR ZONE
MEASUREMENT PORT
MONITOR ZONE
WELL SCREEN
<0.5 TCE CONCENTRATION (ppb)
10 TCE CONCENTRATION CONTOUR (ppb)
NOTES:
1. LOCATION OF SECTION B-B' IS SHOWN ON FIGURES 1 AND 32. THIS SECTION LOCATION WAS MODIFIED FROM EARLIER OU1 EFFECTIVENESS REPORTS.
2. THE WATER TABLE WAS PLOTTED USING MARCH-MAY 1992 DATA.
3. DM313 WAS FIRST SAMPLED JUNE 22, 1992.
4. THE TCE CONTOURS DRAWN ON THIS FIGURE ARE APPROXIMATE AND ARE SHOWN TO ILLUSTRATE THE GENERAL CONCENTRATIONS OF TCE IN THE AREA.
HORIZONTAL SCALE
0 600 1200
IN FEET
VERTICAL EXAGGERATION
10X
TCE CONCENTRATIONS
BASELINE (MARCH-MAY 1992)
SECTION B-B'
Figure 35
CLEAR CREEK ASSOCIATES
OU1 EFFECTIVENESS REPORT
ANNUAL MONITORING REPORT
2015 OPERATIONS
MARCH 2016
OU1-2015-34.DWG 3-11-16

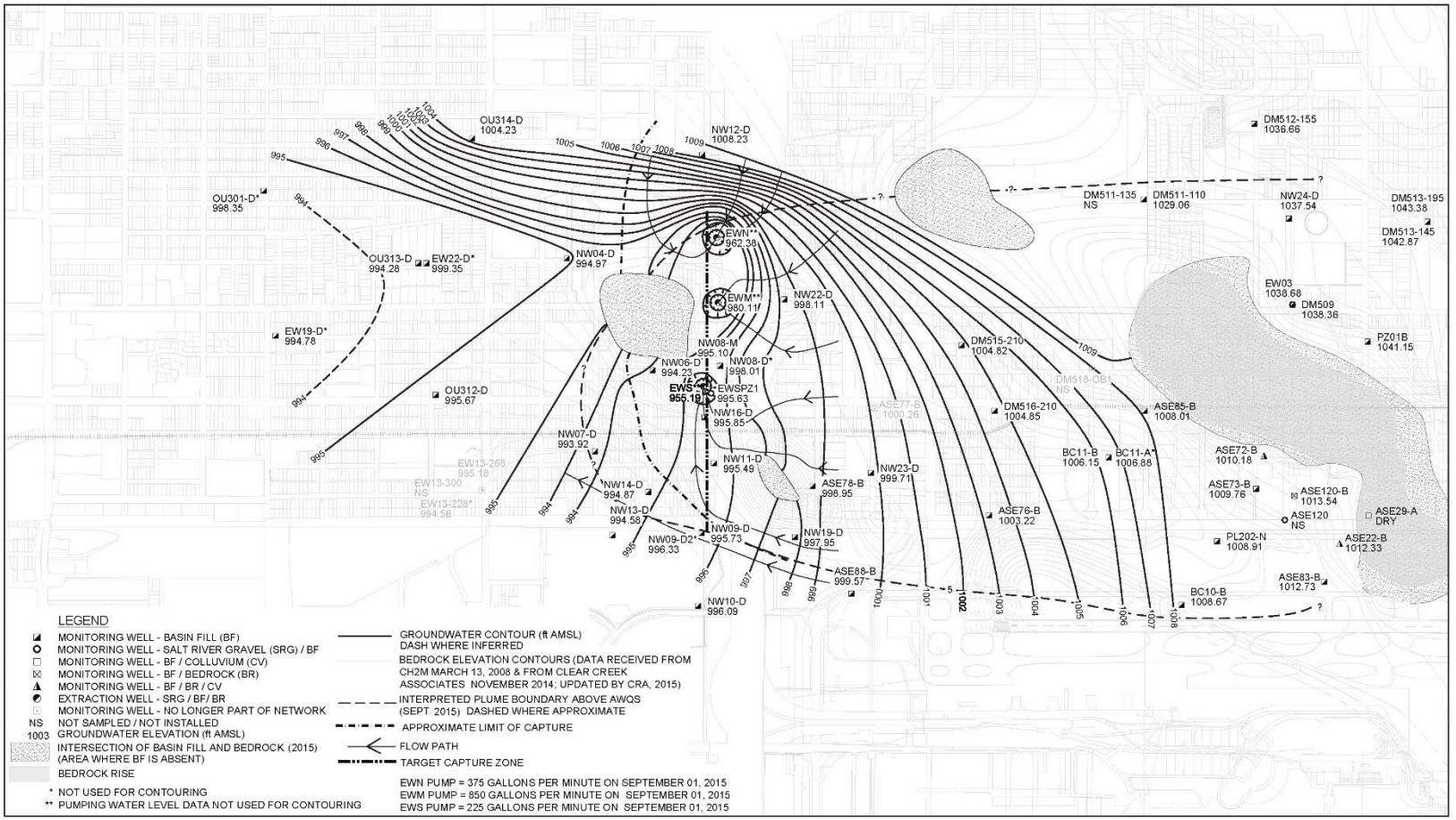

TCE: Trichloroethylene
LEGEND:
SYMBOL WELL TYPE
CONVENTIONAL
EXTRACTION
MULTIPORT
WESTBAY
PRIVATE
DM601 WELL NAME
-085 1140 Depth of Westbay sample port
-135 7440 (in feet bgs) or completion
-200 8680 interval designation.
TCE concentration (ug/l)
DM120 WELL NAME
18.8 TCE concentration (ug/l)
Approximate area of capture
10 TCE concentration contour (ug/l)
Approximate area of bedrock above September 2015 water table.
52nd Street Facility
NOTES:
The TCE contours drawn on this figure are approximate and are represented to illustrate general concentrations of TCE in groundwater in alluvium in the area.
Contours are dashed where approximate or conjectured.
Wells DM311, DM312, and DM313 are currently used as monitor wells only.
Wells DM-23, DM-26, DM-27, DM-28, DM-30, and DM-34 are part of the 56th Street and Earll Drive WQARF Site. Water quality samples are from October 2015.
Analytical results are from September 2015 unless otherwise noted.
0 500 1,000 2,000
Feet
TCE CONCENTRATIONS
PLAN VIEW
SEPTEMBER 2015
Figure 33
CLEAR CREEK ASSOCIATES
OU1 EFFECTIVENESS REPORT
ANNUAL MONITORING REPORT
2015 OPERATIONS
MARCH 2016


A
ELEVATION
FEET AMSL
A'
ELEVATION
FEET AMSL
52ND STREET FACILITY
BEND IN SECTION
SW NE W E
OLD CROSSCUT CANAL
GROUND SURFACE
ALLUVIUM (BASIN FILL)
BEDROCK
PROJECTED DM502
PROJECTED DM120
PROJECTED DM623
PROJECTED DM611
PROJECTED DM612
PROJECTED DM613
PROJECTED DM117
PROJECTED DM111
DM607
DM316
DM618
DM619
DM603
DM307
DM 606
DM314
DM614
DM601
DM615
DM304
MP09
MP03
DM301
MP25
1200
1150
1100
1050
1000
950
900
850
800
750
NS
2.3
<0.5
18.8
0.99
5
10.3
17
2.0
3.2
0.63
13.3
7.2
NS
2600
764
23.3
928
348
1470
<0.5
100
1000
105
77.1
900
1090
53.3
3.0
1000
100
10
5
NS
499
368
1140
7440
95000
8680
61100
10000
2.3
LEGEND:
DM502 NAME OF WELL
GROUND SURFACE
BEDROCK CONTACT
2015 WATER TABLE
MONITOR ZONE
MEASUREMENT PORT
PUMPING PORT
MONITOR ZONE
5.2 TCE CONCENTRATION IN ug/L
NS NOT SAMPLED
5 TCE CONCENTRATION CONTOUR (ug/L)
NOTES:
1. LOCATION OF SECTION A–A' IS SHOWN ON FIGURE 1. SOME WELLS IN CLOSE PROXIMITY TO SEC. A–A' HAVE BEEN PROJECTED TO THE CROSS SECTION. FIGURE 1 SHOWS THE APPROXIMATE AND RELATIVE DISTANCE OF THE PROJECTED WELLS.
2. THE SPECIFIC DEPTHS/LOCATIONS OF MEASUREMENT AND PUMPING PORTS, AND MONITOR ZONES ARE PROVIDED IN THE MI52 1992 FR RI REPORT AND OTHER RELATED DOCUMENTS. THE ENTIRE WELL CONSTRUCTION IS NOT SHOWN ON THIS FIGURE.
3. THE WATER TABLE WAS PLOTTED USING SEPTEMBER 2015 DATA.
HORIZONTAL SCALE
0 600 1200
IN FEET
VERTICAL EXAGGERATION 10X
TCE CONCENTRATIONS SEPTEMBER 2015 SECTION A-A'
Figure 36
CLEAR CREEK ASSOCIATES
OU1 EFFECTIVENESS REPORT ANNUAL MONITORING REPORT 2015 OPERATIONS MARCH 2016
OU1-2015-35.DWG 3-11-16


B
ELEVATION
FEET AMSL
B'
ELEVATION
FEET AMSL
GROUND SURFACE
ALLUVIUM
(BASIN FILL)
BEDROCK
DM313
DM312
DM311
PROJECTED DM605
DM310
DM309
DM611
DM612
DM613
DM308
PROJECTED DM603
DM307
DM306
DM305
PROJECTED DM602
PROJECTED DM622
PROJECTED DM620
PROJECTED DM125
DM621
PROJECTED EW18
DM610
DM609
1200
1150
1100
1050
1000
950
900
850
800
750
1.2
2.4
0.98
NS
<0.5
22.5
76.8
1.1
<0.5
<0.5
1470
950
NS
928
7.2
2600
348
764
23.3
<0.5
164
160
1230
1970
30.8
NS
6.8
6.8
18
8.8
88.3
29.5
<0.5
<0.5
<0.5
100
10
5
1000
100
10
5
LEGEND:
DM313
NAME OF WELL
GROUND SURFACE
BEDROCK CONTACT
2014 WATER TABLE
MONITOR ZONE
MEASUREMENT PORT
MONITOR ZONE
WELL SCREEN
<0.5
TCE CONCENTRATION (ug/L)
10
TCE CONCENTRATION CONTOUR (ug/L)
NOTES:
1. LOCATION OF SECTION B–B' IS SHOWN ON FIGURES 1.
2. SOME WELLS IN CLOSE PROXIMITY TO SECTION B–B' HAVE BEEN PROJECTED TO THE CROSS SECTION. FIGURE 1 SHOWS THE APPROXIMATE AND RELATIVE DISTANCE OF THE PROJECTED WELLS.
3. THE TCE CONTOURS DRAWN ON THIS FIGURE ARE APPROXIMATE AND ARE PRESENTED TO ILLUSTRATE THE GENERAL CONCENTRATIONS OF TCE IN THE AREA.
4. THE WATER TABLE WAS PLOTTED USING SEPTEMBER 2015 DATA.
HORIZONTAL SCALE
0
600
1200
IN FEET
VERTICAL EXAGGERATION
10X
TCE CONCENTRATIONS
SEPTEMBER 2015
SECTION B-B'
Figure 37
CLEAR CREEK ASSOCIATES
OU1 EFFECTIVENESS REPORT
ANNUAL MONITORING REPORT
2015 OPERATIONS
MARCH 2016
OU1-2015-36.DWG 3-11-16


DM607
DM603
DM602
DM601
micrograms per liter
DM-30
DM118
DM119
DM120
DM617
DM618
DM619
DM607
DM603
DM624
DM125
DM620
DM622
DM602
EW18
AZNGD-2A
AZNGD-1
DM305
DM306
DM307
DM611
DM613
DM308
DM309
DM310
DM311
DM312
DM313
DM623
DM604
DM605
DM120
DM606
WT-K
MP30
DM114
MP28
DM303
DM614
DM314
DM615
DM601
DM304
DM301
MP25
DM302
MP11
52nd STREET FACILITY
MP13
DM723
DM714
DM718
DM713
DM726
DM201
DM201-OB1
MP16
DM724
DM735
DM728
DM729-050
DM733
DM502
DM701
DM124
DM605
DM604
DM606
DM502
LEGEND:
SYMBOL WELL TYPE
CONVENTIONAL
EXTRACTION
MULTIPORT
WESTBAY
PRIVATE
DM602 WELL NAME
52nd Street Facility
NOTES:
1. For more detailed information on wells, refer to MI52 Quarterly and Semi-Annual Reports and the MI52 FR RI Report.
2. TCE concentrations in micrograms per liter (ug/l).
3. TCE concentration trends shown for 2005 through 2015
4. Refer to Appendix C for TCE concentration trends for 1992 - 2015 and Appendix D for TCE concentration trends for 2011-2015 time periods.
0 500 1,000 2,000
Feet
TCE CONCENTRATION TRENDS IN SELECTED WELLS, OU1 AREA
Figure 41
CLEAR CREEK ASSOCIATES
OU1 EFFECTIVENESS REPORT
ANNUAL MONITORING REPORT
2015 OPERATIONS
MARCH 2016


LEGEND
MONITORING WELL - SALT RIVER GRAVEL (SRG)
MONITORING WELL - SRG / BASIN FILL (BF)
EXTRACTION WELL - SRG / BF / BEDROCK (BR)
MONITORING WELL - SRG / BR
MONITORING WELL - SRG / CV
MONITORING WELL - COLLUVIUM (CV)
MONITORING WELL - NO LONGER PART OF NETWORK
NS NOT SAMPLED / NOT INSTALLED
902 GROUNDWATER ELEVATION (ft AMSL)
GROUNDWATER ELEVATION CONTOUR
INTERPRETED PLUME BOUNDARY ABOVE AWQS (SEPT. 2015). DASHED WHERE APPROXIMATE
APPROXIMATE LIMIT OF CAPTURE
TARGET CAPTURE ZONE
COLLUVIUM
BEDROCK RISE
FLOW PATHS
EWN PUMP = 375 GALLONS PER MINUTE ON SEPTEMBER 01, 2015
EWM PUMP = 850 GALLONS PER MINUTE ON SEPTEMBER 01, 2015
EWS PUMP = 225 GALLONS PER MINUTE ON SEPTEMBER 01, 2015
* NOT USED FOR CONTOURING
** PUMPING WATER LEVEL (QUALITATIVELY USED TO DEVELOP CONTOUR MAP ONLY, NOT USED FOR CONTOURING)
0 550 1100ft
N
GHD
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE, PHOENIX, ARIZONA
EFFECTIVENESS REPORT - 2015
013932-151
Mar 28, 2016
GROUNDWATER ELEVATIONS - SEPTEMBER 2015 - SRG
FIGURE 3.7

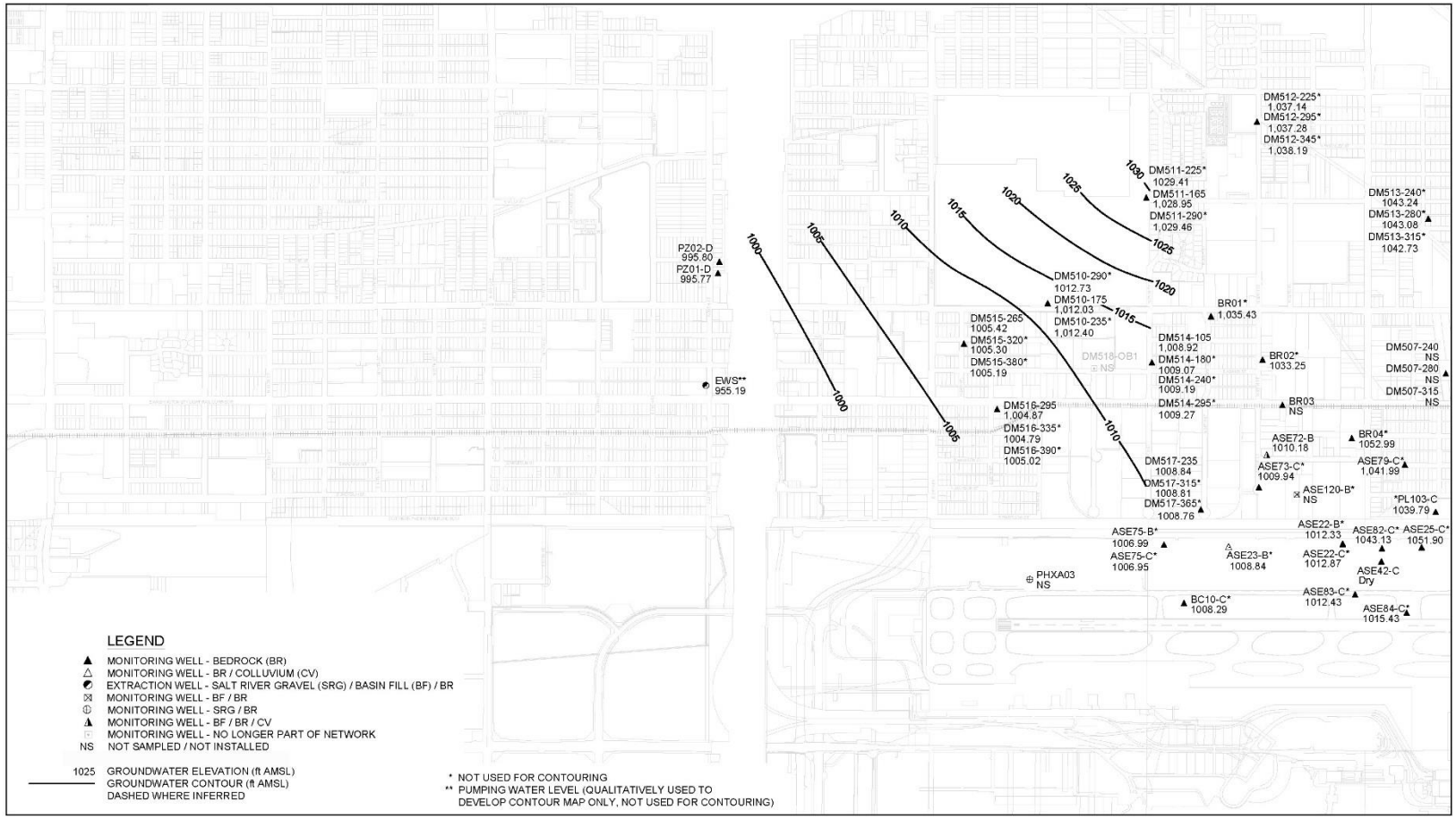


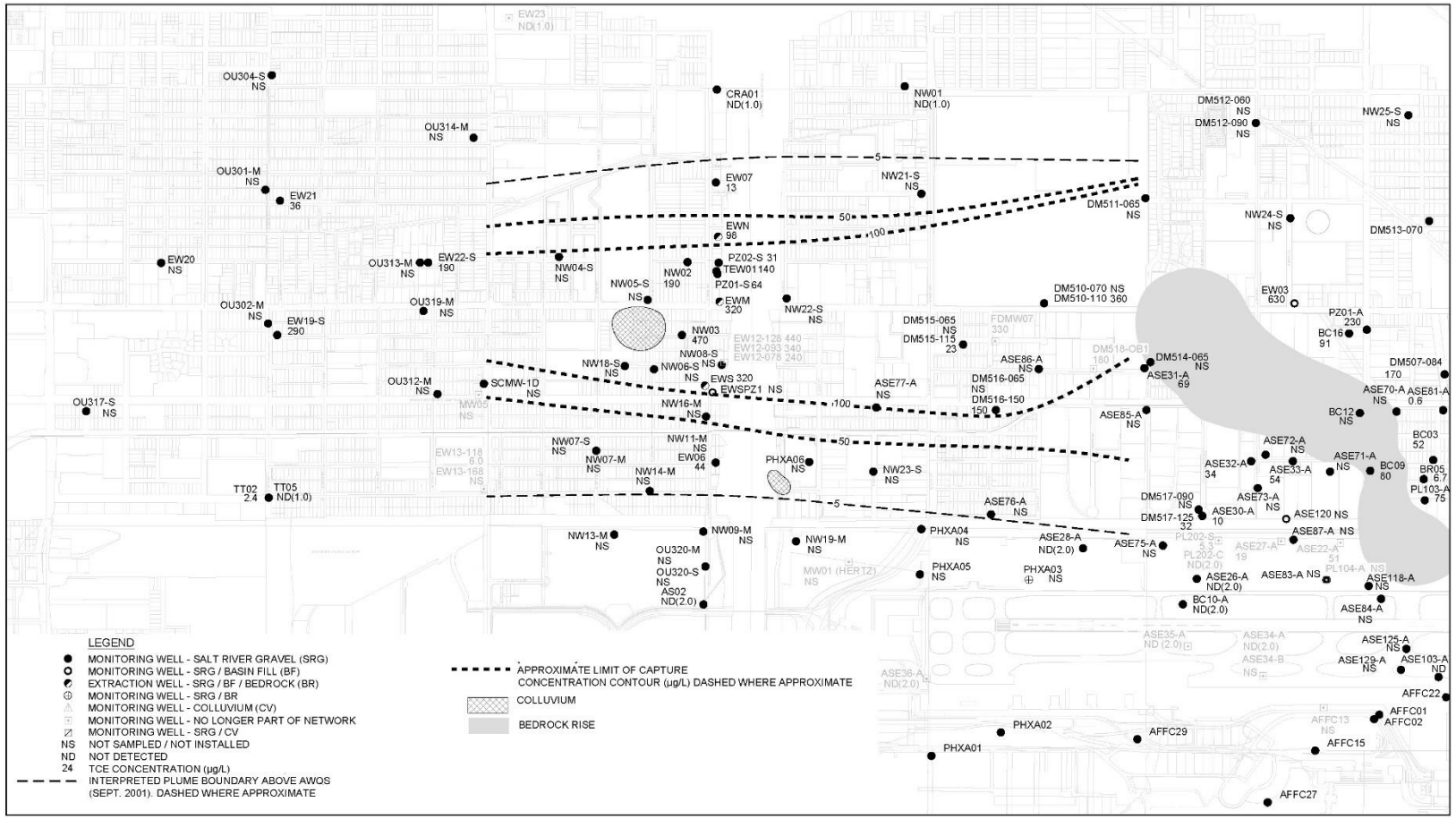
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE, PHOENIX, ARIZONA
EFFECTIVENESS REPORT - 2015

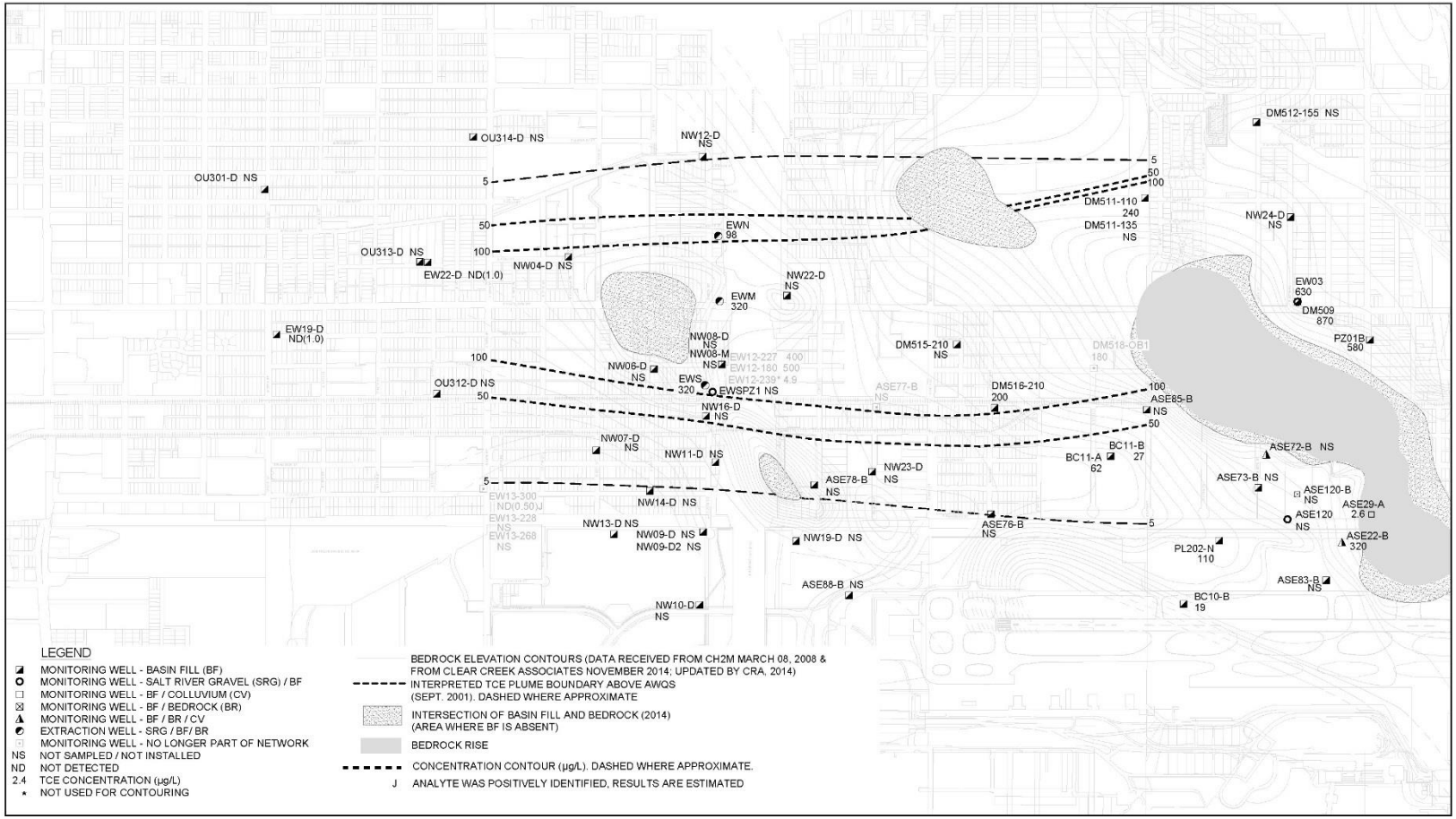
013932-151
Mar 28, 2016

GROUNDWATER ELEVATIONS - SEPTEMBER 2015 - BF

FIGURE 3.8


PZ02-D
995.80
PZ01-D
995.77
EWS**
955.19
DM510-290*
1012.73
DM510-175
1,012.03
DM510-235*
1,012.40
DM515-265
1005.42
DM515-320*
1005.30
DM515-380*
1005.19
DM516-295
1,004.87
DM516-335*
1004.79
DM516-390*
1005.02
DM511-225*
1029.41
DM511-165
1,028.95
DM511-290*
1,029.46
DM512-225*
1,037.14
DM512-295*
1,037.28
DM512-345*
1,036.19
BR01*
1,035.43
DM514-105
1,008.92
DM514-180*
1009.07
DM514-240*
1009.19
DM514-295*
1009.27
DM518-OB1
NS
BR02*
1033.25
BR03
NS
DM513-240*
1043.24
DM513-280*
1043.08
DM513-315*
1042.73
DM507-240
NS
DM507-280
NS
DM507-315
NS
ASE72-B
1010.18
ASE73-C*
1009.94
BR04*
1052.99
ASE79-C*
1,041.99
ASE120-B*
NS
*PL103-C
1039.79
DM517-235
1008.84
DM517-315*
1008.81
DM517-365*
1008.76
ASE75-B*
1006.99
ASE75-C*
1006.95
ASE23-B*
1008.84
ASE22-B*
1012.33
ASE22-C*
1012.87
ASE82-C*
1043.13
ASE25-C*
1051.90
ASE42-C
Dry
PHXA03
NS
BC10-C*
1008.29
ASE83-C*
1012.43
ASE84-C*
1015.43
1000
1005
1010
1015
1020
1025
1030
LEGEND
MONITORING WELL - BEDROCK (BR)
MONITORING WELL - BR / COLLUVIUM (CV)
EXTRACTION WELL - SALT RIVER GRAVEL (SRG) / BASIN FILL (BF) / BR
MONITORING WELL - BF / BR
MONITORING WELL - SRG / BR
MONITORING WELL - BF / BR / CV
MONITORING WELL - NO LONGER PART OF NETWORK
NS NOT SAMPLED / NOT INSTALLED
1025 GROUNDWATER ELEVATION (ft AMSL)
GROUNDWATER CONTOUR (ft AMSL)
DASHED WHERE INFERRED
* NOT USED FOR CONTOURING
** PUMPING WATER LEVEL (QUALITATIVELY USED TO DEVELOP CONTOUR MAP ONLY, NOT USED FOR CONTOURING)
0 550 1100ft
N
GHD
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE, PHOENIX, ARIZONA
EFFECTIVENESS REPORT - 2015
013932-151
Feb 24, 2016
GROUNDWATER ELEVATIONS - SEPTEMBER 2015 - BR
FIGURE 3.9


LEGEND
MONITORING WELL - SALT RIVER GRAVEL (SRG)
MONITORING WELL - SRG / BASIN FILL (BF)
EXTRACTION WELL - SRG / BF / BEDROCK (BR)
MONITORING WELL - SRG / BR
MONITORING WELL - COLLUVIUM (CV)
MONITORING WELL - NO LONGER PART OF NETWORK
MONITORING WELL - SRG / CV
NS NOT SAMPLED / NOT INSTALLED
ND NOT DETECTED
24 TCE CONCENTRATION (µg/L)
INTERPRETED PLUME BOUNDARY ABOVE AWOS (SEPT. 2001). DASHED WHERE APPROXIMATE
APPROXIMATE LIMIT OF CAPTURE CONCENTRATION CONTOUR (µg/L) DASHED WHERE APPROXIMATE
COLLUVIUM
BEDROCK RISE
0 550 1100ft
N
GHD
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE, PHOENIX, ARIZONA
EFFECTIVENESS REPORT - 2015
BASELINE TCE CONCENTRATIONS
SEPTEMBER 2001 - SRG
013932-151
Mar 29, 2016
FIGURE 3.17



0 550 1100ft

N

GHD

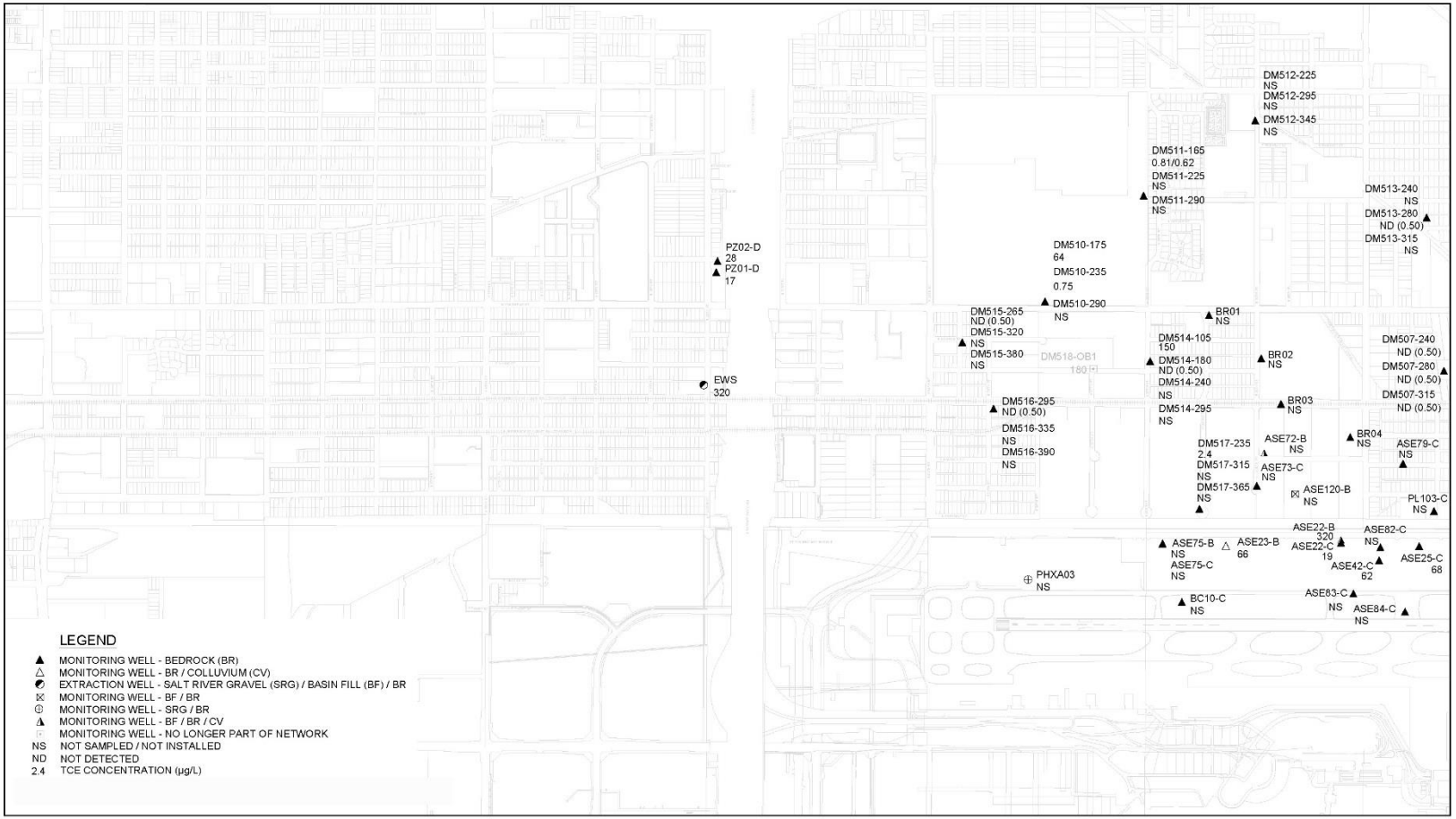
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE, PHOENIX, ARIZONA
EFFECTIVENESS REPORT - 2015

BASELINE TCE CONCENTRATIONS
SEPTEMBER 2001 - BF

013932-151
Mar 29, 2016

FIGURE 3.18

CAD File: I:\CAD\Drawing\013000s\013932\013932-REPORTS\13932-151\013932-151(34)\013932-151(34)GN-PX010 FIGURE 3.18.dwg



0 550 1100ft

N

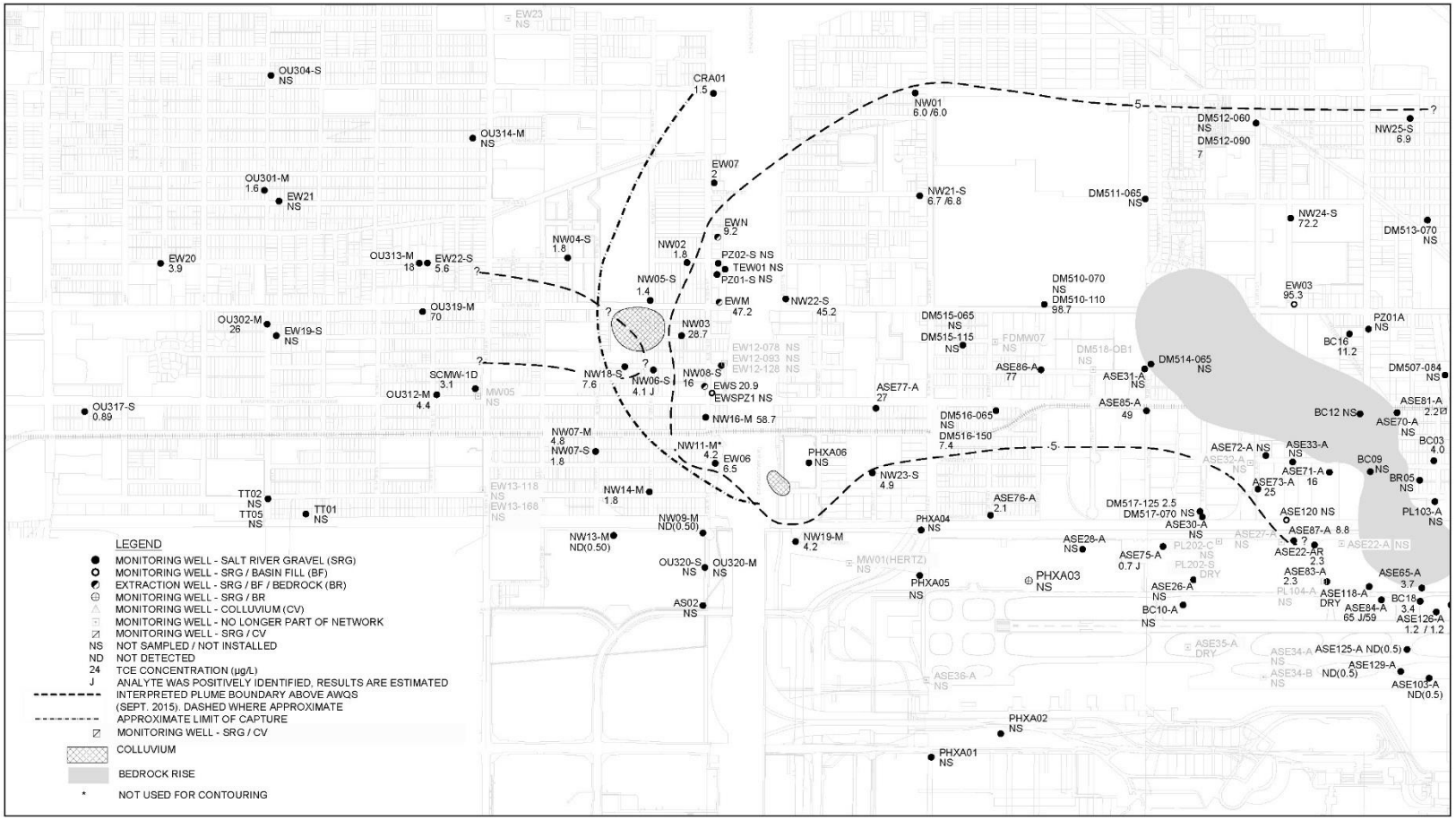
GHD

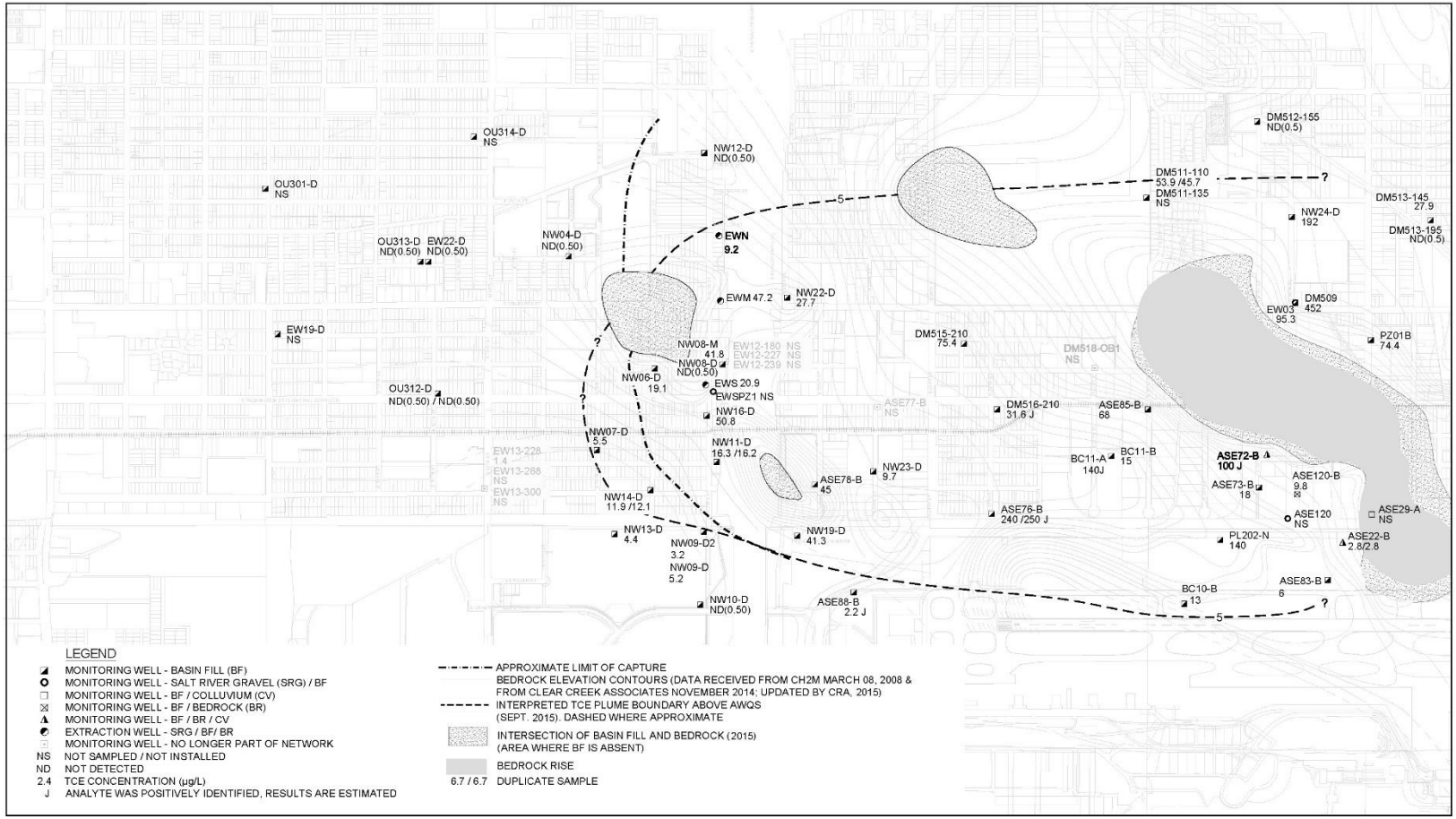
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE, PHOENIX, ARIZONA
EFFECTIVENESS REPORT - 2015

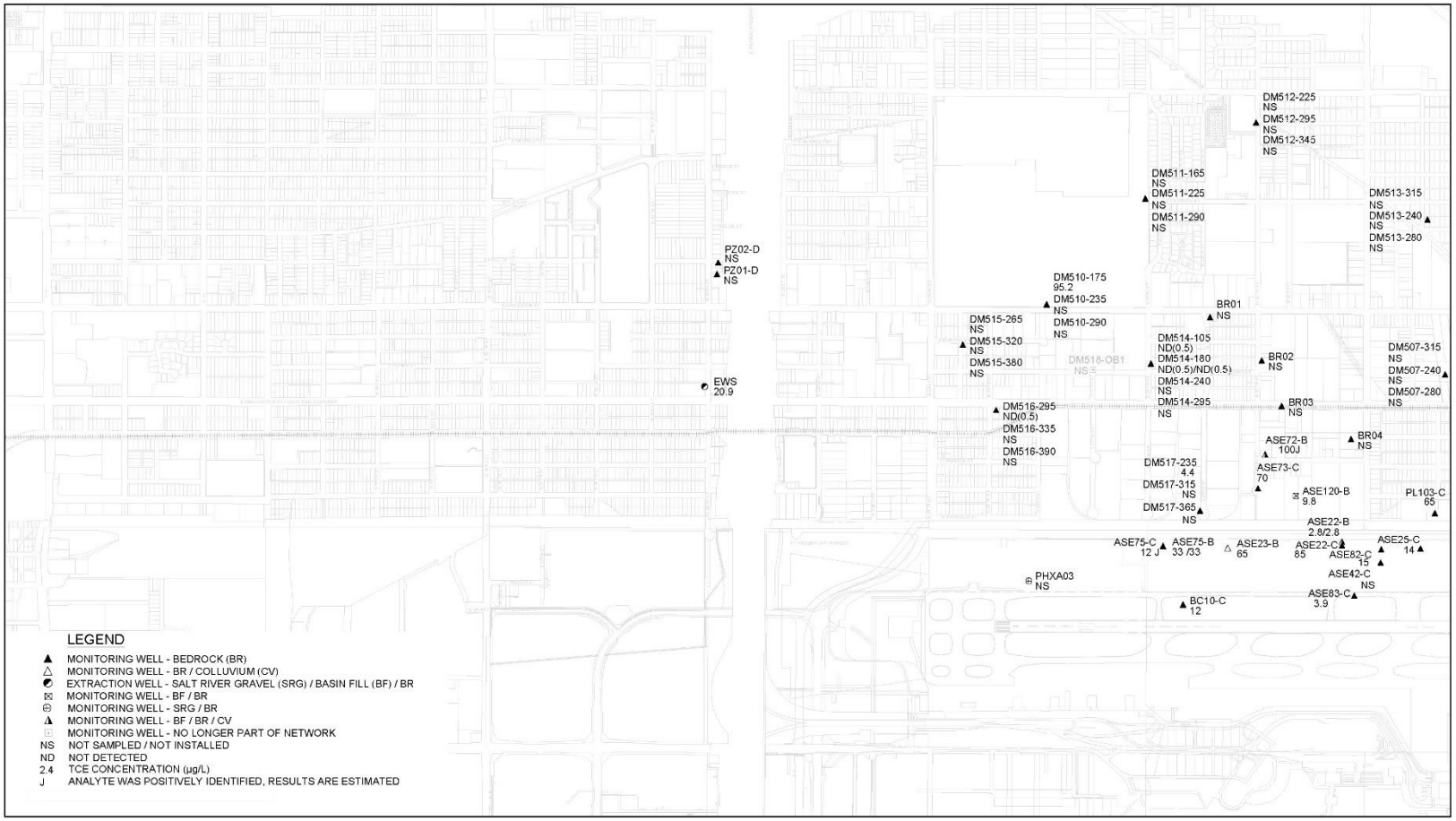
BASELINE TCE CONCENTRATIONS
SEPTEMBER 2001 - BR

013932-151
Feb 1, 2016

FIGURE 3.19


LEGEND
MONITORING WELL - SALT RIVER GRAVEL (SRG)
MONITORING WELL - SRG / BASIN FILL (BF)
EXTRACTION WELL - SRG / BF / BEDROCK (BR)
MONITORING WELL - SRG / BR
MONITORING WELL - COLLUVIUM (CV)
MONITORING WELL - NO LONGER PART OF NETWORK
MONITORING WELL - SRG / CV
NS NOT SAMPLED / NOT INSTALLED
ND NOT DETECTED
24 TCE CONCENTRATION (µg/L)
J ANALYTE WAS POSITIVELY IDENTIFIED, RESULTS ARE ESTIMATED
INTERPRETED PLUME BOUNDARY ABOVE AWQS (SEPT. 2015). DASHED WHERE APPROXIMATE
APPROXIMATE LIMIT OF CAPTURE
MONITORING WELL - SRG / CV
COLLUVIUM
BEDROCK RISE
* NOT USED FOR CONTOURING
0 550 1100ft
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE, PHOENIX, ARIZONA
EFFECTIVENESS REPORT - 2015
013932-151
Mar 25, 2016
TCE CONCENTRATIONS - SEPTEMBER 2015 - SRG
FIGURE 3.23


OU314-D NS
NW12-D ND(0.50)
OU301-D NS
DM512-155 ND(0.5)
DM511-110 53.9 /45.7
DM511-135 NS
DM513-145 27.9
NW24-D 192
DM513-195 ND(0.5)
OU313-D ND(0.50)
EW22-D ND(0.50)
NW04-D ND(0.50)
EWN 9.2
EWM 47.2
NW22-D 27.7
DM509 452
EW03 95.3
EW19-D NS
NW08-M J 41.8
NW08-D ND(0.50)
EW12-180 NS
EW12-227 NS
EW12-239 NS
DM515-210 75.4
DM518-OB1 NS
PZ01B 74.4
NW06-D 19.1
EWS 20.9
EWSPZ1 NS
OU312-D ND(0.50) / ND(0.50)
NW16-D 50.8
ASE77-B NS
DM516-210 31.6 J
ASE85-B 68
NW07-D 5.5
NW11-D 16.3 /16.2
EW13-228 1.4
EW13-268 NS
EW13-300 NS
ASE78-B 45
NW23-D 9.7
BC11-A 140J
BC11-B 15
ASE72-B 100 J
ASE73-B 18
ASE120-B 9.8
NW14-D 11.9 /12.1
ASE76-B 240 /250 J
ASE120 NS
ASE29-A NS
NW13-D 4.4
NW19-D 41.3
PL202-N 140
ASE22-B 2.8/2.8
NW09-D2 3.2
NW09-D 5.2
BC10-B 13
ASE83-B 6
NW10-D ND(0.50)
ASE88-B 2.2 J
LEGEND
MONITORING WELL - BASIN FILL (BF)
MONITORING WELL - SALT RIVER GRAVEL (SRG) / BF
MONITORING WELL - BF / COLLUVIUM (CV)
MONITORING WELL - BF / BEDROCK (BR)
MONITORING WELL - BF / BR / CV
EXTRACTION WELL - SRG / BF/ BR
MONITORING WELL - NO LONGER PART OF NETWORK
NS NOT SAMPLED / NOT INSTALLED
ND NOT DETECTED
2.4 TCE CONCENTRATION (µg/L)
J ANALYTE WAS POSITIVELY IDENTIFIED, RESULTS ARE ESTIMATED
APPROXIMATE LIMIT OF CAPTURE
BEDROCK ELEVATION CONTOURS (DATA RECEIVED FROM CH2M MARCH 08, 2008 & FROM CLEAR CREEK ASSOCIATES NOVEMBER 2014; UPDATED BY CRA, 2015)
INTERPRETED TCE PLUME BOUNDARY ABOVE AWQS (SEPT. 2015). DASHED WHERE APPROXIMATE
INTERSECTION OF BASIN FILL AND BEDROCK (2015) (AREA WHERE BF IS ABSENT)
BEDROCK RISE
6.7 / 6.7 DUPLICATE SAMPLE
0 550 1100ft
N
GHD
OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE, PHOENIX, ARIZONA
EFFECTIVENESS REPORT - 2015
013932-151
Mar 25, 2016
TCE CONCENTRATIONS - SEPTEMBER 2015 - BF
FIGURE 3.24



0 550 1100ft

N

GHD

OPERABLE UNIT 2 AREA
52ND STREET SUPERFUND SITE, PHOENIX, ARIZONA
EFFECTIVENESS REPORT - 2015

013932-151
Feb 24, 2016

TCE CONCENTRATIONS - SEPTEMBER 2015 - BR

FIGURE 3.25

CAD File: I:\CAD\Drawings\013932\013932-REPORT\[013932-151G 013932-151(34)013932-151(34)GN-FM061 FIGURE 3.25.dwg

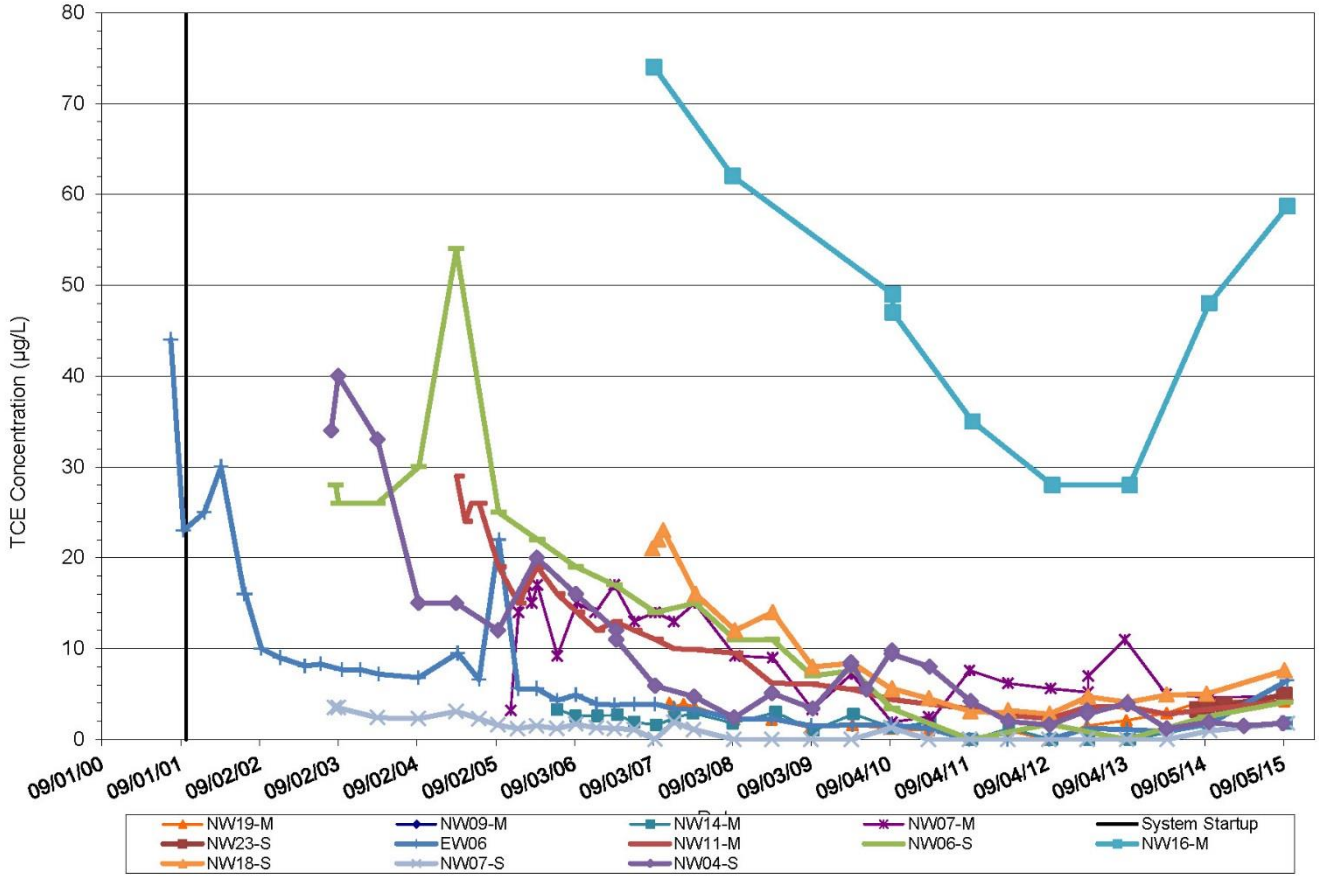


figure D.3
SALT RIVER GRAVEL TCE TREND
52ND STREET SUPERFUND SITE, OU2 AREA
Phoenix, Arizona

GHD 013932 (34) AppD-2

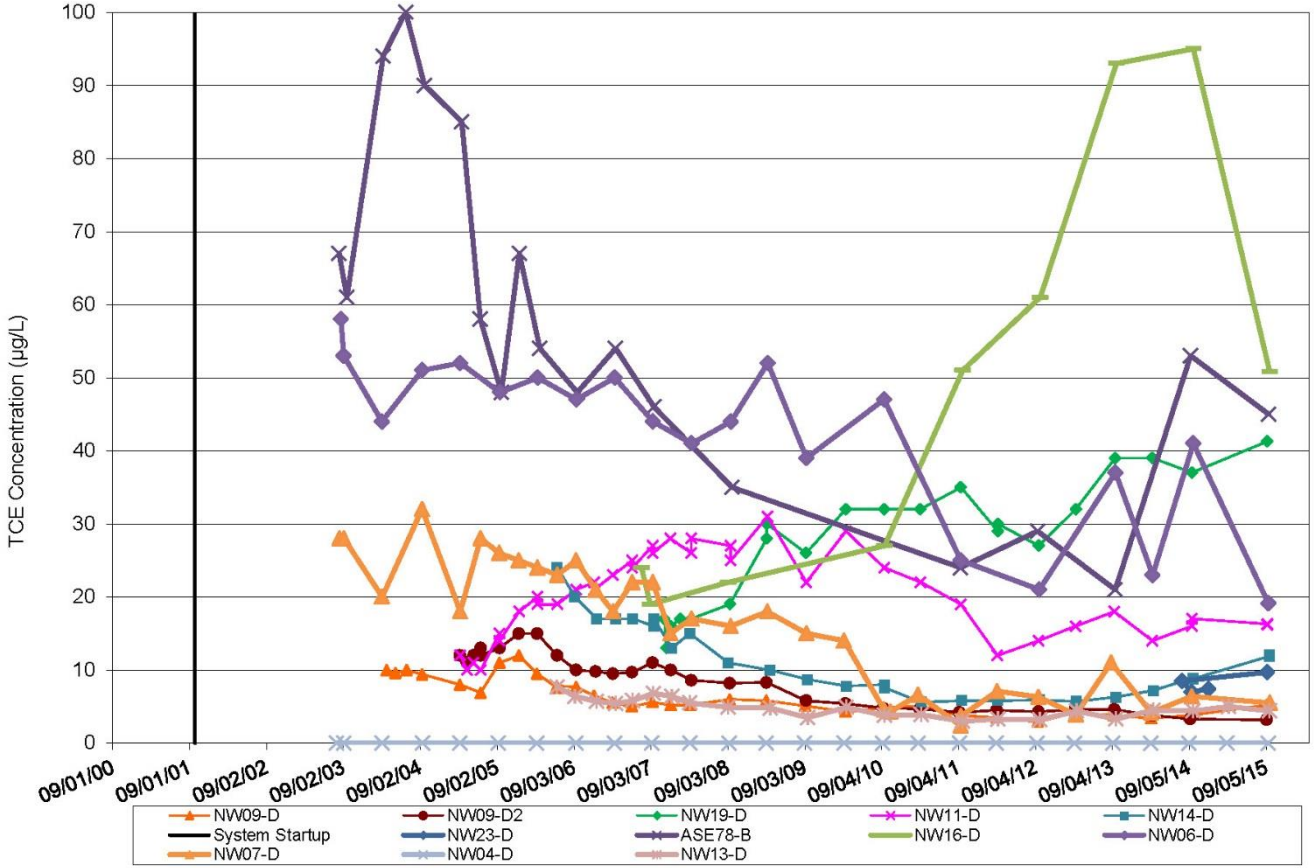


figure D.4
BASIN FILL TCE TREND
52ND STREET SUPERFUND SITE, OU2 AREA
Phoenix, Arizona

GHD 013932 (34) AppD-2

Appendix C: ARAR Assessment

APPENDIX C

ARAR Analysis

This appendix describes the applicable or relevant and appropriate requirements (ARARs) for the Motorola 52nd Street Superfund Site (Site) seventh Five-Year Review (FYR) report.

Section 121(d)(1)(A) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requires that remedial actions at CERCLA sites attain (or justify the waiver of) any Federal or state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements. Selected ARARs are generally "frozen in time" with the decision document (e.g., Record of Decision [ROD], Explanation of Significant Differences [ESD]), unless a change in a particular ARAR impacts the protectiveness or the scope of a remedy. Such changes can be evaluated during the five-year review process or between five-year reviews, but any new ARARs identified for a remedial action would need to be selected in a decision document, such as a ROD Amendment or an ESD.

Federal ARARs include requirements promulgated under any Federal environmental laws. State ARARs are promulgated, enforceable environmental or facility-siting laws of general application that are more stringent or broader in scope than Federal requirements. ARARs are identified on a site-specific basis from information about the chemicals of concern (COCs) at the site, the remedies selected, the physical characteristics of the site, and other factors. ARARs include only substantive, not administrative, requirements, and pertain only to onsite activities. There are three general categories of ARARs: chemical-specific, location-specific, and action-specific.

The Letter of Determination (LOD) and ROD for Operable Unit 1 (OU1) do not identify any specific ARARs. However, the LOD maintains that the design of the selected OU1 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 OU1 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 and LOD explain that drinking water standards will be applied to the groundwater plume in any final remedy when it is selected.

For OU2, the ROD and ESD also state that drinking water standards will be applied to the OU2 plume with the final remedy. Because the interim remedies are for containment of the plume and are not intended to restore the aquifer, these standards were not identified as chemical specific ARARs in these interim remedy documents. Nevertheless, the interim remedy requires treatment of extracted water to meet state and federal groundwater standards. The ROD is clear that drinking water standards will likely not be met in the aquifer through this interim action, but will need to be set as ARARs for the future final remedy selection.

With that, no drinking water standards for Site COCs have changed during the FYR period. Every six years, the U.S. Environmental Protection Agency (EPA) makes recommendations for changing drinking water standards, with the next round due sometime in 2016, but EPA's recommended changes for 2016 have not been issued as of April. In March 2010, EPA stated that they were considering updates for the following four chemicals, of which tetrachloroethylene (PCE) and trichloroethylene (TCE) are relevant to the Site:

- Acrylamide;
- Epichlorohydrin;
- Tetrachloroethylene, and;
- Trichloroethylene.

Should any of these drinking water standards change in 2016 after this FYR, EPA will review whether the change impacts the protectiveness of the remedies for this Site.

The OU2 ROD contains both location- and action-specific ARARs. The status of Federal and state laws and regulations underlying the location and action-specific ARARs for OU2 are presented in Table C-1.

None of the action- and location-specific ARARs identified in the ROD have changed during the FYR review period. There have been no revisions to those ARARs that would affect the protectiveness of the interim remedy.

Although CERCLA section 121 provides that the actual acquisition of permits for onsite activities is not required, the substantive requirements of permits may be selected as ARARs or, if they do not contain legally enforceable regulations, they may be selected as To Be Considered (TBC) requirements. Notably, Arizona's Poor Quality Groundwater Withdrawal Permit to control effluent from a water treatment system does not in itself include any chemical-specific treatment standards, thus there are no potential substantive requirements that might be potential ARARs from that permit.

The 1999 ESD for the OU2 interim remedy selected a closed loop carbon adsorption system for VOCs and UV oxidation for vinyl chloride rather than air stripping for VOCs treatment. There are no emissions as part of the OU2 remedy, and thus the ARARs for air emissions from the treatment systems selected for OU2 no longer apply to that action. The OU1 interim remedy, however, does employ air stripping technology, thus prior FYRs have recommended consideration of the air emissions ARARs that had been in the OU2 ROD for the OU1 system. However, when evaluated, the OU1 treatment system consistently has been found to have emissions well below relevant emissions regulations. Accordingly, failure to select this specific ARAR would not raise an issue of protectiveness at this time, and thus it has not been selected as an ARAR post-ROD. However, because emissions can vary with changing groundwater conditions, should ongoing remedial monitoring indicates the potential for substantially increased air emissions levels from the remedial system rising, these emissions regulations could be considered for ARARs in the future for the protectiveness of the OU1 remedy.

Table C-1. Table Applicable or Relevant and Appropriate Requirements Evaluation for OU2

ARAR per OU2 Interim ROD[1]	Type[2]	Requirement as Stated in ROD	Update Status	Effect on Protectiveness
Endangered Species 16 U.S.C. Section 661 et seq., 40 CFR Section 6.302.	Location-specific	If endangered species are found within or adjacent to the site, remedial actions shall comply with the requirements for endangered species in accordance with the Endangered Species Act. The requirements provide for coordinated management of wildlife resources.	No change.	None.
Fish and Wildlife 16 U.S.C. Section 661 et seq., 40 CFR Section 6.302.	Location-specific	Remedial actions shall protect the fish and wildlife of the area in accordance with 16 USC Section 661 et seq.	No change.	None.

[1] No ARARs were selected in the OU1 LOD, ROD, or ESD.
[2] Note that no chemical-specific ARARs have been selected.

ARAR per OU2 Interim ROD[1]	Type[2]	Requirement as Stated in ROD	Update Status	Effect on Protectiveness
National Archeological and Historical Preservation Act, 16 U.S.C. Section 469, 36 CFR Part 65, A.R.S §41-841 -847 and A.R.S. Section 41-865.	Location-specific	U.S.C. Section 469, 36 CFR Part 65. Criteria to identify and designate National Historic Landmarks, encourage preservation of properties illustrating or commemorating the history and prehistory of the United States. A.R.S §41-841. Provides for managing disturbances of archaeological discoveries, such as artifacts or human remains. A.R.S §41-842. Requires exploration activities to be conducted by qualified personnel. The specified permit fees are not required for onsite activities under CERCLA. A.R.S §41-843. Prohibits defacing or altering artifacts. A.R.S §41-844. Reporting requirements for discoveries, including notification of stakeholders. A.R.S §41-845. Prohibits marketing of genuine or copied archeological artifacts. A.R.S §41-846. Provides for forfeiture of artifacts by violators. A.R.S. §41-865. Provides for management of disturbed human remains or funerary objects.	No change.	None.

ARAR per OU2 Interim ROD[1]	Type[2]	Requirement as Stated in ROD	Update Status	Effect on Protectiveness
New Well Construction & Groundwater Use Requirements Arizona Revised Statutes, Title 45; 45 A.R.S. §454.01; and §45-594, 595 and 596.	Action-specific	Arizona Groundwater Management Act (GMA). For activities conducted onsite, the substantive portions of the provisions within the GMA are applicable, and no state authorization is needed. Section 45-454.01. New well construction is exempt under CERCLA, except: ➢ Section 45-594. Standards for new, replacement, deepened, and abandoned wells, and for capping open wells; ➢ Section 45-595. Construction and modification of wells will be conducted by persons holding a well drillers license issued by the state. ➢ Section 45-596. As an active management area defined by the state, drilling, replacing, or deepening wells at the site requires prior detailed notification to the state. ➢ The ROD for OU2 states that withdrawn groundwater must be reinjected into the aquifer or be put to reasonable and beneficial use, and a person who uses groundwater withdrawn in an active management area may be subject to the withdrawal fee and shall use the groundwater only pursuant to Articles 5-12 of Title 45, Chapter 2 and 3. Although it is discussed as an ARAR in the interim ROD, fees are not required for onsite activities under CERCLA.	No change.	None.

ARAR per OU2 Interim ROD[1]	Type[2]	Requirement as Stated in ROD	Update Status	Effect on Protectiveness
Arizona Air Pollution Control Regulations A.R.S. 49-401 et seq. Maricopa County Air Pollution Control Regulations Rules 200, 210,220 and 320	Action-specific	A.R.S. 49-401. To control present and future sources of emission of air contaminants to insure health, safety, general welfare, property values, and protects plant and animal life. County Rule 200. Revised 2/3/2016. Describes all types of permits required and issued. County Rule 210. Revised 2/3/2016. Describes Title V permit requirements, application procedures for new Title V sources, and application procedures for modifications to existing Title V sources County Rule 220. Revised 2/3/2016. Describes Non-Title V permit requirements, application procedures for new Non-Title V sources and application procedures for modifications to existing Non-Title V sources. County Rule 230. Revised 2/3/2016. Describes procedures for standardized permits for emission sources, governing operations, emissions, monitoring, reporting, or recordkeeping. Title V is part of the federal Clean Air Act Amendments of 1990, 40 CFR 264, Subparts AA and BB. Only substantive, rather than administrative portions of the non-federal requirements may apply at CERCLA sites.	These regulations are no longer ARARs for OU2 since there are no air emissions from the treatment system. The 1999 ESD changed the remedy to a closed loop carbon adsorption system with no air emissions.	None currently. Note that, should influent contamination levels into the OU1 treatment system rise appreciably, this regulation could be considered as an ARAR for that treatment system, which continues to use air stripping technology.

ARAR per OU2 Interim ROD[1]	Type[2]	Requirement as Stated in ROD	Update Status	Effect on Protectiveness
Discharge to Aquifer A.R.S. §49-241 through 49-244.	Action-specific	Portions of the Arizona statutory code for discharge to an Aquifer, (defined in A.R.S. 49-201, 203 and 49-241, et seq.) and implementing regulations (A. A. C. R18-9-101, et seq.) are applicable to the Motorola 52nd Street Site. Discharges must comply with the substantive requirements for an Aquifer Protection Permit. A.R.S. §49-241. Requires a facility that discharges to obtain an aquifer protection permit, unless exempted under section 49-250, which excludes onsite CERCLA activities. A.R.S. §49-242. Requirements for issuing, denying, suspending or modifying individual permits. Permits are not required for onsite activities conducted under CERCLA. A.R.S. §49-243. Specifies information and criteria for issuing permits. Permits are not required for onsite activities conducted under CERCLA. A.R.S. §49-244. Provides for designating a point or points of compliance for each facility receiving a permit under this article. Permits are not required onsite, but may be required offsite. Only substantive, rather than administrative portions of non-federal requirements may be considered as ARARs at CERCLA sites.	No change to substantive requirements. The ARAR does not apply to OU1, since treated groundwater is not discharged directly to the aquifer, but rather it goes to the Grand Canal, a Salt River Project irrigation canal. The ARAR does apply to OU2, since the interim remedy calls for reinjecting treated groundwater back into the aquifer.	None.

ARAR per OU2 Interim ROD[1]	Type[2]	Requirement as Stated in ROD	Update Status	Effect on Protectiveness
Air stripper Emissions Resource Conservation and Recovery Act (RCRA) (40 C.F.R. Part 265, Subpart AA and BB)	Action-specific	The RCRA requirements apply to air emission standards for process vents (Subpart AA) and equipment leaks (Subpart BB) associated with distillation, solvent extraction or air stripping operations. The requirements impact those operations that manage hazardous waste with organic concentrations of at least 10 parts per million. These requirements are applicable.	These regulations are no longer ARARs for OU2 since there are no air emissions from the treatment system. The 1999 ESD changed the remedy to a closed loop carbon adsorption system with no air emissions.	None currently. Note that, should influent contamination levels into the OU1 treatment system rise appreciably, this regulation could be considered as an ARAR for that treatment system, which continues to use air stripping technology.
"Contained in" principle Arizona Hazardous Waste Management Act (AAC R18-8-261)	Action-specific	The "contained in" principle provides that any non-waste material (e.g., groundwater) that contains a listed hazardous waste must be managed as if it were a hazardous waste. Groundwater extracted as part of this interim remedy will contain a listed hazardous waste, therefore these regulations are applicable to the management of that groundwater.	No change.	None.
Arizona Hazardous Waste Management Act, AAC R18-8-262	Action-specific	The regeneration or disposal of spent carbon or other media after use to control emissions of VOCs must be managed in conformance with the generator requirements of the state Hazardous Waste Management Act, including disposal at a permitted offsite hazardous waste facility.	No change.	None.
Arizona Hazardous Waste Management Act Land Disposal Restrictions, AAC Rl8-8-268	Action-specific	Groundwater treatment residuals or other media contaminated with volatile organic compounds are banned from land disposal. Treatment standards must be met before wastes can be land disposed.	No change.	None.

ARAR per OU2 Interim ROD[1]	Type[2]	Requirement as Stated in ROD	Update Status	Effect on Protectiveness
Arizona Hazardous Waste Management Act, AAC Rl 8-8-264 (40 CFR Subpart X)	Action-specific	Air stripping towers are miscellaneous RCRA units, therefore, the substantive requirements of 40 CFR Subpart X, including any closure and post-closure care, will be applicable or relevant and appropriate.	These regulations are no longer ARARs for OU2 since there are no air emissions from the treatment system. The 1999 ESD changed the remedy to a closed loop carbon adsorption system with no air emissions.	This regulation no longer applies to OU2. However, the substantive portions of these regulations could be considered for closure and post-closure of the OU1 air strippers, when applicable.
Air stripper Emissions EPA OSWER Directive 9355.0-2.8, June 1989	Action-specific	This OSWER directive was identified as a TBC in the OU2 ROD for control of air emissions from air strippers used for groundwater treatment. Per the directive, controls would be required on remedial systems with an actual emission rate of 3 Ib/hr, 15 Ib/day, or a potential rate of 10 tons per year of total VOCs.	These regulations are no longer ARARs for OU2 since there are no air emissions from the treatment system. The 1999 ESD changed the remedy to a closed loop carbon adsorption system with no air emissions.	None currently. Note that, should influent contamination levels into the OU1 treatment system rise appreciably, this directive could be considered as a TBC for that treatment system, which continues to use air stripping technology.

Appendix D. Human Health and the Environment Risk Assessment

Appendix D

Human Health and the Environment Risk Assessment

1.0 Site Human Health Risk Assessment Summary

The purpose of this attachment is to support the five year review with a discussion of changes in the practice of health risk assessment that have occurred since the previous Five-Year Review (FYR) (2011). Section 1.0 is a review of Section 3, which was written by the previous FYR review team to provide more details about the health and risk assessment efforts.

A site health assessment was completed by the Agency for Toxic Substances and Disease Registry (ATSDR) for the Site in 1988. The health assessment was reviewed to identify any changes in exposure or toxicity that would impact protectiveness. The1988 health assessment included the following:

- Exposure to groundwater, soil, air, and food;
- Ingestion of groundwater and agricultural products;
- Ingestion and dermal contact with groundwater while swimming;
- Inhalation of VOCs in soil gas and fugitive dust from soil;
- Consumption of bioaccumulated groundwater contaminants in plants and animals.

The health assessment found that a threat to human health was unlikely under current conditions. In particular, the report noted that there was no current potable use of the contaminated groundwater. However, if contaminated groundwater was to be used in the future as a source of drinking water, such use would entail significant health risks.

The health assessment recommended the following;

- Monitor groundwater off site to define the extent of the plume;
- Monitor offsite uses of groundwater for irrigation or residential purposes;
- Protect remediation workers according to the requirements of the Occupational Safety and Health Administration (OSHA);
- Control dust generated during remedial activities, and;
- Monitor ambient air at the site perimeter to comply with National Ambient Air Quality Standards (NAAQS) or the NIOSH recommendation.

ATSDR conducted follow-up health assessments in 1993 and 1996, and the Arizona Department of Health Services (ADHS) completed a baseline risk assessment in November 1992 for both OU1 and OU2. These assessments considered two private domestic wells that were identified within OU1. One of the wells, (the Morgan well) is a residential well for domestic use, which has been used for filling a swimming pool and grounds irrigation. The well was used for household purposes for about six months during the late 1980s. At that time, boron, fluoride,

and lead were detected in the well at concentrations exceeding their respective Maximum Contaminant Levels (MCLs). Several organic chemicals were detected at concentrations below MCLs. Additional monitoring of the well was recommended, although the owner initially refused such sampling. The ATSDR report noted that a replacement well was installed in 1996, after the first well went dry, and it is registered for irrigation and domestic use. This well is regularly sampled and shows not detections of TCE as of 2016. Trichloroethylene (TCE) was detected in a nearby upgradient monitoring well in 1992, and that well is sampled semiannually.

The other well (the Turnage well) was used domestically until about 1970, after which time it was locked and not used until it was decommissioned in 2005. When sampled in the mid-1980s, the water well was found to be contaminated with trichloroethylene measured at thousands of micrograms per liter, as well as lesser amounts of other volatile organic compounds. The extent of use and exposure that may have occurred prior to sampling of that well is unknown.

The risk assessment ("Baseline Risk Assessment, Motorola Inc. 52nd Street Facility, Phoenix, Arizona" prepared by the Arizona Department of Health Services) conducted in 1992 concluded that the potential for exposure was limited because "the impacted groundwater is not used in a public drinking water system" and "data do not indicate excessive risk associated with the use of the [single identified private] well for irrigation, or swimming." This risk assessment also noted there were insufficient data to assess risks due to exposure to on-site soils and that 2 rounds of soil gas sampling indicated no excess indoor air (vapor intrusion) risks to residents living west of the facility. The assessment concluded there was no imminent health hazard.

The risk assessment was summarized in the interim record of decision for OU2, as follows:

> *All risk estimates in the Risk Assessment were based on a number of assumptions regarding contaminant concentrations and fate, exposures, doses, and toxicity information. ADHS took care at each step to ensure that assumptions and estimates were representative of upper bounds. True risk may be much less than calculated. This was done purposely to be protective of public health.*
>
> *The conclusion of the Risk Assessment and the Remedial Investigation/Feasibility Study is that releases of hazardous substances from this site present an imminent and substantial endangerment to public health, welfare, and the environment in the absence of any remedial action. Response action to date has reduced site risk, but groundwater contamination at the site still exceeds Maximum Contaminant Levels and warrants additional remedial action.*

1.1 Revised EPA Exposure Factors

In February of 2014, EPA released Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, which provided updated recommendations for several common recommended default exposure factors used to set risk-based screening levels and calculate human health risks; a few of the exposure assumptions used in the previous risk assessments differ from the 2014 EPA recommended ones. The overall effect of the updated exposure factors, shown in Table 1, would be slightly

(roughly 5 to 10%) less stringent risk estimates and risk-based cleanup goals. Therefore the protectiveness of existing clean-up goals is not affected by these changes.

Exposure Factors (general)			
Parameter	**Reasonable Maximum Exposure (adult)**		
	Per ROD	**USEPA Update 2014**	**Effect upon Risks and Risk-Based Cleanup Goals**
Body weight	70 kilograms	80 kilograms	Less stringent
Averaging time for noncancer effects	See exposure duration	See exposure duration	None
Averaging time for cancer effects (years)	70 years	70 years	None
Ingestion rate (water)	2 liters/day	2.5 liters/day	More stringent
Inhalation rate (air)	20 cubic meters/day	No longer adjusted.	Similar for continuous exposure.
Groundwater consumption (domestic)			
Exposure frequency and duration	2 liters/day, 350 days/year for 30 years	2.5 liters/day, 350 days/year for 26 years	Slightly more stringent.
Occupational air inhalation (indoors and outdoors)			
Exposure time, frequency, and duration.	8 hours/day, 250 days/year, for 30 years	8 hours/day, 250 days/year, for 25 years	None for noncancer effects. Less stringent for cancer effects.
Residential air inhalation (outdoors)			
Exposure time, frequency, and duration.	8 hours/day, 350 days/year, for 30 years	8 hours/day, 350 days/year, for 26 years	None for noncancer effects. Less stringent for cancer effects.
Residential air inhalation (indoors)			
Exposure time, frequency, and duration.	24 hours/day, 350 days/year, for 30 years	24 hours/day, 350 days/year, for 26 years	None for noncancer effects. Less stringent for cancer effects.

1.2 EPA Toxicity Values

EPA's Integrated Risk Information System (IRIS) periodically updates toxicity values used by the agency in risk assessment, when newer scientific information becomes available.

Additionally since 2013, EPA has conducted data collection and analyses of Contaminants Of Potential Concern (COPCs) to identify if there are additional site related chemicals that should be considered for cleanup. As part of these analyses, the following COPCs have been detected and identified for further sampling and data evaluation. For OU1 these are: hexavalent chromium, 1,4-dioxane, arsenic, flouride, and the addition of 1,2-dichlorobenzene and 1,2,4-trichlorobenzene to the routine groundwater monitoring program. For OU2, the COPCs for further sampling and data analyses are hexavalent chromium, 1,4-dioxane, naphthalene and 2-methylnaphthalene.

1.2.1 Trichloroethylene (TCE)

The groundwater at the site is contaminated with volatile organic compounds (VOCs), primarily TCE. Of particular note are conclusions about non-cancer hazards identified in the 2011 toxicity reassessment of TCE, which raised concerns about health sensitivities of the developing fetus and young children.

In 2011, EPA finalized an updated toxicity assessment for TCE, a primary contaminant at the Motorola 52nd Street site. This toxicity assessment upgraded TCE's carcinogen classification from "Probable Human Carcinogen" to "Carcinogenic to Humans", increased the cancer potency values used to estimate risk by approximately 3-fold and identified non-cancer hazards of potential concern. Most notably, the toxicity assessment identified TCE's potential to cause fetal cardiac malformations arising from short-term in utero exposures occurring as a result of TCE inhalation by pregnant women. This Integrated Risk Information System (IRIS) assessment set a reference concentration (RfC) of 2 µg/m3 to be protective for the non-cancer hazards, including fetal cardiac malformations. In 2014 EPA Region 9 issued a memorandum regarding EPA Region 9 Interim Action Levels and Response Recommendations to Address Potential Developmental Hazards Arising from Inhalation Exposures to TCE in Indoor Air from Subsurface Vapor Intrusion. Also in 2014, EPA's Office Of Superfund Remediation and Technology Innovation issued a memorandum to the EPA Regional Superfund offices on Compilation of Information Relating to Early/Interim Actions at Superfund Sites and the TCE IRIS Assessment. This revised toxicity assessment has the potential to affect the protectiveness conclusions of remediation goals established for the site, evaluation of vapor intrusion and ambient air impacts of treatment facility emissions.

The previous FYR (2011) indicates that partial soil cleanup activities specified in the interim ROD for OU1 were not completed. At this time, the soil cleanup has been not completed. The ROD for OU1 notes that additional cleanup may be required as part of the final remedy. Concentrations of TCE in groundwater influent to the treatment system remain well above the MCL although treated to below the MCLs at the effluent. A vapor intrusion investigation including indoor air sampling for TCE (and PCE) was conducted in 2016 at the former Motorola 52nd Street campus to determine if vapor intrusion is occurring at buildings overlying on-site soil and groundwater contamination; the indoor air data indicate this is not an exposure pathway of potential health concern.

1.2.2 1,4-Dioxane

1,4-Dioxane is an emerging contaminant that is increasingly considered as a contaminant of potential concern due to evidence it is consistently associated with chlorinated volatile organic chemical contamination. The RODs or annual effectiveness reports for this site make no mention of 1,4-dioxane. There currently are no federal or state (AZ) Maximum Contaminant Levels (MCLs) for 1,4-dioxane. The current RSL is 0.46 µg/L, which represents an excess lifetime cancer risk of one-in-one-million for exposure via residential drinking water. 1,4-Dioxane is increasingly being included as a target analyte for environmental investigations. Recent evidence indicates that it may be associated a variety of volatile organic chemicals (previously it was thought to be associated only with 1,1,1-trichloroethane). Monitoring for

1,4-dioxane has been conducted at the Motorola 52nd Street site. Because 1,4-dioxane was detected, it is being evaluated as a COPC with regular groundwater monitoring.

1.3 Vapor Intrusion

In 2015, EPA published guidance to evaluate the potential for adverse health effects arising from indoor air exposure resulting from vapor intrusion. The vapor intrusion guidance focuses on sites, such as Motorola 52nd Street, at which volatile compounds are present in groundwater, especially within 100 feet of a current or potential future building. EPA's understanding of contaminant migration from soil gas and/or groundwater into buildings (vapor intrusion) has evolved over the past few years, along with an understanding that soil gas concentrations can change over time: leading to the conclusion that vapor intrusion may have a greater potential for posing risk to human health than was assumed when the interim RODs were prepared. EPA evaluates the potential for vapor intrusion using a "multiple lines of evidence" approach consistent with its 2015 vapor intrusion guide, OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OSWER Publication 9200.2-154.

At the Motorola 52nd Street site, the potential for vapor intrusion was previously addressed in the Baseline Risk Assessment (1992).The 1992 risk assessment concluded that excess lifetime cancer risks (ELCRs) from potential indoor air exposures were below 10^{-6} for all residential areas; only one occupational location exceeded a 10^{-6} ELCR. No non-cancer hazards of concern were identified. Therefore in the 1992 risk assessment vapor intrusion was not identified as an exposure pathway of potential concern.

The potential for vapor intrusion exposure was recognized in the 2011 FYR, with the recommendation to re-evaluate that potential. For OU1, a vapor intrusion investigation was conducted from 2010 to 2016 which demonstrated vapor intrusion in a number of residences west and northwest of the former Motorola 52nd Street facility. Those residences received vapor mitigation systems to ensure indoor air results meet EPA's health based standards. Additionally in OU1, vapor intrusion was investigated at the former Motorola 52nd Street Plant campus during winter and summer of 2016. These data indicate vapor intrusion is not occurring at any of the commercial buildings at this location and concludes the vapor intrusion investigation in OU1. This, and recent updates to the toxicity values for volatile organic chemicals (in particular TCE) have contributed to the ongoing investigations for vapor intrusion in OU2. Also, a reference concentration for non-cancer hazards arising from inhalation of tetrachloroethylene became available in 2012; none was available prior to that time. As a result of the vapor intrusion findings in OU1, and the findings of a limited EPA vapor intrusion screening exercise in OU2, an additional vapor intrusion investigation is underway in OU2. Because the OU2 vapor intrusion investigation is ongoing, the former recommendation for further evaluation of vapor intrusion at the Motorola 52nd Street site is reiterated in this FYR for OU2.

1.4 Ecological Review

There are no remedial action objectives designed to mitigate ecological risk. The interim record of decision for OU2 states:

An Ecological Risk Assessment performed by EPA in April 1993 concludes that no threatened or endangered species have been verified at the vicinity of the Motorola 52nd Street facility. Two wells used for irrigation, domestic well 4626G and Salt River Project (SRP) well 18E-5N, may potentially expose plants and animals to contaminants in groundwater. The average concentration of TCE detected hi well 4626G is 0.3 ppb, with the highest detection being 0.7 ppb. Water from the SRP well is diluted as it is discharged into the canal system by a factor of 59 in the winter and 294 during the summer. VOCs have not been detected in this well.

Groundwater may also be encountered in the Old Crosscut Canal at approximately Oak Street, where a spring seep occurs. Model predictions estimate contaminant concentrations in groundwater at this point to be approximately 10 ppb of VOCs, which would be diluted due to flows in the canal.

There is no indication that there have been any site changes (e.g., site physical alterations, new ecological receptors, new ecological exposure pathways) that would change those conclusions.

1.5 Updated Risk Estimates

Due to the aforementioned revised toxicity values and exposure assumptions, revised risk estimates are likely to differ from those that were originally estimated. The FYR considers what those changes might mean with respect to protectiveness of the remedy, but it does not actually revise them. The baseline risk estimates are complex, and could be updated and recorded with primary CERCLA documents as part of a process including public review and comment (i.e., remedial investigation, feasibility study, proposed plan, and final records of decision). Any resulting significant changes to remediation goals generally would require amending the record of decision, or in this case interim records of decision. Most important in this regard is that with one possible exception (vapor intrusion), revising the risk estimates would make no substantive difference in the ongoing interim remediation process, since exposures are prevented and groundwater is being treated to meet MCLs.

In the future, a revised risk assessment may be of use in determining additional chemicals of concern (COCs) such as hexavalent chromium or 1,4-dioxane (if identified as COCs in the future) beyond those identified with potential ARARs. Final records of decision will help establish a set of specific remediation goals. Upon attainment of those finalized goals, which will likely take years, further updates to the risk estimates may be advisable to reflect accumulated changes in risk assessment methods and assure that total site risk for all COCs and exposures are appropriate for the intended land use.

2.0 Assessment of Potential Contaminant-Specific Cleanup Goals

Final RODs have not yet been issued for the three OUs at the Motorola 52nd Street site, so no final remediation goals have been formally established. Nevertheless, the two interim groundwater extraction and treatment systems in place remediate groundwater to below the EPA Maximum Contaminant Levels (MCLs) for the site related volatile organic compounds (VOCs). Remediation goals for contaminated groundwater at a Superfund site, such as Motorola 52nd Street, are typically set to MCLs established by EPA's Office of Drinking Water in accordance with the Safe Drinking Water Act. In the event no MCL has been established for a site-related contaminant, a risk based cleanup goal is typically set using toxicity and exposure information from the baseline risk assessment for that Superfund site. EPA also has the option to set a risk based cleanup for a contaminant having an MCL should the Agency determine that extraordinary risk would remain if remedial action attained only the MCL concentration. The health-based MCLs have been appropriate for the interim remedies at the Motorola 52nd Street Superfund site.

At the Motorola 52nd Street site, interim actions to date have focused on remediation to site related contaminant-specific MCLs. Since MCLs are ARARs (Applicable or Relevant and Appropriate Regulations), a Superfund remedial action must, at a minimum, meet MCLs and remedial goals are typically set at MCL concentrations for current or potential drinking water sources.

Regional Screening Levels (RSLs) are media-specific risk-based screening levels developed using toxicity values reflecting a contaminant's potential to cause or promote cancer and non-cancer health effects, along with default exposure assumptions for specific scenarios (e.g., residential, commercial/industrial). RSLs are used to evaluate potential risks identified by monitoring data and to provide a context for setting risk-based remedial goals (cleanup goals) where needed. As noted, when newer scientific information becomes available, EPA's IRIS program periodically reviews and updates toxicity information used by the Agency in earlier risk assessments; such revised toxicity information can affect protectiveness conclusions regarding cleanup goals. In the past five years, there have been a number of changes to the toxicity values for many COCs at the Site; these changes are reflected in current RSLs.

To evaluate the protectiveness of the existing Motorola 52nd Street site remediation goals for this FYR, those goals were compared to the contaminant-specific MCLs set under the Safe Drinking Water Act and to EPA's current RSLs; this comparison is presented in Table 1. MCLs are enforceable drinking water standards and are ARARs which must be achieved, at a minimum, by a Superfund site remediation. The RSLs are contaminant-specific risk-based screening levels. For contaminants with the ability to cause or increase the risk of developing cancer, RSLs are set at the lowest end (10-6 excess lifetime cancer risk [ELCR] concentration) of the protective exposure range for cancer risks; this range corresponds to EPA's acceptable ELCR range of 10-6 (1-in-one-million) to 10-4 (100-in-one-million). For non-cancer health effects, RSLs are set to an exposure concentration that corresponds to a Hazard Quotient equal

to 1.0, which EPA deems protective for lifetime daily exposures for even sensitive sub-populations., RSLs are useful risk screening tools; EPA considers exposure to contaminant concentrations equal to or less than RSLs to be sufficiently protective at Superfund sites. The protectiveness of exposure to concentrations greater than RSLs are assessed on a case-by-case basis, taking into account the magnitude of the RSL exceedance.

Table 1 below presents a comparison for tetrachloroethylene and TCE, which are the focal points of the long term monitoring program. Also included are 1,1-dichloroethane, 1,1-dichloroethene, and 1,1,1-trichloroethane, since they were noted as COCs in the Site Assessment Overview presented in previous FYRs.

Table 1. MCLs and RSLs for Motorola 52nd Street Site COCs

Contaminant of Concern	**2016 Tap Water RSL at Cancer Risk of $1x10^{-6}$ (µg/L)**	**Protective Cancer Risk Exposure Range (µg/L)**	**2016 Tap Water RSL at Noncancer Hazard Quotient = 1 (µg/L)**	**MCL (µg/L)**
Tetrachloroethylene	11	11 to 1,100	41 (child)	5
Trichloroethylene	0.49	0.49 to 49	2.8 (child)	5
1,1-dichloroethane	2.8	2.8 to 280	3,800*	NA
1,1-dichloroethylene	NA	NA	280	7
1,1,1-trichloroethane	NA	NA	8,000	200

NA – Not Available

*- Noncancer reference dose is a provisional USEPA Tier II toxicity value.

Groundwater concentrations that fall below the cancer-based RSL indicate that the hypothetical (i.e., if exposure were to occur) ELCR for that chemical is below than low end of the noted cancer risk range (*de minimus*), while concentrations significantly above the cancer RSL may indicate increased ELCRs that may nonetheless be acceptable (if the total site cancer risk is below $1x10^{-4}$), or unacceptable (*de manifestis*). Other chemicals of potential concern, and other exposures may additionally contribute to total site risk estimates.

The hazard quotient of 1.8 for a child consuming potable water containing trichloroethylene at the MCL (5 µg/l) exceeds a hazard quotient equal to 1; the exceedance is not great.

Recent samples of groundwater from monitoring wells in OU1 (Table 12 of the 2014 annual effectiveness report) indicate that many wells have tetrachloroethylene (PCE) and trichloroethylene (TCE) at concentrations exceeding their respective MCLs, in each case by several orders of magnitude. While the interim remedy treats the concentrations of TCE and

PCE to below the MCLs, at such consistently high concentrations, protectiveness remains indisputably threatened with respect to the need to prevent actual exposure to the contaminated groundwater.

Although land use controls are not part of the interim remedy, the interim ROD for OU1 notes that contaminated groundwater is not being consumed by children or others, as follows;

> *The only current uses of the groundwater are one private well for irrigation and swimming pool filling, and a second well which is pumped by the Salt River Project to supplement irrigation water flow in the Grand Canal. There is no current use of the groundwater for drinking water purposes.*

The interim ROD for OU2 notes:

> *This area of contamination is not currently used as a source of drinking water; however, the area may potentially be used as a future drinking water source.*

Appendix E: Press Notice

Motorola 52nd St. Superfund Site

U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • February 2016

Public Notice: Five-Year Review

The U.S. Environmental Protection Agency (EPA) and Arizona Department of Environmental Quality (ADEQ) are beginning the Five-Year Review for the existing Records of Decision (RODs) and associated ongoing environmental clean-up actions at the Motorola 52nd Street Superfund site. As part of the five-year review process, interviews will be held with public officials, facility representatives, and members of the community. These interviews are used to make technical assessments of the site conditions. The Five-Year Review Report will be completed in September 2016.

What is a Five Year Review?

The five-year review is conducted to determine if the clean-up goals (known as Remedial Action Objectives or RAOs) are adequately protecting human health and the environment. If issues that impact the protectiveness of the remedy are found during the five-year review, recommendations to address them are made. The Site is a groundwater plume divided into three areas called Operable Units (OUs). The RAOs for OU1 of the site were described in the 1988 ROD and the RAOs for OU2 were described in the 1994 ROD and the 1999 Explanation of Significant Differences.

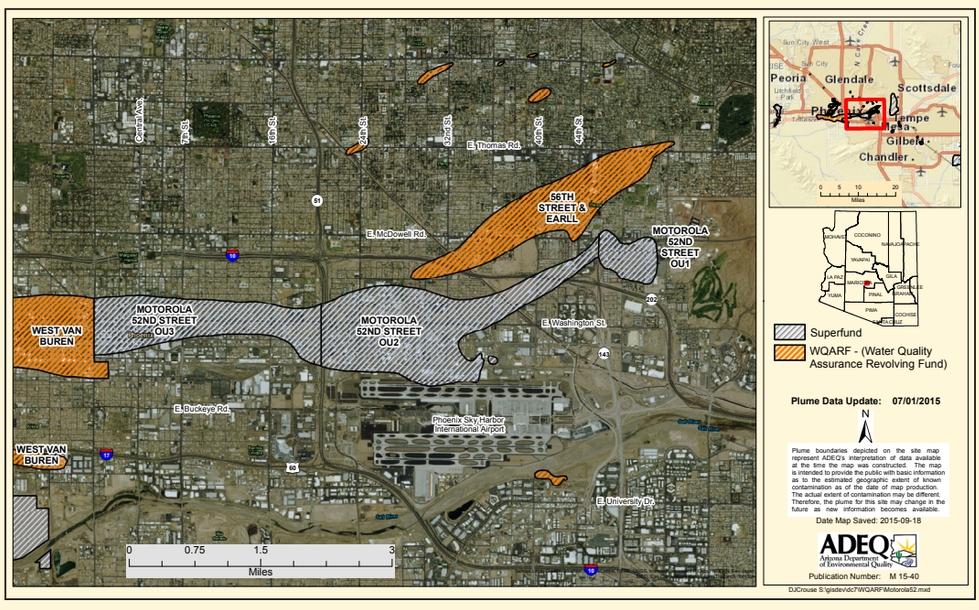
The five-year review is a technical assessment with a focus on answering three key questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the assumptions used at the time of remedy selection still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The Motorola 52nd Street Superfund site has two ongoing groundwater extraction and treatment systems resulting from formal Records of Decision. These are the primary clean-up actions to be evaluated in the Five-Year Review, although additional or voluntary clean-up actions also under way at the site will be referenced and considered.

Site Background

The Motorola 52nd Street Superfund Site is located in the City of Phoenix, Maricopa County, Arizona. Groundwater is not used for drinking water purposes in the site area. In the past, chemicals were spilled/leaked at the former Motorola semiconductor manufacturing plant (Motorola) at 52nd Street and McDowell Road, the Honeywell jet fuel facility (Honeywell) at 34th Street and Air Lane, and potentially at other facilities in the area. OU1 is the easternmost area and includes the former Motorola 52nd Street Semiconductor facility. OU2 is the central portion of the groundwater plume and includes the Honeywell 34th Street Plant and other facilities. OU3 is the western portion of the groundwater plume and includes Arizona Public Service and Adobe Air/Arvin Meritor as well as other facilities. The entire site study area boundaries are generally 52nd Street to the east, Palm Lane to the north, 7th Street to the west and Buckeye Road to the south. Motorola Semiconductor Products Sector (Motorola) owned and operated the 52nd Street facility from 1956 to 1999. As part of its electronics manufacturing operation, Motorola used solvents, including volatile organic compounds such as trichloroethene (TCE), tetrachloroethene (PCE), and 1,1,1-trichlorethane (TCA) to clean and degrease parts and equipment. Investigations in the 1980s revealed groundwater contamination at the 52nd Street facility and to the west. In 1989 the site was added to the Superfund National Priorities List, or NPL. Freescale (a company formerly a part of Motorola) has operated a groundwater extraction and treatment system since 1992 in OU1. In OU2, Freescale and Honeywell have operated a groundwater extraction and treatment system since 2001. These treatment systems have effectively reduced the overall groundwater plume and contain and treat the contaminated groundwater in OU1 and OU2. Individual facility cleanups are also ongoing in OU3. Groundwater treatment is expected to continue for many years.



For More Information

When completed, the Five-Year Review Report will be available on the EPA and ADEQ websites and at the following site repositories:

Web Pages

Information about the Site is available at the following Web pages:

ADEQ: http://azdeq.gov/environ/waste/sps/phxsites.html#mot52a
EPA: http://www.epa.gov/

Information Repositories

The information repositories listed below holds the Five-Year Review Report for the Motorola 52nd Street Superfund Site as well as other documents related to the investigation and cleanup of this Superfund Site:

Burton Barr Public Library
1221 North Central Avenue
Phoenix, AZ 85004
(602) 262–4636

Saguaro Library
2808 North 46th Street
Phoenix, AZ 85008
(602) 262–6801

ADEQ Records Center
1110 West Washington Street
Phoenix, AZ 85007
(602) 771–2300
(800) 234–5677

EPA Superfund Records Center
75 Hawthorne Street (3rd floor)
San Francisco, CA 94105
(415) 820–4700

United States Environmental Protection Agency, Region 9
75 Hawthorne Street (SFD-6-3)
San Francisco, CA 94105
Attn: Carlin Hafiz (M52 2/16)

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Public Notice: Five-Year Review

How To Contact Us

If you have questions or concerns about the Motorola 52nd Street Superfund Site, please contact any of the staff listed below:

EPA Contacts for Site:

Carlin Hafiz
Community Involvement Coordinator
U.S. EPA, Region 9 (SFD-6-3)
600 Wilshire Boulevard, Suite 1460
Los Angeles, CA 90017
(213) 244–1814
hafiz.carlin@epa.gov

ADEQ Contacts for Site:

Wendy Flood
Community Involvement Coordinator
Arizona Department of Environmental Quality
1110 West Washington Street
Phoenix, AZ 85007
(602) 771–4410 / (800) 234–5677
flood.wendy@azdeq.gov

Versión en español adentro

Appendix F: Interview Forms

Five-Year Review Interview Record			
Site:	Motorola 52nd Street Plant Operable Unit 1 (M52-OU1)	**EPA ID No:**	AZD009004177

Interview Type:
Location of Visit: OU-1 Integrated Groundwater Treatment Plant (IGWTP)
Date: February 24, 2016 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

Summary of Conversation

1) What is your overall impression of the project?

Performing to remove VOC's from groundwater.

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

Treatment plant performs as expected. Overall remedy outside the scope of our O&M services.

3) What does the monitoring data show? Is contaminant containment occurring?

IGWTP is removing VOC's from groundwater. Outside the scope of our O&M services.

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 plant is staffed during normal work hours Monday through Friday and on-call alarm response outside normal work hours. GPI performs inspections and O&M of the treatment plant and wells, and collects water and air samples.

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.

ON Semiconductor stopped receiving treated water in 2011. IGWTP discharge was modified so treated water could be discharged to the City of Phoenix (COP) sewer system under a wastewater permit. In December 2015 a pipeline to the Old Crosscut Canal (OCC) was finished for discharge of treated water. Discharge goes to COP sewer system during SRP's annual canal dry-up period or other times as required by SRP. Assessment is outside the scope of the O&M services that GPI provides.

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

No

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

Yes, reduced the number of water samples collected within the treatment plant by no longer collecting samples after each of the two air strippers and between the LGAC units. Stopped collecting air sample for influent to carbon unit. These changes reduced sampling costs.

8) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

Outside the scope of our O&M services.

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

No

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:
Location of Visit: OU-1 Integrated Groundwater Treatment Plant (IGWTP)
Date: February 24, 2016 Time:

Interviewers

Name	Title	Organization

Interviewees

Name	Organization	Title	Telephone	Email
Jason S. Weed, P.E.	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?

The OU-1 treatment system has been in operation since 1992 and continues to perform 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? Is contaminant containment occurring?

The analytical results of samples collected at the IGWTP shows that the treatment system is operating as designed to remove VOC's from influent water from the extraction well system. An assessment of contaminant containment 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.

ON Semiconductor discontinued manufacturing operations in November 2011 and therefore no longer had a use for the treated water from OU-1. As a temporary measure, ADEQ approved the treated water discharge to the City of Phoenix (COP) sewer system under a Class A Wastewater Discharge Permit. ADEQ also approved the discharge of the treated water to the Grand Canal via the Old Crosscut Canal (OCC) as an interim end use. Salt River Project (SRP) agreed to accept the treated water under a private Agreement with Freescale and the discharge pipeline to the OCC was completed in December 2015 where it is beneficially used for agricultural uses, irrigation and aquifer recharge. The treated water is sent to COP sewer system during SRP's annual canal dry-up period for maintenance or during other times that water cannot be accepted into the canal system (such as during storm or flood events). Both the COP Wastewater Permit and SRP Agreement require additional sampling of the treated water. An assessment of the protectiveness of the remedy is outside the scope of the O&M services that GPI provides.

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

None.

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

Yes, we were able to reduce the number of water samples collected by eliminating the collection of the samples after each air stripper and between the liquid phase carbon units. Operating history and historical data allowed for this change to the sampling procedure. We also reduced the number of air samples collected by eliminating the sample for the influent to the vapor phase

carbon unit. Through discussions with ADEQ, the calculations for the VOC removal efficiency of the carbon (used to determine when the carbon needs to be changed) was changed to be based on Potential to Emit, which is calculated from the influent water concentrations to the treatment plant from the wells and individual well flows. These changes in the number of water and air samples collected reduced costs for sampling. The change of discharge from COP sewer to SRP canal system allows for the treated water to be beneficially used.

8) 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.

9) 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, Operable Unit 1 (OU1), Phoenix, AZ	**EPA ID No:**	

Interview Type: *Visit*

Location of Visit: Integrated Groundwater Treatment Plant (IGWTP), and associated extraction wells Date: February 26, 2016

Time: 11:15 am-1pm

Interviewers

Name	Title	Organization
Chris Legg, Hargis and Associates, Contractor to ADEQ	Senior Hydrogeologist	Hargis and Assoc.

Interviewees

Name	Organization	Title	Telephone	Email
Jenn McCall	Freescale	Strategic Programs Manager	480-814-4587	Jenn.mccall@freescale.com
Leo Wilson	Gutierrez-Palmenberg, Inc	MTS operator	602-790-7452	Leo.w@gpimail.com
Jason Weed	Gutierrez-Palmenberg, Inc	MTS operator	602-234-0696x150	Jason.w@gpimail.com

Summary of Conversation

1) What is your overall impression of the project?

Good. For a system that is nearly 30 years old, it appeared to be in good operating condition, well maintained with appropriate upgrades and maintenance over the years.

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

Yes, The OU1 groundwater treatment system was operational for 91.4 percent of 2014 and was only down for routine maintenance and repairs and appears to have the same trends in 2015. The OU1 treatment system appears to be providing hydraulic containment for the majority of the main trichloroethene (TCE) plume, with the possible exception of the northern portion of the plume. The northern portion of the plume will be investigated during 2016 as part of Final Remedial Investigation/Feasibility Study activities and modifications to the OU1 remedy will be made if necessary to attain full hydraulic capture.

3) What does the monitoring data show? Is contaminant containment occurring?

Generally, the monitoring data shows, that hydraulic containment of the main TCE plume is occurring with the possible exception of the northern TCE plume boundary in the alluvial aquifer. Final Remedial Investigation/Feasibility Study activities, conducted during 2016, will be used to develop potential modifications to the OU1 remedy if deemed necessary. Significant reduction of TCE mass in groundwater, down gradient of the hydraulic capture system has also been observed since activation of the remediation system.

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.

Yes, there appears to be a continuous O&M presence with either personnel on-site or remote monitoring of the system by on-call personnel who have the ability to shut down the system remotely if necessary. There are alarms to alert the operators who may be located off site, of issues with the IGWT.

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.

I am not aware of any significant changes in the O&M requirements over the past 5 years. The main operational change within the past five years has been moving the discharge location for the treated effluent from the City of Phoenix Sanitary Sewer System to the Old Cross-Cut Canal which ultimately discharges to the Grand Canal, both is operated by Salt River Project. This change allows the treated effluent from the OU1 system to be beneficially used for crop irrigation. This change does not affect the protectiveness of the remedy. The changeover in discharge location occurred in late 2015.

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

There do not appear to have been any unexpected O&M difficulties over the past five years.

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

Not aware of any significant changes.

8) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

Not aware of any changes in laws and regulations that me effect the protectiveness of the remedy.

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

Depending on the results of the 2016 Final RI/FS investigations, appropriate enhancements of the groundwater extraction system may be necessary.

Additional Site-Specific Questions

[If needed]

Five-Year Review Interview Record

Site:		EPA ID No:	

Interview Type: *Email after Site Visit*
Location of Visit:
Date: 4/5/16 Time:

Interviewers

Name	Title	Organization

Interviewees

Name	Organization	Title	Telephone	Email
Brian Stonebrink	ADEQ	Project Manager	602-771-4197	BS4@azdeq.gov

Summary of Conversation

1) What is your overall impression of the project?
The treatment system is operating at a high efficiency. ADEQ as the lead for the OU2 treatment system under the 2010 Consent Decree has received regular reporting and the O & M plans are up to date. Extraction and treatment of the contaminated groundwater is continuously removing VOCs with around 15,000 pounds of VOCs removed since start up in 2001.

2) Is the remedy functioning as expected? How well is the remedy performing?
Yes. Containment and capture is adequate. The southern extraction well could be performing better.

3) What does the monitoring data show? Is contaminant containment occurring?
Yes, levels are greatly reduced. There is residual contaminants from before the treatment system was in place (2001) on the western downgradient side of the ridge (in the vicinity of 20th Street) and in the colluvium that are still detectable at low levels, but the upgradient contaminated groundwater is being treated and cut off from migrating downgradient. The annual effectiveness report show statistically significant decreasing contaminant concentration trends.

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.
Yes. ADEQ is notified of all shut downs for planned maintenance (annual canal dry up), power outages, pump failures, etc.

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 were new wells added in 2014 to monitor the upgradient plume. The sampling schedule has been consistent and is adequate.

6) Have there been unexpected O&M difficulties at the site in the last five years? If so, please give details.
Water levels have greatly declined. There is concern about the Southern extraction well (EWS) that does not have much water above the bottom of the screen.

7) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
Changes in the pumping rates have been kept at near optimum efficiency to keep the extraction rates high.

8) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy? **No.**

9) Do you have any comments, suggestions, or recommendations regarding the project? **The three extraction wells are maintaining containment as designed.**

Additional Site-Specific Questions

[If needed]

Five-Year Review Interview Record

Site:	Motorola 52nd Street Superfund Site, Operable Unit 2 (OU2), Phoenix, AZ	EPA ID No:	

Interview Type: *Visit*
Location of Visit: 20th Street Groundwater Treatment Plant (12 N. 20th Street), Phoenix, AZ
Date: February 24, 2016 Time: 8:00 – 11:00 a.m.

Interviewers

Name	Title	Organization
Matthew Masten, P.E.	Environmental Engineer	USACE

Interviewees

Name	Organization	Title	Telephone	Email
Manfred Plaschke	GHD Services Inc.	Project Manager	6022167200	Manfred.Plaschke@ghd.com
Eric Mannlein	GHD Services Inc.	Project Engineer	6022167200	Eric.Mannlein@ghd.com
Mike McNeil	GHD Services Inc.	Operator	6022167200	Michael.McNeil@ghd.com

Summary of Conversation

1) What is your overall impression of the project?
Great 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, CH2M, Hargis and CB&I).

2) Is the remedy functioning as expected? How well is the remedy performing?
The interim remedy (OU2 Groundwater Extraction System [GES]) is performing as designed and containing the full width and depth of the VOC plume at 20th Street (I-10).

3) What does the monitoring data show? Is contaminant containment occurring?
The OU2 GES is containing the contaminants of concern (VOCs). Overall, there are long term decreasing downgradient contaminant concentration trends in all downgradient monitor wells screened in the Salt River Gravels and Basin Fill.

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 call-outs, 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. In 2012, the Companies installed variable speed drives (VSD) on extraction wells EWN and EWS to better control flows as water levels starting dropping in the alluvial aquifer and the flow control valves were creating extra back pressure on the pumps/motors that would decrease their operational longevity. In 2015, the Companies changed the operation mode at extraction wells EWN and EWS from a flow control to level control. The speed of the variable speed drives (VSD) is now controlled by a water level transducer in the two extraction wells. EWN/EWS pump at a rate that maintains a safe operational water level in each extraction well and maximizes groundwater capture. This alteration in pumping control was performed in order to maximize the pumping/extraction rate in EWN and EWS while protecting the pump and motor from damage due to decreasing regional groundwater levels.

The VFD upgrade has reduced the electricity costs at EWN and EWS. Additionally, the VFD and pump control changes also help protect the pump/motor without plume containment impacts.

6) Have there been unexpected O&M difficulties at the site in the last five years? If so, please give details. No.

7) 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 Report the O&M/groundwater sampling is reviewed and proposed for the next calendar year. Beginning in 2011, the groundwater quality well sampling frequency has been reduced for certain wells from semiannual to annually (September). However, in 2014, 8 new groundwater monitor wells were installed and sampled for 4 quarters. In mid-2015, the Companies recommended changing sampling to annual (for the 8 new groundwater wells installed in 2014) and the Agencies concurred. The reduction in sampling frequency has provided a cost savings to the Companies. In 2012, after two years of sampling, the Companies recommended changing the boron sampling frequency in the Facility discharge and the SRP Grand Canal from quarterly to semi-annually and the Agencies concurred.

As water levels have dropped in the alluvial aquifer, extraction well flowrates have steadily decreased because there is less available impacted groundwater to pump. Additionally, the frequency of carbon change-outs for the carbon vessels has been reduced from four times a year to three times a year. This equates to a reduction of 90,000 lbs of carbon changed out every year and an annual cost savings of approximately $60,000 per year.

8) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy? No

9) 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 Superfund Site, Phoenix, AZ	**EPA ID No:**	

Interview Type: e-mail

Location of Visit:

Date: May 2, 2016

Time: 7:23

Interviewers

Name	Title	Organization

Interviewees

Name	Organization	Title	Telephone	Email
Steve Brittle	Don't Waste Arizona	M52 Community Information Group Member		sbrittle@yahoo.com

Summary of Conversation

1) What is your overall impression of the project? *The project is a failure.*

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

The remedy is not functioning well; very little contamination is being removed, and the remedy doesn't get to the root of the problem, which is the DNAPLS in the fractured bedrock.

3) What does the monitoring data show? Is contaminant containment occurring?

The monitoring data doesn't add up. New contaminated areas within the site's boundaries have been discovered recently with very high levels of contamination.

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. N/A *Don't know; that information is not being provided.*

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. N/A

Don't know; that information is not being provided.

6) Have there been unexpected O&M difficulties at the site in the last five years? If so, please give details. N/A

Don't know; that information is not being provided.

7) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency. N/A *Don't know; that information is not being provided.*

8) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy? N/A *Don't know; that information is not being provided.*

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

Plenty, but I doubt they are welcome or will be respected. I have been involved in this issue since 1992, and things are deteriorating. Community involvement is now a sick joke.

Additional Site-Specific Questions

[If needed]

Appendix G: Site Inspection Checklist

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Motorola (52nd St Plant) OU1 & OU2	**Date of inspection:** 10 February 2016
Location: Phoenix AZ	**EPA ID:** AZD009004177
Agency, office, or company leading the five-year review: EPA, Region 9	**Weather/temperature** sunny, 75°

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☐ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: *e.g. Groundwater monitoring*
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Jason Weed (Name) Engineer (Title) 2/24/16 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 602-234-0696
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** Jenn McCall (Name) Program Manager (Title) 2/24/16 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 480-814-4587
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ 602-234-0696
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

Interviews with other Motorola 52nd St OU1 and OU2 staff conducted separately via email. Attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	☐ Up to date	☐ N/A
■ As-built drawings	■ Readily available	■ Up to date	☐ N/A
■ Maintenance logs	■ Readily available	■ Up to date	☐ N/A

Remarks

2. **Site-Specific Health and Safety Plan** ■ Readily available ☐ Up to date ☐ N/A
☐ Contingency plan/emergency response plan ■ Readily available ☐ Up to date ☐ N/A
Remarks

3.	**O&M and OSHA Training Records** Remarks	■ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	■ N/A
	■ Effluent discharge	■ Readily available	■ Up to date	☐ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
5.	**Gas Generation Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
6.	**Settlement Monument Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
7.	**Groundwater Monitoring Records** Remarks	■ Readily available	■ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks	☐ Readily available	■ Up to date	☐ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☐ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
10.	**Daily Access/Security Logs** Remarks	■ Readily available	☐ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ■ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons:

See Attached for O&M costs

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ■ Gates secured ☐ N/A
Remarks

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ■ N/A
Remarks

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) self reporting

Frequency _____

Responsible party/agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ■ N/A

Violations have been reported ☐ Yes ☐ No ■ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ■ N/A

Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident

Remarks

2. **Land use changes on site** ■ N/A

Remarks

3. **Land use changes off site** ■ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ■ Roads adequate ☐ N/A

Remarks

B. Other Site Conditions

Remarks

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established
   ☐ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks

B. Benches ☐ N/A ☐ Applicable

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks

C. Letdown Channels ☐ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks

5. **Obstructions** Type_____ ☐ No obstructions ☐ Location shown on site map
Areal extent_____ Size_____
Remarks

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning
☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration
Remarks

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** ☐ N/A ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks

2. **Erosion** Areal extent_____ Depth_____ ☐ Erosion not evident
   Remarks

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks

4. **Dam** ☐ Functioning ☐ N/A
   Remarks

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored ☐ Evidence of breaching
   Frequency_____ Head differential_____
   Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☑ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☑ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☑ Air stripping ☑ Carbon adsorbers
☑ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent) sodium hexametaphosphate
☐ Others_____
☑ Good condition ☐ Needs Maintenance
☑ Sampling ports properly marked and functional
☑ Sampling/maintenance log displayed and up to date
☑ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ■ Good condition ■ Proper secondary containment ☐ Needs Maintenance
Remarks

4. **Discharge Structure and Appurtenances**
☐ N/A ■ Good condition ☐ Needs Maintenance
Remarks

5. **Treatment Building(s)**
☐ N/A ■ Good condition (esp. roof and doorways) ☐ Needs repair
■ Chemicals and equipment properly stored
Remarks

6. **Monitoring Wells** (pump and treatment remedy)
■ Properly secured/locked ■ Functioning ■ Routinely sampled ■ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks

D. Monitoring Data

1. Monitoring Data
■ Is routinely submitted on time ■ Is of acceptable quality

2. Monitoring data suggests:
■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ■ N/A
Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy is intended to remove VOC mass from the groundwater, contain the groundwater plume, and ultimately restore the groundwater to VOC levels below the MCLs. The remedy is effective and functioning as designed.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M activities appear to be adequate and contribute to the current and long-term effectiveness of the remedy.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

UV-ox unit in OU2 may be sold as it is not used. There is no UV-ox unit in OU1.

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Motorola (52nd St Plant) OU1 & OU2	**Date of inspection:** 10 February 2016
Location: Phoenix AZ	**EPA ID:** AZD009004177
Agency, office, or company leading the five-year review: EPA, Region 9	**Weather/temperature** sunny, 75°

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☐ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: *e.g. Groundwater monitoring*
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Jason Weed (Name) Engineer (Title) 2/24/16 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 602-234-0696
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** Jenn McCall (Name) Program Manager (Title) 2/24/16 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 480-814-4587
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ 602-234-0696
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

Interviews with other Motorola 52nd St OU1 and OU2 staff conducted separately via email. Attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	☐ Up to date	☐ N/A
■ As-built drawings	■ Readily available	■ Up to date	☐ N/A
■ Maintenance logs	■ Readily available	■ Up to date	☐ N/A

Remarks

2. **Site-Specific Health and Safety Plan** ■ Readily available ☐ Up to date ☐ N/A
☐ Contingency plan/emergency response plan ■ Readily available ☐ Up to date ☐ N/A
Remarks

3.	**O&M and OSHA Training Records** Remarks	■ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	■ N/A
	■ Effluent discharge	■ Readily available	■ Up to date	☐ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
5.	**Gas Generation Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
6.	**Settlement Monument Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
7.	**Groundwater Monitoring Records** Remarks	■ Readily available	■ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks	☐ Readily available	■ Up to date	☐ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☐ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
10.	**Daily Access/Security Logs** Remarks	■ Readily available	☐ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☒ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons:

See Attached for O&M costs

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
Remarks

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A
Remarks

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) self reporting
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☒ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☒ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks

2. **Land use changes on site** ☒ N/A
Remarks

3. **Land use changes off site** ☒ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions

Remarks

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established
   ☐ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks

B. Benches ☐ N/A ☐ Applicable

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks

C. Letdown Channels ☐ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks

5. **Obstructions** Type_____ ☐ No obstructions ☐ Location shown on site map
Areal extent_____ Size_____
Remarks

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning
☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration
Remarks

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** ☐ N/A ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks

2. **Erosion** Areal extent_____ Depth_____ ☐ Erosion not evident
   Remarks

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks

4. **Dam** ☐ Functioning ☐ N/A
   Remarks

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored ☐ Evidence of breaching
   Frequency_____ Head differential_____
   Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☑ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☑ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☑ Air stripping ☑ Carbon adsorbers
☑ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent) sodium hexametaphosphate
☐ Others_____
☑ Good condition ☐ Needs Maintenance
☑ Sampling ports properly marked and functional
☑ Sampling/maintenance log displayed and up to date
☑ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ■ Good condition ■ Proper secondary containment ☐ Needs Maintenance
Remarks

4. **Discharge Structure and Appurtenances**
☐ N/A ■ Good condition ☐ Needs Maintenance
Remarks

5. **Treatment Building(s)**
☐ N/A ■ Good condition (esp. roof and doorways) ☐ Needs repair
■ Chemicals and equipment properly stored
Remarks

6. **Monitoring Wells** (pump and treatment remedy)
■ Properly secured/locked ■ Functioning ■ Routinely sampled ■ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks

D. Monitoring Data

1. Monitoring Data
■ Is routinely submitted on time ■ Is of acceptable quality

2. Monitoring data suggests:
■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ■ N/A
Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy is intended to remove VOC mass from the groundwater, contain the groundwater plume, and ultimately restore the groundwater to VOC levels below the MCLs. The remedy is effective and functioning as designed.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M activities appear to be adequate and contribute to the current and long-term effectiveness of the remedy.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

UV-ox unit in OU2 may be sold as it is not used. There is no UV-ox unit in OU1.

	Motorola 52nd Street - FYR 2016 OU1 & OU2 O&M Costs by Year				
	2011	2012	2013	2014	2015
OU1 (O&M with Agency Oversight Costs)	**$ 1,424,277**	**$ 1,632,477**	**$ 1,417,563**	**$ 1,613,539**	**$ 1,655,505**
EPA Oversight	$ 172,729	$ 460,780	$ 321,074	$ 344,379	$ 542,844
ADEQ Oversight	$ 63,384	$ 91,212	$ 21,980	$ 116,308	$ 89,138
Total OU1 O&M w/o Agency Oversight Costs	$ 1,188,164	$ 1,080,486	$ 1,074,509	$ 1,152,852	$ 1,023,522
OU2 (100% O&M with Agency Oversight Costs)	**$ 1,070,434**	**$ 1,070,434**	**$ 1,070,434**	**$ 1,070,434**	**$ 1,070,434**
EPA Oversight	$ 334,879	$ 12,741		$ 317,189	
ADEQ Oversight	$ 84,963	$ 84,963	$ 84,963	$ 84,963	$ 84,963
Total OU2 O&M w/o Agency Oversight Costs*	$ 985,471	$ 985,471	$ 985,471	$ 985,471	$ 985,471

* OU2-Both Freescale and Honeywell incur additional consulting and sampling costs that are not included in these costs.

Appendix H: Trip Report from Inspection Visit

Appendix H
Trip Report – Five-Year Review Site Inspection

Motorola 52nd Street Superfund Site – Groundwater Treatment Systems

1. INTRODUCTION

a. Date of Visit: 24 February 2016

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	602-216-7200
Jenn McCall	Program Manager, Freescale Semiconductor	480-814-4587
Jason Weed	Engineer, Gutierrez-Palmenberg	602-234-0696
Leo Wilson	Gutierrez-Palmenberg	602-244-6317
Christopher Legg	Hydrologist, Hargis + Associates	480-345-0888
Mike McNeil	GHD, OU2 Operator	602-708-6265
Douglas Hulmes	Scientist, CB&I	480-213-9722
Eric Mannlein	Engineer, GHD	602-216-7200
Bob Frank	CH2M	480-295-3927
Jeff Menken	Hargis + Associates	480-345-0888
Brian Stonebrink	ADEQ	602-771-4197

2. SUMMARY

A site visit to the Motorola 52nd Street Superfund Site, Operable Unit 1 (OU1) and Operable Unit 2 (OU2) was conducted on 24 February, 2016. 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 groundwater treatment systems, groundwater extraction wells, and groundwater discharge points.

3. DISCUSSION

On 24 February 2016, 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. McNeil 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; according to Mr. Plaschke, hasn't run since 2001, except for one day a year for maintenance. It is the team's recommendation that the UVOX system be sold.

The team toured the GAC vessel facility. The weather was sunny, calm, and approximately 60 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 indicated that one issue the facility is facing is dropping groundwater levels. In 2014, there was a four foot drop in levels, a 1.5 foot drop in 2015. Variable frequency drives (VFDs) were added to the North and South extraction wells in the last three years, and the control logic for the pumps was changed to use water level instead of flow. Through 2013, the system pumped approximately 1 billion gallons of water per year. In 2014, that number was down to 800 million gallons, and in 2015, 700 million gallons.

Mr. Plaschke informed the team that there has been an average of three carbon change outs per year for the last three years. The change outs occur once there is break through into the effluent. The process is sampled monthly. The spent carbon undergoes a custom reactivation and is mixed with virgin carbon during change out. Over its lifetime, the system has had a 95-98% uptime. System data is logged and auto-downloaded weekly. The system is remotely controlled, monitored and alarmed.

Twelve volumes of O&M manuals and drawings were present on-site, the last revision was in 2011. Maintenance logs and daily reports were available. In the last year, there were minor weld leaks in some vessels. These were repaired and the vessels were recertified. Mr. McNeil stated that in 2016 and 2017, repairs were planned that included re-lining the carbon vessels. Health and Safety Plans (HASP) were available, there was a small update to the HASP a few weeks prior to the site inspection. 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 adjacent to the facility, deterring any would-be vandals. Overall, the system appeared to be in excellent condition and functioning correctly.

The team walked to the 'middle' extraction well, and passed a few monitoring wells on the way. Monitoring well NW08 S was inspected, the flush mount cover was removed. The well head was secured and appeared to be in good shape. Eight new monitoring wells were added in 2014. Some monitoring wells are sampled annually, some semi-annually. The middle extraction well was so-called by Mr. Plaschke because it is in the middle of the plume and has the highest VOC concentrations. The wellhead and associated well house appeared to be in good working order, no evidence of trespassing or vandalism was present. The team next traveled to the pipeline discharge for the treated water in the Arizona Grand Canal. Salt River Project maintains the canal sidewall where the treated water is discharged.

The team arrived at the OU1 facility at 1115 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. The system was constructed in 1992. Mr. Weed stated that the system is meeting all substantive requirements. Carbon change outs occur approximately every 180 days. A new

discharge pipeline was recently finished, leading to the Crosscut Canal. Beginning this year, the system is discharging treated water to the canal rather than the City of Phoenix storm water 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 'dry out' where the canals are drained, the facility discharges to the City of Phoenix through a Class A storm water permit.

Water levels in extraction wells are measured monthly, and well pumps are controlled manually. The system is remotely monitored and alarmed 24/7. 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. 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 paper. No hazardous waste is leaving the site. 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.

A dedicated power line and transformer was installed to the system two years ago. This has resulted in cost savings, as the power no longer needs to be purchased via the on-site semiconductor company. Steam and chilled water for the dehumidifier is still being sourced from the on-site company.

The team traveled to view the well field and discharge point adjacent the Crosscut Canal. It was noted that some well vaults had minor damage to the protective sliders over the locks, however, 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 discharge point was functioning at approximately 200 gallons per minute, which is close to the maximum flowrate for the system. Mr. Weed indicated that SRP has remote shut-off capability should they need to stop discharges to the canal.

All components of the remedial action for Motorola Inc, (52nd Street Plant) 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.

4. ACTIONS

The USACE will incorporate information obtained from the site visit into the Five-Year Review report.

Matthew Masten, P.E.
Environmental Engineer
CESPL-TESB

Appendix H – OU1 Photos

Trip Report – Five-Year Review Site Inspection Photos

Motorola 52nd Street Superfund Site – Groundwater Treatment Systems

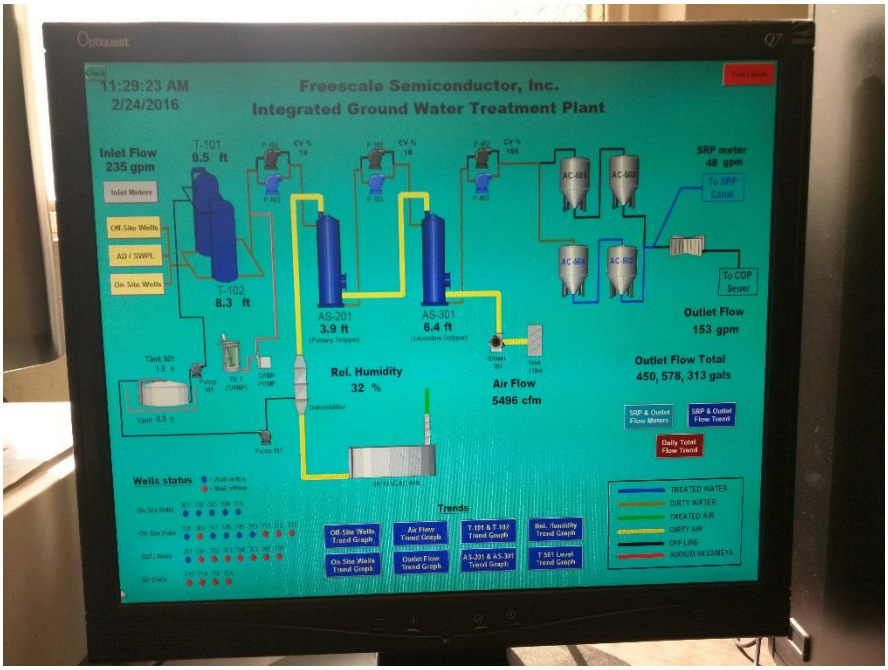

Figure 1-OU1 control console

Figure 2-OU1 air stripper towers

Figure 3-OU1 vapor phase GAC roll off vessel

Figure 4-OU1 liquid phase GAC vessel

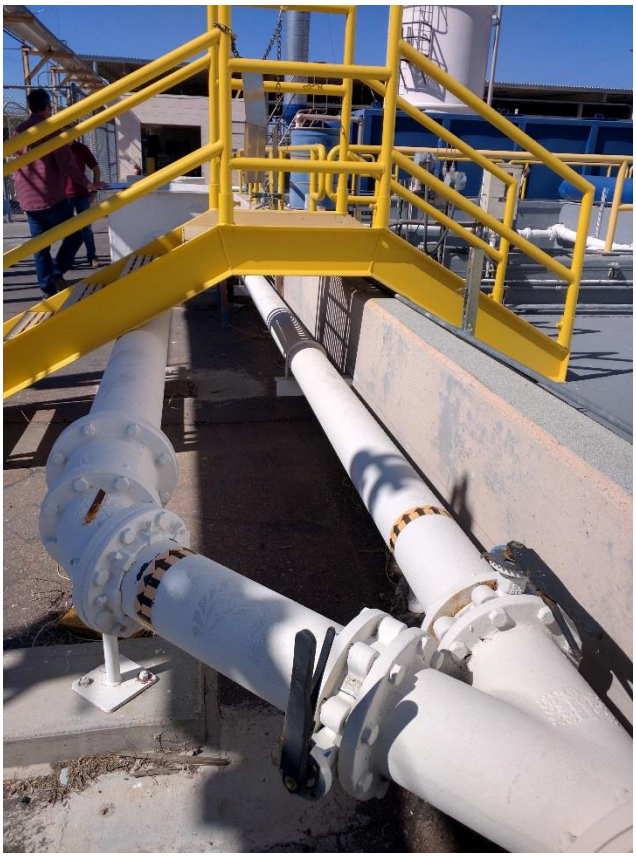

Figure 5- OU1 Discharge pipe to canal and City storm sewer

Figure 6- OU1 sodium hexametaphosphate injection tank

Figure 7- Overview of OU1 system, facing northeast


Figure 8-OU1 well DM-309 vault with lock protected by slider

Figure 9- Interior well vault DM-309

Figure 10- Crosscut Canal, facing south

Appendix H – OU2 Photos

Trip Report – Five-Year Review Site Inspection Photos

Motorola 52nd Street Superfund Site – Groundwater Treatment Systems

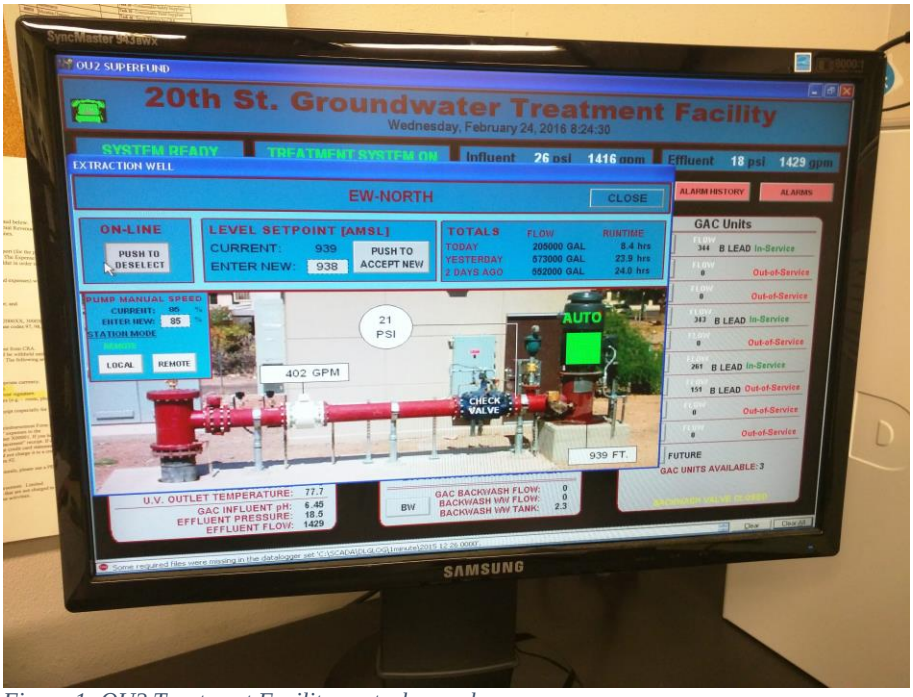

Figure 1- OU2 Treatment Facility control console

Figure 2-Overview of OU2 facility, facing east

Figure 3-OU2 fence and security gate

Figure 4-OU2 south extraction well

Figure 5-South extraction well control panel


Figure 6-OU2 GAC vessels, facing southwest

Figure 7-OU2 treated water supply for carbon refilling


Figure 8-OU2 valve tree

Figure 9-Treated water irrigation pipe for on-site landscaping


Figure 10-Empty vessel with screen to prevent bird entry

Figure 6-Vault access to underground 48,000 gallon backwash waste water tank

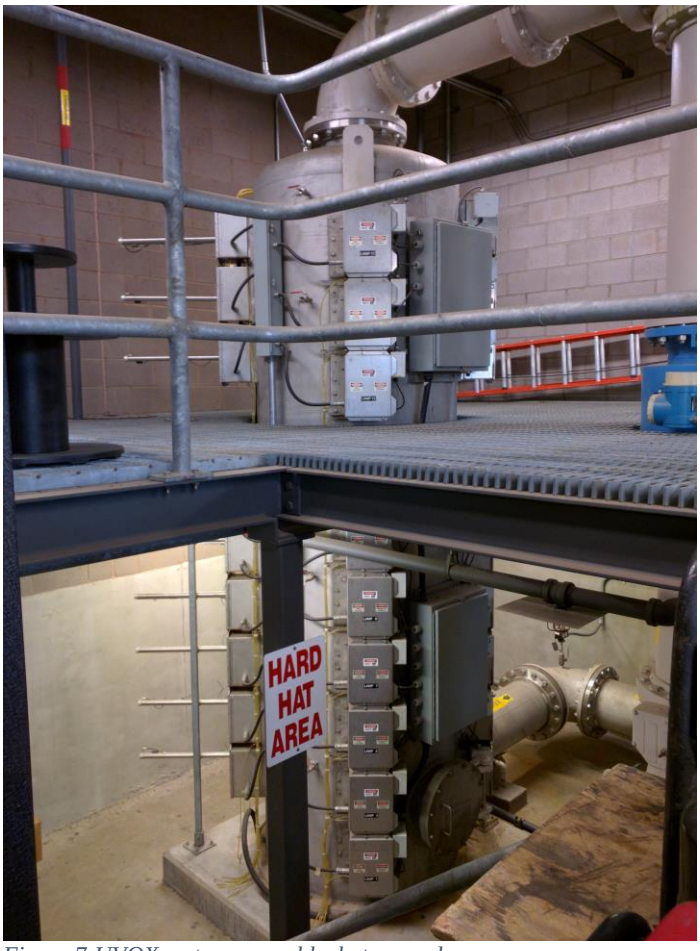

Figure 7-UVOX system, operable, but unused

Figure 8-Flush mount monitoring well NW08

Figure 94-Middle extraction well

Figure 15-Extraction well control panel


Figure 16-Discharge to Arizona Grand Canal