THIRD FIVE-YEAR REVIEW REPORT FOR INDIAN BEND WASH SUPERFUND SITE MARICOPA COUNTY, ARIZONA

PREPARED BY

U.S. Army Corps of Engineers

FOR

U.S. Environmental Protection Agency

Region 9

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Executive Summary

This is the third Five-Year Review of the Indian Bend Wash Superfund Site (Site) located in Maricopa County, Arizona. The purpose of this Five-Year Review is to review information to determine if the remedy is and will continue to be protective of human health and the environment.

In 1987, the United States Environmental Protection Agency (EPA) divided the Indian Bend Wash Site into two sub-sites, encompassing approximately 13 square miles of the Paradise Valley Groundwater Basin. The Site includes 10-square miles as the North Indian Bend Wash, located in the City of Scottsdale and 3-square miles as the South Indian Bend Wash, located in Tempe. Groundwater within the Indian Bend Wash footprint is an important source of drinking water for the Phoenix metropolitan area. In 1981, trichloroethylene (TCE) was discovered in the groundwater from several City of Scottsdale municipal wells at concentrations exceeding Arizona Department of Health Services action levels in effect at that time. In September 1983, EPA placed the Indian Bend Wash Site on the National Priorities List due to the widespread presence of chlorinated solvents, particularly TCE and perchloroethene (PCE) in groundwater.

EPA selected the remedy for the North Indian Bend Wash in the 1988 Scottsdale Groundwater Operable Unit Record of Decision, the 1991 Shallow Soils and Groundwater Record of Decision, the 2001 Final Record of Decision Amendment, and the 2012 Explanation of Significant Differences. EPA selected the remedy for the South Indian Bend Wash in the September 1993 Vadose Zone Record of Decision, 1998 Groundwater Record of Decision, and the 2004 Record of Decision Amendment.

North Indian Bend Wash

In the 2001 Final Record of Decision Amendment for the North Indian Bend Wash, EPA selected the final remedy to address aquifer restoration by containment, treatment, and monitoring of volatile organic compounds in groundwater, to protect long-term human health and the environment. In 2012, the Explanation of Significant Differences, EPA required a change in treatment location and technology for an extraction well that ultimately provides a potable supply of water for the City of Scottsdale. Components of the North Indian Bend Wash remedy include:

- Five groundwater extraction and treatment systems were constructed. The five-groundwater extraction and treatment systems continue to operate as part of the ongoing groundwater remedial efforts for North Indian Bend Wash. These include the Area 7 and Area 12 Source Area Groundwater Extraction and treatment facilities and three additional plants serving the public supply: the Central Groundwater Treatment Facility and Northern Groundwater Treatment Facility serving the City of Scottsdale and the Miller Road Treatment Facility serving the City of Paradise Valley.
- Area 6, 8, and 12 soil vapor extraction systems were operated and decommissioned based on performance data and achievement of ROD-specified groundwater protection criteria. The Area 7 soil vapor extraction system was operated intermittently from July 1994 to December 2000 when it was shut down for long-term rebound testing, followed by a brief period of

operation between 2008 and 2010. EPA issued approval for the decommissioning of the Area 7 soil vapor extraction treatment system in April 2015. Decommissioning activities were performed in August and September 2015, and the decommissioning report submitted on November 18, 2015.

The Area 7 remedy extracts groundwater from three middle alluvial unit wells and is a critical remedy component. It removes volatile organic compounds and is intended to prevent contamination from migrating to the southwest margin of the Site and subsequently into the lower alluvial unit. The Area 12 remedy extracts and treats middle alluvial unit groundwater and is intended to prevent volatile organic compounds in the middle alluvial unit from migrating to the southwest margin and then into the lower alluvial unit.

The North Indian Bend Wash remedial actions are contributing to restoring groundwater for beneficial use. Treated groundwater is supplied to the City of Scottsdale and Paradise Valley potable water system, to the Salt River Project for irrigation use, and to shallow injection wells that recharge the upper alluvial unit aquifer and provide hydrological containment. The groundwater extraction and treatment remedy are controlling exposure to contaminated groundwater. Production wells to the north of the Site are protected from contaminants related to the Site as the Northern Groundwater Treatment Facility extracts the northward moving contaminates and treats them to allowable concentrations. The groundwater remedy for North Indian Bend Wash is currently undergoing a remedy optimization evaluation to determine if additional enhancements are required to ensure long term protectiveness.

The North Bend Indian Wash remedy is currently protective of human health and the environment. Short-term vapor intrusion mitigation measures are in place at the two buildings adjacent to Area 7. However, to be protective in the long term, the vapor intrusion concerns at Area 7 need to be permanently addressed. The extent of the vapor intrusion source at Area 7 needs to be defined and remediated. The Northern Groundwater Treatment Facility provides plume containment for the northern extent of the groundwater plume and prevents the groundwater plume from moving further north into the production wells. For the remedy to be protective in the long-term, the extent of the groundwater flow at the Western Margin needs to be more thoroughly defined. The communication system at the Central Groundwater Treatment Facility needs to be upgraded to prevent further accidental releases. The Remedy Optimization study, once completed, is expected to provide specific recommendations that to ensure long term protectiveness.

South Indian Bend Wash Operable Unit, Tempe, Arizona

In the 2004 Record of Decision Amendment, EPA selected the final remedy for the South Indian Bend Wash to address groundwater restoration by monitored natural attenuation in order to protect long-term human health and the environment. The South Indian Bend Wash monitored natural attenuation remedy has successfully reduced volatile organic compound concentrations in groundwater in the upper alluvial unit in the western and central plumes, and the middle alluvial unit in the eastern plume to below drinking water maximum contaminant levels. The Remedial Action Completion Report was completed and approved by EPA in June 2020 indicating all remedial actions were completed and

remediation goals defined in the Record of Decision were achieved. Soil gas study results found all source areas were determined to require no further action for vapor intrusion as no risk-based screening levels were exceeded for either commercial/industrial or residential use.

In 2016 EPA was informed that the City of Tempe had shut down three municipal supply wells due to the presence of per-and polyfluoroalkyl substances (PFAS) in groundwater. Subsequently, PFAS has also been found in several South Indian Bend Wash groundwater monitoring wells. EPA is preparing to conduct a new Remedial Investigation and Feasibility Study to define the extent of contamination and evaluate alternatives to address PFAS at South Indian Bend Wash. PFAS compounds are highly persistent in the environment, do not degrade and can spread widely.

The South Indian Bend Wash remedy is currently protective, following successful attainment of remedial action objectives for volatile organic contaminants, which now meet drinking water standards. The vapor intrusion evaluation required by the second Five Year Review has been completed; the results of recent soil gas sampling concluded no further action was necessary to address vapor intrusion risk as health-based criteria were not exceeded for either commercial/industrial or residential use at any of the former source areas. Although there is no current exposure to PFAS in the public drinking water supply, for the remedy to be protective in the long term, a new investigation to determine the extent and sources of PFAS in groundwater is necessary, and ultimately a new remedy. The monitored natural attenuation remedy for volatile organic compounds is not expected to be effective for PFAS contaminants that do not naturally degrade.

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List of Abbreviations and Acronyms

1,1-DCE	1,1-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
ARAR	applicable or relevant and appropriate requirement
AWC	Arcadia Water District
bgs	below ground surface
CGTF	Central Groundwater Treatment Facility
COS	City of Scottsdale
COT	City of Tempe
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Difference
HVAC	Heating, ventilation, and air conditioning
LAU	Lower Alluvial Unit (monitoring wells are designated “LA”)
MAU	Middle Alluvial Unit (monitoring wells are designated “MA”)
MRTF	Miller Road Treatment Facility
NIBW	North Indian Bend Wash
NGTF	Northern Groundwater Treatment Facility
MCL	Maximum Contaminant Level (EPA drinking water standard)
PCs	North Indian Bend Wash Participating Companies
PCE	Perchloroethylene or Tetrachloroethylene
PFAS	Per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
ROD	Record of Decision
“Site”	Indian Bend Wash Superfund site
SIBW	South Indian Bend Wash
SRP	Salt River Project
TCE	trichloroethylene
UAU	Upper Alluvial Unit (monitoring wells are designated “UA”)
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per meter cubed (air volume)
USACE	U.S. Army Corps of Engineers
VLEACH	Vadose Zone Leaching Model

1. Introduction

The purpose of a Five-Year Review is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review 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 Five-Year Review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act Section 121, 40 Code of Federal Regulation Section 300.430(f)(4)(ii) of the National Contingency Plan and EPA policy.

This is the third Five-Year Review for the Indian Bend Wash Site. The triggering action for this statutory review of the Indian Bend Wash is the completion date of the previous Five-Year Review on September 29, 2016. The Five-Year Review has been prepared because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

The Indian Bend Wash is composed of two sub-sites: the North Indian Bend Wash and the South Indian Bend Wash, which are each addressed in this Five-Year Review. The North Indian Bend Wash includes the groundwater extraction, treatment, and remedies in the northern portion of the Indian Bend Wash Site and the South Indian Bend Wash Site includes the monitored natural attenuation remedy for groundwater at the southern portion of the Site.

The Indian Bend Wash Superfund Site Five-Year Review was led by Carolyn d'Almeida of EPA Region 9 and Cynthia Wetmore, EPA Region 9 Superfund Five-Year Review Coordinator. The U.S. Army Corps of Engineers participants were Jacob Williams, Program Manager; Deborah Johnston, Technical Lead; and Justin McNabb, Geologist. The review began at the project kickoff meeting on November 12, 2020.

Table 1. Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Indian Bend Wash Superfund Site		
EPA ID: AZD980695969 (North Indian Bend Wash and South Indian Bend Wash)		
Region: 9	**State:** AZ	**City/County:** Scottsdale and Tempe/ Maricopa
SITE STATUS		
National Priorities List Status: Final		
Multiple Operable Units? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Carolyn d'Almeida		
Author affiliation: U.S. Environmental Protection Agency, Region 9		
Review period: 11/12/2020- 7/27/2021		
Date of site inspection: 10/6/2020		
Type of review: Statutory		
Review number: 3		
Triggering action date: 9/29/2016		
Due date *(five years after triggering action date)*: 9/29/2021		

1.1. Background

The entire area of the Indian Bend Wash Site covers about 13 square miles in Scottsdale and Tempe, Arizona. There are numerous industrial facilities located in and near the Indian Bend Wash Site. Up until the 1970s, industrial solvents containing volatile organic compounds were typically disposed of directly onto the ground or in dry wells. These disposal practices, along with other releases, resulted in the soil and groundwater contamination at the Site. In 1987, EPA divided the Indian Bend Wash into two sub-sites : North Indian Bend Wash located north of the Salt River within the City of Scottsdale and the South Indian Bend Wash located south of the Salt River within the City of Tempe (Figures 1 through Figure 3).

1.2. Physical Characteristics

1.2.1. North Indian Bend Wash

The North Indian Bend Wash is located north of the Salt River within the City of Scottsdale, Arizona (approximately 10 square miles) and is within the southern portion of the Paradise Valley Basin. The Paradise Valley Basin is bounded by the McDowell Mountains to the northeast, the Phoenix Mountains to the west, and Camelback Mountain and the Papago Buttes to the southwest. The Paradise Valley Basins continues and deepens to the east. The North Indian Bend Wash is in the eastern portion of the Salt River Valley, an irrigated region around the lower course of the Salt River. The Salt River is seasonally fed by mountain streams near the Mogollon Rim of the Mogollon Plateau and, if there is an adequate supply of water, it flows southwest to join the Gila River in south-central Arizona. Otherwise, the Salt River is typically dry downstream of Tempe as it only flows during major rainfall and snow events and all water is diverted at a point upstream of Tempe and Scottsdale.

Land use in the North Indian Bend Wash is a mix of residential, industrial/commercial, agricultural, public parks, a cemetery, undeveloped space, and waterways. The North Indian Bend Wash groundwater plume is located in a highly developed urban setting and is generally bound by the Salt River to the south, Chaparral Road to the north, the Pima freeway (Loop 101) to the east, and Scottsdale Road to the west. Environmentally sensitive areas in the North Indian Bend Wash Site are associated with the Indian Bend Wash and the Salt River. The U.S. Fish and Wildlife Service National Wetland Inventory map characterizes the Salt River as a Riverine System and the numerous lakes (e.g., McKellips Lake) along the Indian Bend Wash are characterized as Freshwater Ponds. The southern portion of the North Indian Bend Wash Site is located within the 100-year flood zone of the Salt River and the Indian Bend Wash and associated green belt areas are designated as a regulatory floodway.

Groundwater is primarily used for municipal and irrigation purposes. Complex water rights and apportionment of groundwater among various municipal, quasi-governmental, and private entities govern groundwater use in the North Indian Bend Wash. Several municipalities and water purveyors extract groundwater from within, or adjacent to, the North Indian Bend Wash groundwater plume.

Figure 1. Indian Bend Wash Location Map

Source: Second Five-Year Report for Indian Bend Wash Site

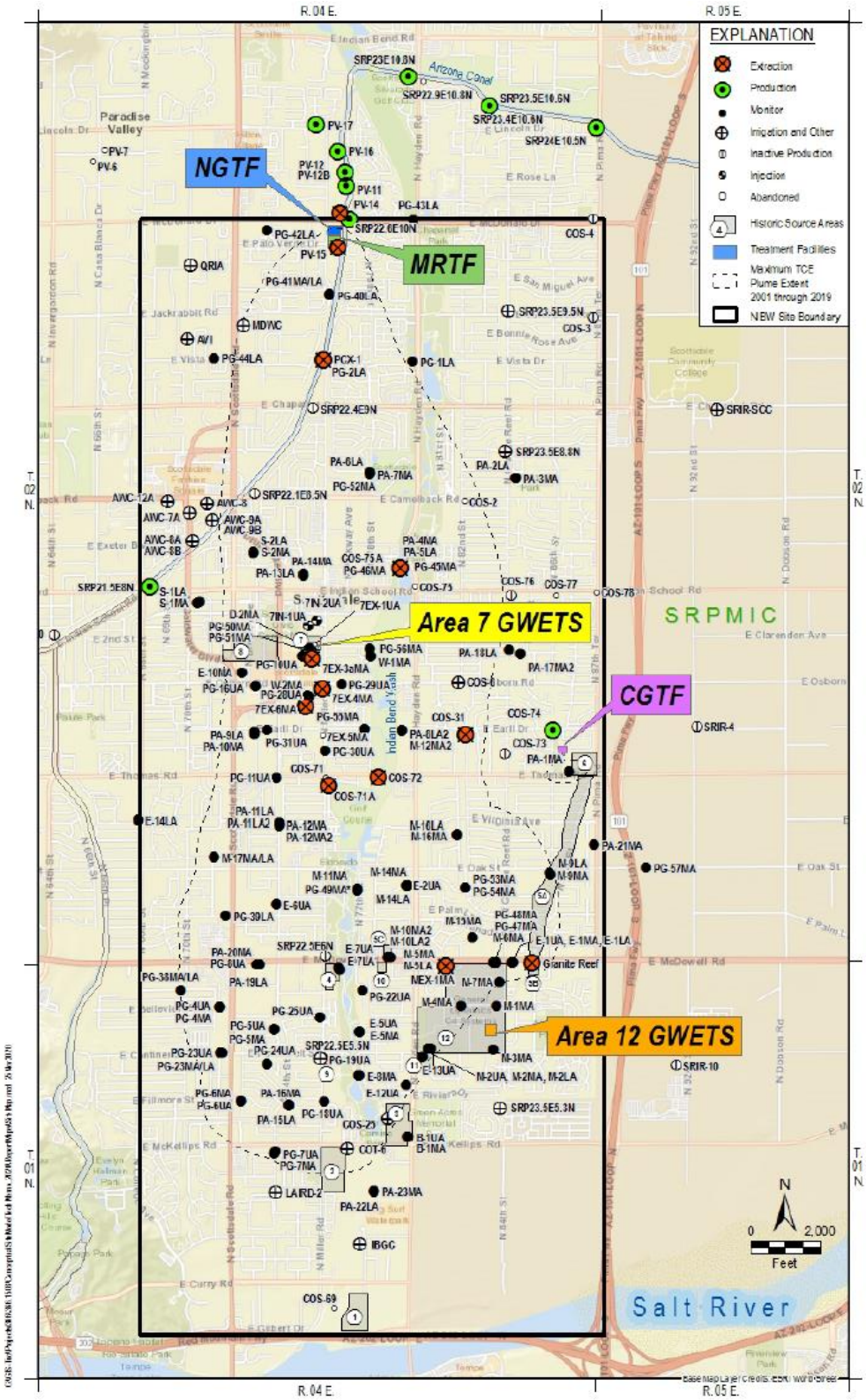
1.2.2. South Indian Bend Wash

The South Indian Bend Wash Site is approximately three-square miles located in the City of Tempe. The area is bounded by Apache Boulevard to the south, Rural Road to the west, Loop 101-Price Freeway to the east, and the Salt River to the north. In the South Indian Bend Wash, surface water is used as the primary drinking water source with groundwater used as a stand-by drinking water supply and for industrial purposes.

Land in the South Indian Bend Wash is developed for residential, commercial, and light industrial uses. The area between Apache Boulevard and University Drive is primarily residential. Land use north of University Drive is largely retail and commercial, including light-industrial and auto repair/scrap facilities in the area south of the Salt River. The area east of Rural Road is primarily used by Arizona State University for off-campus student housing, dormitories, athletic fields, a golf course, and includes many single-family homes. The northernmost area of the South Indian Bend Wash Site has been developed into a regional retail center. The South Indian Bend Wash Site includes the Salt River itself, which is ephemeral and flows during storm events and during releases from the upstream Roosevelt Dam. The northern portion of the South Indian Bend Wash Site is located within the 100-year flood zone of the Salt River.

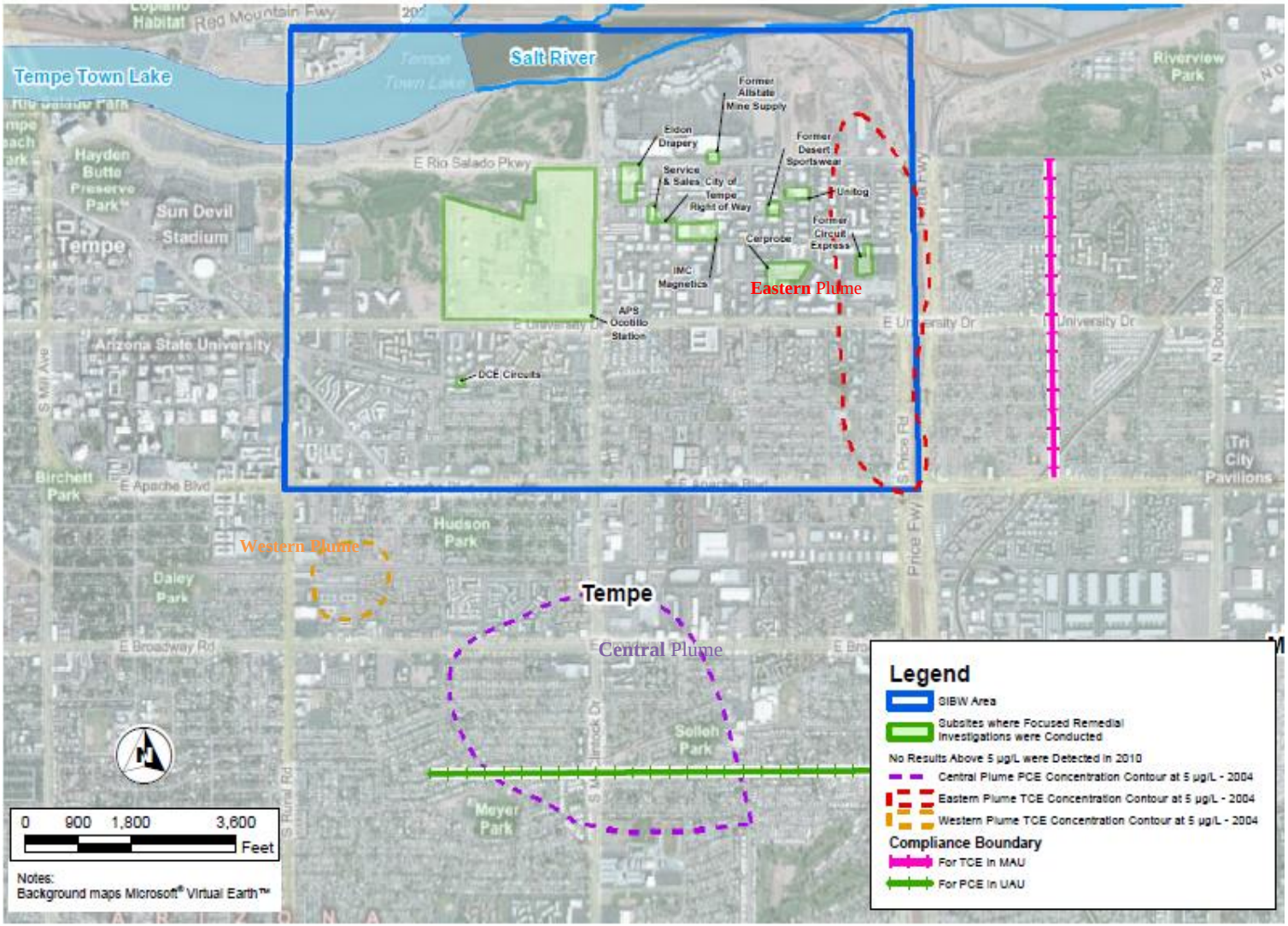
Environmentally sensitive areas located in or adjacent to the South Indian Bend Wash include the Salt River and associated wetlands, as well as Tempe Town Lake. The U.S. Fish and Wildlife Service National Wetland Inventory map characterizes the Salt River as a Riverine System. Tempe Town Lake was conceived as a project to transform a portion of the Salt River into an urban lake to provide recreational opportunities and promote habitat restoration and economic benefits. The lake is approximately two miles long and up to 220 acres in size. Tempe Town Lake is located approximately one mile north of the South Indian Bend Wash groundwater plumes.

Figure 2. Detailed Map of the North Indian Bend Wash Groundwater Plume Extent and Five Treatment Plant Locations



Source: 2021 Draft Conceptual Site Model Update

Figure 3. Detailed Map of the South Indian Bend Wash Former Groundwater Plumes



Source: First Five-Year Report for Indian Bend Wash Site

1.3. Hydrology

1.3.1. North Indian Bend Wash

The North Indian Bend Wash Site is situated in the Basin and Range geologic province, with the groundwater basin consisting primarily sedimentary deposits derived from erosion and uplift of the surrounding mountain blocks. Principal geologic characteristics of the sedimentary alluvial deposits in the vicinity of the North Indian Bend Wash Site are present in three distinct groundwater units: the upper alluvial unit (UAU), middle alluvial unit (MAU), and lower alluvial unit (LAU) (Figure 4).

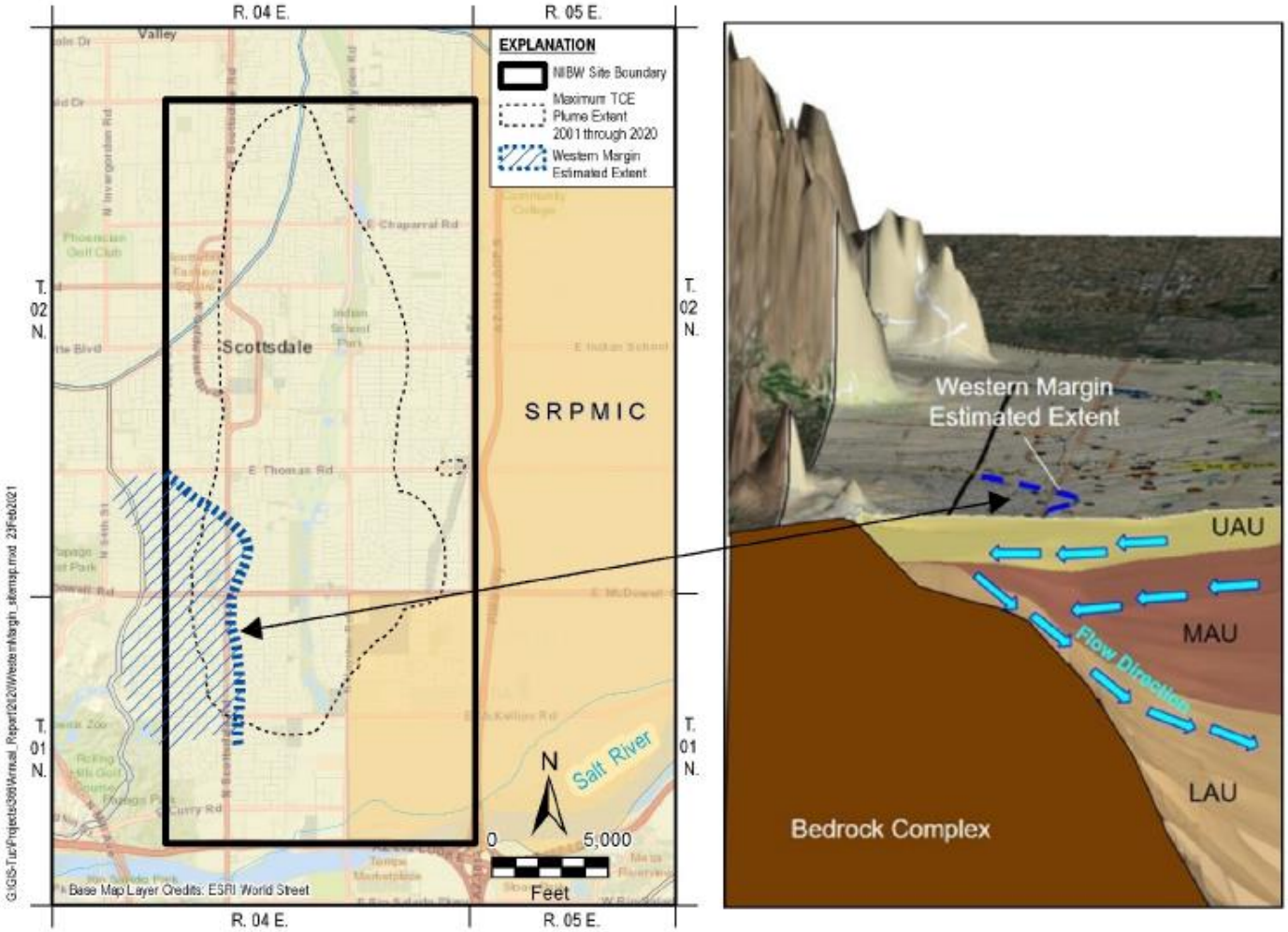
The upper alluvial unit consists primarily of sand, coarse gravel, cobbles, and boulders. The depth to the water table in the upper alluvial unit ranges from approximately 65 feet to 104 feet below ground surface (bgs), with 40 to 100 feet of saturated thickness. In the North Indian Bend Wash, the direction of groundwater movement in the upper alluvial unit is from east to west in the area south of McDowell Road, and (slightly changes directions from the northern part of the area) northeast to southwest in the vicinity of Thomas Road. The upper alluvial unit groundwater flows toward the southwest margin of the North Indian Bend Wash where bedrock is encountered, and there, groundwater moves vertically into the underlying alluvial units (Figure 4). The upper alluvial unit is not used for potable supply.

The middle alluvial unit primarily consists of silt, clay, and interbedded fine sands that transmit much of the water that occurs in the unit. The middle alluvial unit thickness ranges from approximately 360 to 660 feet. Water elevations in wells screened in the middle alluvial unit are under hydraulically confined conditions and occur at depths between approximately 90 feet and 150 feet bgs. Groundwater flow within the middle alluvial unit is generally to the southwest towards the western margin where the Papago Buttes form an alluvial fan. At the western margin groundwater in the middle alluvial unit merges with the lower alluvial unit and groundwater flows northward towards the Paradise Valley extraction wells.

The lower alluvial unit consists of cemented gravel, boulders, sand, sandy clay, and silty sand, with some interbedded clayey zones. The lower alluvial unit is coarser grained than the middle alluvial unit and is the principal alluvial unit in the region for irrigation and drinking water. The lower alluvial unit is at least 500 feet thick and likely thicker than 700 feet at some parts of the Site. The lower alluvial unit thins out at the basin margin in the vicinity of exposed bedrock at the southwest margin and near the mountainous part of Paradise Valley. Water elevations in wells perforated in the lower alluvial unit are under confined conditions and occur at depths of between approximately 129 and 341 feet.

Large production wellfields located north of the North Indian Bend Wash groundwater plume draw groundwater primarily from the lower alluvial unit and to a lesser extent from the middle alluvial unit. At the western margin of the basin, the groundwater in the upper alluvial unit and middle alluvial unit flows into the lower alluvial unit due to the lower hydraulic head of the lower unit compared to the two upper units. Groundwater flow in the North Indian Bend Wash plume is complex; there is some uncertainty in the conceptual site model with regards to groundwater flow with respect to vertical and lateral gradients and contaminant transport.

Figure 4. North Indian Bend Wash Plume extent and Western Margin



Source: 2020 Annual Site Monitoring Report, North Indian Bend Wash

1.3.2. South Indian Bend Wash

Prior to 1967, groundwater in the South Indian Bend Wash was the primary source of potable water for the City of Tempe. In 1967, City of Tempe started to rely predominantly on surface water to meet its potable water needs. Groundwater was used for stand-by potable supply and for industrial purposes. The City of Mesa, located outside but adjacent to the South Indian Bend Wash Site, uses groundwater for municipal supply.

The South Indian Bend Wash groundwater is present in the same three distinct alluvial units as found in the North Indian Bend Wash. The upper alluvial unit is distributed across the entire South Indian Bend Wash. The upper layer is typically not present near the Salt River but is more than 20 feet thick locally south of the Salt River channel. The upper alluvial unit is encountered from ground surface to approximately 110 to 170 feet bgs further south. The groundwater table fluctuates more than 50 feet.

The groundwater flow direction in the upper alluvial unit is toward the south to southwest during non-river flow conditions in the Salt River. These flow directions shift to the south to southeast during river flow conditions in the Salt River when recharge influences groundwater flow directions. Groundwater flow through the upper alluvial unit originates mainly from Salt River recharge (during flow events) and lateral inflow moves vertically downward, eventually entering the middle alluvial unit.

The middle alluvial unit occurs throughout the South Indian Bend Wash Site. The interbedded stratigraphy encountered within the middle alluvial unit is subdivided into three subunits A, B, and C. The Subunit A is very thin and discontinuous; consequently, no EPA wells are screened in this subunit. The groundwater flow direction in Subunit B is generally west to east, but insufficient data exists to fully characterize the flow direction. The groundwater flow direction in Subunit C varies from due north to east, with northeast appearing to be the predominant flow direction.

During the South Indian Bend Wash remedial investigation, the lower alluvial unit was encountered only once, at a depth of 500 feet bgs.

2. Remedial Actions Summary

2.1. Basis for Taking Action

In 1981, trichloroethylene (TCE) was discovered in the groundwater at several Scottsdale and Salt River Project[1] municipal wells at concentrations exceeding the Arizona Department of Health Services action levels and federal drinking water standards (also known as Maximum Contaminant Levels). EPA then sampled additional wells in the surrounding areas, including the City of Tempe production wells. Results from this sampling indicated TCE and tetrachloroethylene (PCE) concentrations in some of the City of Tempe production wells were above federal drinking water standards. In 1982, EPA placed the Indian Bend Wash Site on the National Priorities List. Groundwater at the Indian Bend Wash Site is contaminated with volatile organic compounds at concentrations above the federal drinking water standards.

In the North Indian Bend Wash, the contaminants are TCE, PCE, chloroform, 1,1-dichloroethene (1,1-DCE), and 1,1,1-trichloroethane (1,1,1-TCA). In the South Indian Bend Wash, the contaminants were TCE and PCE. Low concentrations of volatile organic compounds were initially discovered at the South Indian Bend Wash in three areas designated as the western, central, and eastern plumes. The presence of these contaminants in the drinking water was the basis for taking action.

[1] The Salt River Project is the umbrella name for two separate entities: the Salt River Project Agricultural Improvement and Power District, an agency of the state of Arizona that serves as an electrical utility for the Phoenix metropolitan area, and the Salt River Valley Water Users' Association, a utility cooperative that serves as the primary water provider for much of central Arizona. It is one of the primary public utility companies in Arizona.

2.2. Remedy Selection

2.2.1. North Indian Bend Wash

The decision documents for the selection of the remedy at North Indian Bend Wash are the 1988 Groundwater Operable Unit Record of Decision (ROD), the 1991 Shallow Soils and Groundwater ROD, the 2001 Final ROD Amendment, and the 2012 Explanation of Significant Differences (ESD).

Summary of 1988 Groundwater ROD

The remedy for the North Indian Bend Wash groundwater (1988 ROD), included extraction and treatment to address volatile organic compounds in the middle alluvial unit and lower alluvial unit in the Scottsdale area. The remedial action objectives in the 1988 ROD are to protect public health and the environment by protecting unaffected wells from volatile organic compounds; to provide a mechanism for the long-term management of the contaminated groundwater; and to provide a potable water source for the City of Scottsdale within the constraints of projected water demands.

Summary of 1991 Shallow Soils and Groundwater ROD

In September 1991, EPA issued the Shallow Soils and Groundwater ROD (EPA, 1991) and selected additional remedial actions for the vadose zone[2] and the upper alluvial unit, neither of which were addressed in the 1988 ROD (EPA, 1991). EPA chose soil vapor extraction as the selected remedy for the vadose zone for Area 6, Area 7, Area 8, and Area 12. All other Areas (13 total areas) were determined by EPA to not warrant further action (Areas 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, and City of Scottsdale wells) unless additional data indicated that those Areas required action. The remedy also included expanded groundwater monitoring in the upper and middle alluvial units.

The remedial action objectives for the vadose zone and upper alluvial unit were to: remove the potential for continued groundwater contamination due to migration of contamination from the vadose zone and reduce volatile organic contaminant mass in the vadose zone to levels that no longer threatens to contaminate underlying groundwater.

Summary of the 2001 Final ROD Amendment

The purpose of the 2001 ROD Amendment was to select a final remedial action for the North Indian Bend Wash Site and consolidate previous actions, including the former voluntary actions, into one final document. The 2001 ROD Amendment addresses aquifer restoration by containment, treatment, and monitoring of contaminants in groundwater as well as soil remediation actions. The remedial action objectives for the North Indian Bend Wash Site, as outlined in the 2001 ROD Amendment, are:

- Restore the Upper, Middle, and Lower Aquifers to drinking water quality by decreasing the concentrations of the contaminants of concern to below the Cleanup Standards.
- Protect human health and the environment by eliminating exposure to contaminated groundwater.

[2] The vadose zone, also termed the unsaturated zone, extends from the top of the ground surface to the water table.

- Provide the City of Scottsdale with a water source that meets Maximum Contaminant Levels for North Indian Bend Wash volatile organic compounds.
- Achieve containment of the groundwater contamination plume by preventing any further lateral migration of contaminants in groundwater.
- Reuse of the water treated at the Site to the extent possible in accordance with Arizona's Groundwater Management Act.
- Mitigate any soil contamination that continues to impact groundwater.
- Provide long-term management of contaminated groundwater to improve the regional aquifer's suitability for potable use.

The selected remedy included the following requirements and actions:

- Groundwater containment in the middle and lower aquifers to prevent further migration of the groundwater contamination plumes;
- Localized focus on groundwater containment including contingency actions at Areas 7 and 12 to prevent migration of the contaminants in these specific areas from migrating to the southwest margin;
- Restoration of the upper, middle and lower aquifers to drinking water quality by decreasing the concentrations of the contaminants of concern to below the cleanup standards;
- Treatment of extracted groundwater using air stripping and UV oxidation technologies;
- Groundwater monitoring in the upper, middle and lower aquifers to verify and evaluate plume control, and overall effectiveness of the remedy;
- Continued evaluation of remedy effectiveness based on periodic updates to the groundwater model; and
- Completion of soil cleanup actions using soil vapor extraction which were required by an NIBW Record of Decision issued in 1991.

The remedy enhancements, conducted voluntarily outside the scope of the previous RODs, but had been completed and were necessary to achieve capture of the groundwater contamination plume, were adopted as part of the selected remedy described in the 2001 ROD Amendment.

Standards for recycled treated groundwater into the municipal supply include the North Indian Bend Wash cleanup levels for potable end use, the Arizona Pollutant Discharge Elimination System requirements for discharge of treated groundwater to surface water, and the Aquifer Protection Permit substantive requirements for injection back into the aquifer.

The North Indian Bend Wash cleanup levels were selected from the EPA Safe Drinking Water Act standards with the exception of chloroform which was selected from the EPA health-based guidance (Table 2).

Table 2. North Indian Bend Wash Drinking Water Groundwater Cleanup Levels from 2001 Amended ROD

Chemical	Cleanup Levels (µg/L)	Basis for Cleanup Level[1]
PCE	5	Federal Maximum Contaminant Level
1,1-DCE	6	Federal Maximum Contaminant Level
1,1,1-TCA	200	Federal Maximum Contaminant Level
Chloroform (trichloromethane)	6	Federal Ambient Water Quality Criteria
TCE	5	Federal Maximum Contaminant Level

Summary of the 2012 Explanation of Significant Differences

In 2012, EPA signed an ESD and selected a change in the treatment technology and end-use for one remedy well only (well PCX-1), which had been part of the groundwater remedy for the Miller Road Treatment Facility selected in the 2001 ROD Amendment. These changes were in response to two incidences of contaminated groundwater entering the Arizona American Water Company Paradise Valley Arsenic Removal Facility and subsequently the potable supply system in 2007 and 2008 (1 incident each year). Immediately following the 2008 incident, Arizona American Water Company indicated it was no longer willing to accept the treated water from PCX-1.

The ESD changed the treatment technology to a liquid-phase granular activated carbon system from air stripping, the previous remedy. The Remedial Action Objectives and cleanup standards specified in the 2001 ROD Amendment did not change as a result of the ESD.

2.2.2. South Indian Bend Wash

The decision documents for the selection of the remedy at North Indian Bend Wash are the 1993 Vadose Zone ROD, the 1998 Groundwater ROD, and the 2004 Groundwater ROD Amendment.

Summary of the 1993 Vadose Zone ROD

In the 1993 Vadose Zone ROD, EPA selected the remedial action for volatile organic compounds in soils in the vadose zone at South Indian Bend Wash. (The ROD did not address groundwater). EPA selected soil vapor extraction using an off-gas system (which may consist of vapor-phase carbon or another adsorptive treatment, or catalytic thermal oxidation) to treat air emissions. The remedial action objectives established in the 1993 Vadose Zone ROD are:

- Adequately protect human health from ingestion or inhalation of volatile organic compounds that migrate from the vadose zone to groundwater.
- Adequately protect human health from the inhalation of volatile organic compounds that migrate from the vadose zone to the atmosphere.
- Control the sources of continuing groundwater contamination to minimize the loss of groundwater resources and reduce the degree of groundwater cleanup that may be required.

Several subsites were identified at South Indian Bend Wash all of which contained volatile organic compound contamination and contributed to underlying South Indian Bend Wash groundwater contamination plumes. Based on the special circumstances presented by the South Indian Bend Wash Site, EPA determined that the use of two innovative approaches to administrating the Site would greatly enhance the efficiency and effectiveness of this remedy. These were the "Presumptive Remedy" and the "Plug-in Approach". The selected Presumptive Remedy for the subsites was soil vapor extraction to treat contaminated soil above the water table on the Site, using an off-gas system (which may consist of vapor-phase carbon or another adsorptive treatment, or catalytic thermal oxidation) to treat air emissions. The 1993 soil ROD established risk-based criteria to be evaluated at each subsite to determine if remediation was necessary; and if so, the subsite would use the "Plug-in Approach." The "Plug-in" criteria were based on VLEACH Modeling (page II-64 and Table II-1 of the ROD).

Summary of the 1998 Groundwater ROD

EPA issued a ROD (September 30, 1998) for the cleanup of volatile organic compounds in groundwater at South Indian Bend Wash. The 1998 Groundwater ROD addressed three contaminated groundwater plumes at South Indian Bend Wash: the western plume, the central plume, and the eastern plume (Figure 3). The western and central plumes are present in the upper alluvial unit where TCE and PCE were the primary constituents of concern, respectively. The eastern plume was present in the middle alluvial unit and TCE was the primary constituent of concern. There are no known volatile organic compounds in groundwater in the lower alluvial unit in the South Indian Bend Wash Site.

The remedy selected for the western plume was extraction and treatment, and the remedy selected for the central and eastern plumes was monitored natural attenuation.

Summary of the 2004 Groundwater ROD Amendment

In the 2004 ROD Amendment, EPA changed the remedy for the western plume from extraction and treatment to monitored natural attenuation when it became apparent that the western plume was rapidly achieving drinking water standards under monitored natural attenuation, and extraction and treatment would not be required. In the event that monitored natural attenuation did not perform as anticipated and the cleanup standards are not reached within projected timeframes, a contingency remedial action of extraction and treatment for the western plume was selected as part of the ROD Amendment. The ROD Amendment only addressed groundwater in the upper alluvial unit as the other alluvial units are not present in the western plume area.

EPA intended the 2004 ROD Amendment to be the final decision document for groundwater at the Site. It did not alter or affect the remedy previously selected for the central and eastern plumes. The cleanup standards for the groundwater contaminants (TCE and PCE) are set at federal drinking water standards (Table 3).

The remedial action objectives are:

- Protect human health by minimizing the potential for human exposure to groundwater exceeding cleanup goals.
- Cost-effectively reduce contamination in groundwater to concentrations that meet cleanup goals to return groundwaters to their beneficial uses to the extent practicable within a time frame that is reasonable, given the particular circumstances of the site and
- Protect groundwater resources by preventing or reducing migration of groundwater with contaminants above applicable or relevant and appropriate requirements (ARARs).

Table 3. 2004 ROD Amendment Cleanup Standards South Indian Bend Wash

Chemical	Drinking Water Standards (µg/L)	Basis for Standard
Tetrachloroethylene (PCE)	5	Federal 0Maximum Contaminant Level
Trichloroethylene (TCE)	5	Federal Maximum Contaminant Level

2.3. Remedy Implementation

2.3.1. North Indian Bend Wash

Approximately 70 percent of extracted groundwater is treated and recycled for use as a municipal water supply in the North Indian Bend Wash Site by the City of Scottsdale (COS), EPCOR Water USA, and the Salt River Project (SRP). There are five treatment facilities associated with the remedy which are: the Central Groundwater Treatment Facility, North Indian Bend Wash Liquid-phase Granular Activated Carbon Treatment Facility, Miller Road Treatment Facility, Area 7 Groundwater Extraction and Treatment System, and Area 12 Groundwater Extraction and Treatment System.

The Central Groundwater Treatment Facility began operating in 1994 by the North Indian Bend Wash Participating Companies[3]. Groundwater extraction is performed at four supply wells that are networked by approximately 18,000 feet of buried piping to the Central Groundwater Treatment Facility. The Central Groundwater Treatment Facility treats the contaminated groundwater using air stripping and provides treated water to the City of Scottsdale for use as part of their municipal water supply.

The Miller Road Treatment Facility was constructed in 1997 by the North Indian Bend Wash Participating Companies to capture and remove groundwater affected by contaminants in the northern lower alluvial unit (from 505 to 1,730 feet bgs) that may migrate to the EPCOR water well field adjacent to the Site. Groundwater extraction is performed at two supply wells that are individually connected to the Miller Road Treatment Facility by buried piping. The treatment facility consists of three air stripper

[3] Companies that are potentially responsible for, or contributing to, a spill or other contamination at a Superfund site. At North Indian Bend Wash, these companies are conducting the cleanup of Site under EPA oversight.

towers followed by a granular activated carbon filter to reduce the volatile organic compounds concentration in the air stripper off-gas before discharge to the atmosphere.

The North Groundwater Treatment Facility, adjacent to the Miller Road Treatment Facility, began operating in 2013 by the North Indian Bend Wash Participating Companies and provides plume containment for the northern extent of the groundwater plume. The North Groundwater Treatment Facility was constructed to treat groundwater extracted from well PCX-1. Liquid-phase granular activated carbon is used to remove contaminants and the treated water is blended into the potable supply for the City of Scottsdale.

The Source Area 7 groundwater extraction and treatment system was constructed in 1999 by the North Indian Bend Wash Participating Companies to extract groundwater from three middle alluvial unit wells. It includes a 5,000-gallon equalization tank to balance influent flows; an ultraviolet light/chemical oxidation system; a low-profile air stripper to remove any remaining volatile organic compounds from the effluent stream; and a vapor-abatement system using granular activated carbon. At Area 7, extracted water is re-injected into the upper alluvial unit as part of the plume containment.

The Area 12 groundwater extraction treatment system was constructed in 1999 by the North Indian Bend Wash Participating Companies to extract groundwater from the middle alluvial unit and is located at the former Motorola facility. At Area 12, extracted water is treated by air stripping before being discharged to the Salt River Project company's irrigation distribution system through a connection to a Salt River Project company lateral pipeline located in Granite Reef Road.

The Area 6, 8 and 12 soil vapor extraction systems were operated and decommissioned by the North Indian Bend Wash Participating Companies based on performance data and groundwater protection criteria specified in the ROD. The Area 7 soil vapor extraction system was operated intermittently by the North Indian Bend Wash Participating Companies from July 1994 to December 2009 when it was shut down for long-term rebound testing. This soil vapor extraction system was decommissioned in January 2016.

Table 4. North Indian Bend Wash Groundwater Extraction and Treatment Facilities

Treatment Facility	CGTF	MRTF	NGTF	Area 7 GWETS	Area 12 GWETS
Treatment System Owner	COS	EPCOR	PCs	PCs	PCs
Primary Operator	COS	EPCOR	COS	PCs	PCs
Start of Operation to Treat VOCs	1994	1997	2013	1999	1999
Principal Remedy Function	MAU/LAU capture and treatment	Northern LAU capture and treatment	Northern LAU capture and treatment	MAU Source Control capture and treatment	MAU Source Control capture and treatment
Extraction Wells tied in to Treatment and (Aquifer Unit)	COS-75A (LAU) COS-71A (MAU/LAU) COS-72 (MAU/LAU) COS-31 (MAU/LAU)	PV-14 (LAU)* PV-15 (LAU)*	PCX-1 (LAU)*	7EX-3aMA (MAU) 7EX-4MA (MAU) 7EX-6MA (MAU)	MEX-1MA (MAU) Granite Reef (MAU)
Treatment Technologies	Air stripping	Air stripping	Granular Activated Carbon	Ultraviolet oxidation and air stripping	Air stripping
Treatment Standards **	NIBW Cleanup Standards	NIBW Cleanup Standards	NIBW Cleanup Standards & AZPDES Permit	NIBW Cleanup Standards	NIBW Cleanup Standards & AZPDES Permit
Treated Groundwater End Use	Municipal supply for COS or discharged to SRP water supply system via Grand Canal	Delivered to EPCOR for municipal use	Municipal supply for COS or delivered to SRP water system via Arizona Canal	Injection to UAU using wells 7IN-1UA and 7IN-2UA	Discharged to SRP irrigation water supply system via McKellips Lake

Source: 2020 Annual Site Monitoring Report, North Indian Bend Wash, NIBW Participating Companies

2.3.2. South Indian Bend Wash

The first Plug-in Determination was issued in February 1994 for the DCE Circuits Subsite. The second Plug-in Determination was issued in January 2002 for the following seven facilities: Eldon Drapery, Circuit Express, Allstate Mine Supply, Desert Sportswear, Cerprobe Corporation, Service and Sales, and the City of Tempe Right-of-Way. EPA determined that soil cleanup was not required at any of these facilities.

Soil vapor extraction was performed at two of the Sub-sites, Ocotillo Power Plant and Unitog Rental Service, during the Remedial Investigation, and these Subsites were closed as part of the Remedial Investigation process in 2006. The soil vapor extraction system at each subsite finished their operation when volatile organic compounds concentrations met the criteria required by the 1993 Record of Decision. The third Subsite, DCE Circuits, was closed in 2019 with EPA approval by the completion of soil gas sampling to evaluate vapor intrusion risk required by the 2016 second Five Year Review.

The Remedial Action Completion Report for the twelve remaining Subsites was completed and approved by the EPA in June 2020 indicating all remedial actions were completed and remediation goals as defined in the ROD were completed. All sites have met the cleanup standards and the Remedial Action Completion Report documented this.

The 1998 ROD for the South Indian Bend Wash mentions institutional controls in general but states that "institutional controls will be established to protect the public from exposure to contaminated groundwater until aquifer cleanup goals are met." It does not establish any specific institutional controls in the document. The 2004 ROD Amendment for the South Indian Bend Wash reiterates the language from the 1998 ROD and does not establish any specific institutional controls. However, there are governmental controls in place. The Water Utilities Division of Tempe's Municipal Utilities Department supplies municipal water service to the residents in the Tempe area. In addition, the Arizona Department of Water regulates all groundwater wells in Arizona to ensure proper management and protection of our groundwater. EPA searched the Arizona Department of Water well water database for wells within the area of South Indian Bend Wash, and no wells in the area were identified as domestic.

2.4. System Operations/Operation and Maintenance

2.4.1. Operations and Maintenance Requirements

2.4.1.1 North Indian Bend Wash

The February 2021 Operation and Maintenance Plan presents the general operation and maintenance activities for the groundwater extraction well network and five treatment plants associated with the North Indian Bend Wash remedy. The North Indian Bend Wash operation and maintenance activities consist of groundwater monitoring, extraction and treatment conducted by the North Indian Bend Wash Participating Companies. A fourth Granular Activated Carbon treatment train was installed at the Northern Groundwater Treatment Facility on October 12, 2016. This allows the Northern Groundwater Treatment Facility to continue operations during Granular Activated Carbon service events and has minimized downtime for routine maintenance since 2016. Based on ambient air monitoring results in the

vicinity of the Area 12 Groundwater Extraction and Treatment System, new upgraded Granular Activated Carbon containers were installed on the Area 12 air system discharge in April 2018.

Groundwater monitoring at the North Indian Bend Wash includes collection, analysis, and reporting of water level, water quality, and pumping data from a network of groundwater monitoring, extraction, peripheral production, irrigation, and other water wells completed in the upper alluvial unit, middle alluvial unit, and lower alluvial unit. Groundwater level monitoring is conducted semi-annually using a network of 71 monitoring wells in April (May in 2020 due to COVID19) and 99 monitoring wells in October. For the groundwater monitoring program, EPA previously approved the use of HydraSleeve® sampling when aging dedicated pumps fail at monitor wells. Between 2016 and 2020, 23 wells have been shifted to long-term use of the HydraSleeve sampling protocol after their pumps failed. Twelve additional wells were shifted to HydraSleeve sampling until the pump in the well could be replaced within that period.

Extracted groundwater at the five treatment systems is discharged either to the City of Scottsdale municipal drinking water system or into the irrigation canals, except Area 7, where treated water is reinjected back into the upper alluvial unit. Sampling is conducted in accordance with requirements of the approved Sampling and Analysis Plan and treatment facility Operation & Maintenance Plans. The groundwater extraction well sites are visited on a minimum monthly basis for routine operation and maintenance and contaminant sampling. Well sites may be visited more frequently at the operators' discretion.

2.4.1.2 South Indian Bend Wash

The South Indian Bend Wash operation and maintenance activities consisted of routine groundwater monitoring for the eastern, central, and western plumes. Routine soil vapor and indoor air monitoring at the DCE Circuits subsite was conducted up until the 2019 DCE Circuits Remedial Action Completion Report concluded that monitoring was no longer necessary. To evaluate the monitored natural attenuation remedy, annual groundwater elevation levels are measured in 21 South Indian Bend Wash wells, and groundwater samples are collected from 12 wells and analyzed for contaminants. These wells were screened in the upper alluvial unit or upper alluvial unit/middle alluvial unit, based on which South Indian Bend Wash plume they were intended to monitor.

Analytical results from monitoring wells reported volatile organic contaminants at concentrations below the maximum contaminant levels since 2016. With attainment of remedial action objectives and the issuance of the Remedial Action Completion Report for the twelve remaining Subsites in 2020, long term operations and maintenance monitoring is no longer required. The Remedial Action Completion Report documents that all media are below regulatory levels specified in the various RODs.

2.4.2. Significant Operations and Maintenance Issues over the Past Five Years

2.4.2.1 North Indian Bend Wash

There have been several developments in the past five years that may have impact on the effectiveness of the groundwater remedy. In late 2016 the City of Scottsdale notified EPA they were unable to continuously operate the main remediation wells 71A and 72 due to increasing nitrate concentrations which could not be treated by the Central Groundwater Treatment Facilities air strippers. Nitrates are likely from fertilizers and former agricultural use and not related to the Superfund Site but are a drinking water concern. The City reprioritized the extraction well operation in order to continue to meet their blending requirements to meet the public demand. The re-prioritization of well operations at the Central Groundwater Treatment Facility may have impacted the effectiveness of remediation and containment of the North Indian Bend Wash groundwater plumes. The City of Scottdale has since constructed a reverse osmosis plant to treat water leaving the Central Groundwater Treatment Plant to remove nitrates and address hardness issues to meet the public demand; however, the new reverse osmosis plant has not affected the groundwater remedy operation or well prioritization.

Area 7 extraction wells 7EX3a-MA and 7EX6-MA have been the primary pumping wells since 2016. Extraction well 4MA with higher concentrations has been off line for most of the past 5 years, after it was removed from service in October 2016 due to reduced pumping efficiency. Replacement well 7EX6-MA removes higher volume of water but lower concentrations than well 7EX-4MA. Rehabilitation of well 7EX4-MA has yet to be completed. Area 12 extraction wells MEX-1 and Granite Reef well also were off line for a significant period for well rehabilitation due to decreased pumping rates. Extraction well MEX-1 was off line between January and March 2019 to reduce scale build up on well screens and to install a new pump. Granite Reef well (Salt River Project well 23.6E-6.0N) was also off line from November 2019 until September 2020 for rehabilitation, pump replacement and fluid movement investigations.

In March 2019 a pipeline break beneath the canal shut down operations of Northern Groundwater Treatment Facility well PCX-1, the primary containment well for the northern lower aquifer unit groundwater plume for several weeks. Miller Road Treatment Facility wells PV-14 and 15 serving Paradise Valley municipal supply continued to operate without significant increases in groundwater concentrations. Well PCX-1 was restarted in July 2019 after the new temporary pipeline was installed.

In 2020, pump failure and repairs caused two Miller Road Treatment Facility extraction wells to be down for prolonged periods: EPCOR well PV-14 was unavailable for pumping from early November 2020 to April 2021 when the pump was out of service for conversion from a vertical turbine to line-shaft pump. Northern Groundwater Treatment Facility well PCX-1 was unavailable for pumping after September 16, 2020 when the pump failed and remained unavailable for the remainder of 2020. The pump was replaced in early January 2021 and failed again shortly thereafter. The pump was replaced in early February 2021 and has been online since replacement.

Between 2016 and 2020, seven accidental releases of untreated groundwater also occurred, as described in Table 5 below.

Table 5. Accidental raw water releases from NIBW Groundwater Extraction and Treatment Facilities.

Date	Treatment Facility	Description of Release
6/18/16	CGTF	The raw water transmission line from well COS-72 ruptured during startup, resulting in the release of approximately 1.2 million gallons of water to the ground. Water sampling showed levels of TCE between <0.5 – 63 µg/L at the site of the break. Soil sampling at the leak site did not indicate the presence of TCE, likely due to rapid volatilization in the heat. Standing water in the vicinity of the release was removed and discharged to the City's wastewater collection system.
1/20/18	CGTF	During a routine wellfield inspection, Air Relief Valve #16 was found to be dripping a small amount of water. Testing was not performed due to insufficient sample volume and a rain event that occurred immediately followed the leak.
January 2019	CGTF	A second air release valve leak at well COS 75A released less than 500 gallons from the air release valve. Soil samples were collected/analyzed for TCE and all results were non-detect.
February 2019	Area 12	A minor accidental release during the rehabilitation of Well MEX-1 released approximately 200 gallons. Water and soil samples were collected/analyzed for TCE and PCE. All results were below the cleanup standards for treated water.
March 2019	NGTF	A rupture beneath the canal in the pipeline between well PCX-1 and the treatment facility released approximately 55,500 gallons into the irrigation canal. Water samples were collected/analyzed for TCE and PCE and all results were non-detect. Well PCX-1 was shut down for several weeks until a temporary pipeline could be constructed over the irrigation canal. Permanent repair of the pipeline beneath the canal is planned for the next scheduled dry up of the canal in 2029.
5/25/19	Area 7	A release of untreated groundwater occurred when a momentary power outage caused a communication failure and shutdown the Area 7 Treatment System. The remote well 7EX-6MA continued to pump to the until the treatment system overflowed. The released water flowed through the alley south of Area 7 until it collected in a closed storm water system. An estimated 29,250 gallons of untreated groundwater was released.
April 2020	CGTF	A third air release valve leak in the extraction well pipeline released an estimated 2000 –3000 gallons of untreated water. Water and soil samples were collected/analyzed for TCE and PCE. PCE did not exceed the cleanup standards for treated water, however, the closest sample did exceed the cleanup standards for TCE which spilled onto a concrete sidewalk (the farthest was non-detect). Soil samples were non-detect. TCE is expected to rapidly volatilize and dissipate in the heat.

Treatment System Maintenance and Upgrades:

In early 2018 repairs were made to tears in ductwork between the air stripper and vapor emission controls at the Area 12 Groundwater Extraction and Treatment Facility after fugitive emissions were detected in the surrounding neighborhood. Routine cleaning of the air stripper column, fan maintenance, pipeline inspections and upgrades to the vapor emissions controls were completed at the same time.

Following the May 25, 2019 accidental release at the Area 7 treatment plant, upgrades were made to the communications system to shut down the pumps upon loss of communication with Area 7 treatment system controls during a power outage. Additionally, a new backup power supply was added mitigate impacts of power outages, as well as additional upgrades to the pipeline shutoff valves, and upgrades to the alarm and operator notification system.

Between November 2019 and March 2020 the Central Groundwater Treatment Facility was shut down for major upgrades and rehabilitation work on the air stripper towers, Salt River Project bypass piping, and reconfiguration and replacement of the acid feed and water distribution system piping. The packing material was removed from the three air stripper towers and interior of the columns were treated for corrosion and repainted, and packing was replaced. Refurbishment included descaling of pumps, replacement of seals, valves, gaskets, and necessary repair or replacement of components or instrumentation, The CGTF refurbishment project did not make modifications to the extraction wellfield communications system. However, a Smart Ball video camera survey was completed in 2017 along the CGTF extraction well pipelines as recommended by the 2016 Second Five Year Review and no leaks were detected.

The NIBW Participating Companies also submitted updates to the Operations and Maintenance Plans and Contingency and Emergency Response Plans for each of the groundwater extraction and treatment facilities in 2020.

2.4.2.2 South Indian Bend Wash

The selected remedy for South Indian Bend Wash chlorinated solvents plume has successfully achieved remedial action objectives. However, the recent finding of per and poly-fluoroalkyl substances in SIBW groundwater wells above health-based screening levels necessitates a new remedial investigation and feasibility study.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the Second Five-Year Review for the North Indian Bend Wash and South Indian Bend Wash stated the following:

> *A protectiveness determination of the remedy at North Indian Bend Wash Superfund Site cannot be made at this time until further information is obtained. Further information will be obtained by collecting ambient air samples around the groundwater treatment facilities and completing a revised emission exposure assessment; and by completing a vapor intrusion assessment around the source areas. It is expected that these actions will take approximately one year to complete, at which time a protectiveness determination will be made. In addition, to be protective in the long-term, the following actions must be completed:*
>
> - *Complete the inspection, maintenance, and possible replacement of the NIBW pipelines, and*
> - *Upgrade the communication system for the facility*
>
> *A protectiveness determination of the remedy at South Indian Bend Wash Superfund Site cannot be made at this time until further information is obtained. Further information will be obtained by completing a vapor intrusion assessment for the residential properties adjacent to DCE Circuits property and around the source areas. It is expected that these actions will take approximately one year to complete, at which time a protectiveness determination will be made.*

The sitewide protectiveness statement from the Second Five-Year Review for the Indian Bend Wash Site stated the following:

> *A protectiveness determination of the remedy at Indian Bend Wash Superfund Site cannot be made at this time until the following information is obtained: collect ambient air samples around the groundwater treatment facilities and complete a revised emission exposure assessment at NIBW and complete a vapor intrusion assessment for the residential properties adjacent to DCE Circuits property at South Indian Bend Wash and two vapor intrusion assessments at both North Indian Bend Wash and South Indian Bene Wash source areas.*

The Second Five-Year Review included five issues and recommendations. Each recommendation and its current status are discussed below.

Table 6: Status of Recommendations from the 2016 Five-Year Review

	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
North Indian Bend Wash	Given the recent pipeline rupture at Wells 71A/72, and the finding of corrosion at the rupture site, the North Indian Bend Wash pipelines are due for inspection, maintenance, and possible replacement to prevent such events in the future. Problems with communication delay between automatic shutdown of facility operations and pumping wells during power outages have been blamed for pipeline ruptures and discharges of raw untreated water on more than one occasion.	Complete the inspection, maintenance, and possible replacement of the North Indian Bend Wash pipelines, and upgrade the communication system for the facility	Ongoing	The City of Scottsdale completed a Smart Ball leak detection survey in September 2017 along the pipeline for wells 71A and 72. No leaks were detected during the survey. Upgrades to the communication system remain to be completed. EPA anticipates completion by September 2022.	
North Indian Bend Wash	Based upon the revised toxicity values for TCE and the increase in TCE air emissions concentrations at Area 12, the air emissions exposure pathway for facilities should be reassessed.	Collect ambient air samples around the facilities and update the exposure assessment for air emissions.	Completed	Air emissions data from all GWETS were re-evaluated based air dispersion modeling and upon revised TCE toxicity values. EPA concluded the remedy remains protective as long as vapor emission controls remain in place.	September 2020
North Indian Bend Wash	The original cleanup objective for vadose zone did not consider the vapor intrusion pathway from contamination in the vadose zone. Based the revised toxicity values for TCE, the potential risk for vapor intrusion from the vadose zone contamination, may pose a risk.	Reassess the potential for vapor intrusion from residual contamination in the vadose zone.	Ongoing	Of 12 former North Indian Bend Wash source areas, only Area 7 was found to pose a vapor intrusion risk. A sub-slab depressurization system was installed in four apartments and air filters were delivered to occupants at two other locations. A long-term remedy for remaining high soil gas concentrations in the vicinity of the Area 7 treatment facility remains to be implemented.	
South Indian Bend Wash	The original cleanup objective for vadose zone did not consider the vapor intrusion pathway from contamination in the vadose zone. Based the revised toxicity values for TCE, the potential risk for vapor intrusion from the vadose zone contamination, may pose a risk.	Reassess the potential for vapor intrusion from residual contamination in the vadose zone.	Completed	The vapor intrusion analysis found no unacceptable risk to commercial/industrial or residential receptors at former source areas.	June 2020
South Indian Bend Wash	A vapor intrusion assessment of residential areas adjacent to the former DCE Circuits has not been conducted.	Complete a vapor intrusion assessment	Completed	The vapor intrusion assessment completed at DCE and found no unacceptable risk to commercial/industrial or residential receptors.	June 2020

3.2. Work Completed at the Site During this Five-Year Review Period

3.2.1. North Indian Bend Wash

Five groundwater treatment systems have operated over the past five years at the North Indian Bend Wash Site. A total of 80,667 acre-feet of water was treated and 9,834 pounds of TCE removed. Table 7 describes the volume of groundwater extracted and mass of TCE removed at each of the five North Indian Bend Wash treatment facilities.

Table 7. Groundwater Extraction and TCE Mass Removed

Treatment Facility	Year	Volume pumped & treated (acre feet)	TCE Mass removed (pounds)
Central Groundwater Treatment Facility	2016	6,894	594
	2017	3,494	336
	2018	4,329	407
	2019	4,875	368
	2020	3,691	267
Miller Road Treatment Facility	2016	5,181	42
	2017	6,487	68
	2018	6,683	59
	2019	5,872	42
	2020	6,190	50
North Granular Activated Carbon Treatment Facility	2016	3,664	561
	2017	3,968	550
	2018	3,830	498
	2019	2,206	315
	2020	2,793	387
Area 7 Groundwater Extraction and Treatment System	2016	442	735
	2017	499	682
	2018	489	685
	2019	437	680
	2020	560	881
Area 12 Groundwater Extraction and Treatment System	2016	1,941	449
	2017	1,070	221
	2018	1,671	388
	2019	1,668	292
	2020	1,733	277

The North Indian Bend Wash Participating Companies prepared a 2021 update to the North Indian Bend Wash groundwater flow model as well as a new three-dimensional visualization analysis of the site stratigraphy and groundwater plumes and a conceptual model update in January 2021. EPA is currently reviewing this Conceptual Model Update and updated groundwater flow models. A Remedy Optimization study is also currently underway to identify ways to make the remedy operate more efficiently.

The 2016 Five-Year Report recommended that a vapor intrusion assessment be conducted at North Indian Bend Wash. Vapor intrusion assessments conducted between 2017 to 2019 at North Indian Bend Wash locations concluded that no further action was necessary for former North Indian Bend Wash source areas except for Area 7 where vapor intrusion was identified in four apartments and an adjacent event center. A sub-slab depressurization system was installed in the impacted apartment units in April 2018. EPA continued to collect soil gas and indoor air samples in the area adjacent to the apartments and the event center at Area 7 up until field work was terminated due to the COVID-19 pandemic. Results of this investigation are included in Section 4.2.2.1.

3.2.2. South Indian Bend Wash

In April 2017, in response to recommendations of the 2016 Five Year Review, EPA conducted indoor air screening by using the Trace Atmospheric Gas Analyzer at three apartment units near the DCE Circuits site in the South Indian Bend Wash. Shallow soil investigations at all 12 South Indian Bend Wash Subsites were completed in 2019 by EPA's consultant, Gilbane. Results of this investigation are included in Section 4.2.2.2.

The Final Remedial Action Completion Report for DCE Circuits subsite was approved by EPA in July 2019. The Remedial Action Completion Report for the entire South Indian Bend Wash Site was completed and approved by the EPA in June 2020 indicating all remedial actions were completed and remediation goals defined in the various RODs were completed. It was concluded that all response actions have been successfully completed in accordance with Comprehensive Environmental Response, Compensation, and Liability Act of 1980, the National Oil and Hazardous Substances Pollution Contingency Plan, and EPA policy and guidance. No further superfund response is necessary at the South Indian Bend Wash Site to protect human health and the environment in compliance with the decision documents.

In 2019, EPA sampled select monitoring wells to test for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), after the City of Tempe shut down three municipal supply wells due to finding PFAS above health-based levels. PFAS was found in most South Indian Bend Wash monitoring wells; details are provided in Section 4.2.1.2. As a result, EPA is proceeding towards a new Remedial Investigation/Feasibility Study for PFOS/PFOA at South Indian Bend Wash.

4. Five-Year Review Process

4.1. Community Notification and Site Interviews

4.1.1. Five-Year Review Public Notice

EPA issued a notice in the *Scottsdale Progress* on June 20, 2021, stating that there was a Five-Year Review and inviting the public to submit any comments to the EPA. EPA did not receive any comments in response to the notice. The results of the review and the report will be made available at EPA's Site webpage located at http://www.epa.gov/superfund/indianbendwash.

4.1.2. Site Interviews

Interview questions were sent to multiple stakeholders familiar with the project. The Principal Hydrogeologist (a consultant to the North Indian Bend Wash Site Participating Companies) provided a group response from the Participating Companies to the interview questions. The Participating Companies stated they have taken a proactive approach toward the remedy, addressing issues before they are brought up by the agencies, conducting voluntary testing programs, collecting supplemental data, developing improved evaluation tools, and taking steps to evaluate actions that would improve remedy performance. These steps have resulted in short-term cost increases but have provided long-term benefits to the remedy. The remedy was designed around and continues to be operated and optimized to tie the extraction and treatment program into beneficial end-use (municipal, irrigation, injection). They believe that:

- Remediation programs have now been completed in all previously identified source areas to meet the objective of removing the on-going threat to groundwater.
- With a 98% reduction in TCE mass, a 92% reduction in plume area, and only one well that exceeds the TCE clean-up standard, upper alluvial unit groundwater is almost completely restored.
- Water level data and model projections show that the middle alluvial unit and lower alluvial unit plumes continue to be contained, ensuring the protection of peripheral production wells.
- The two middle alluvial unit source control programs (Area 7 and Area 12) are effectively capturing and treating higher-concentration areas in accordance with their approved design goals and the site performance standards, reducing the amount of mass that migrates from the middle into the lower alluvial units along the western margin.
- Significant progress has been made toward the removal and restoration of groundwater to drinking water quality with respect to the site contaminants. From the inception of the groundwater remedy, about 135 billion gallons of groundwater have been extracted to remove an estimated 96,300 pounds of TCE.
- Extraction wells in the Northern lower alluvial unit create a regional cone of depression that serves to control plume migration. Extraction wells are projected to capture the entire TCE plume, as well as a substantial area outside of the plume where groundwater is below the cleanup standards.
- Supplemental sampling was conducted in 2020 at Arcadia Water Company and other wells located outside of the Site TCE plume boundary. TCE concentrations indicated that the plume continues to be contained on-Site.

The City of Scottsdale Water Quality Director responded and found that the remedy is working as intended. The data indicates that mass is being removed, no new wells are impacted that are not already tied to treatment, and the remedy is operating as designed and is providing containment.

The Senior Environmental Compliance Scientist from the Salt River Project, in lieu of answers to the interview questions, provided copies of previous comment letters which detailed significant concerns, including:

- The noted westward lateral migration of the plume contours over time.

- Protection of Salt River Project wells not tied into treatment and currently not contaminated;
- Reduced pumping in the area of the Central Groundwater Treatment Plant due to nitrates contributing to the lateral migration of contaminants;
- Exceedances of Area 7 metrics established in the Groundwater Monitoring and Evaluation Plan for assessing plume containment and cleanup;
- Area 12 has not consistently met requirements for hydraulic capture;
- Contingency measures and remedy enhancements to protect peripheral production wells should be implemented to prevent mass from migrating away from source areas;
- North Indian Bend Wash discharges to the canal will also have to meet Arizona Pollutant Discharge Elimination System permit requirements, which do allow more flexibility for blending of nitrates arsenic and chromium than City of Scottsdale's system.

The Project Manager from the Arizona Department of Environmental Quality indicated that the Participating Companies are providing multiple remedial actions and are implementing a generally successful cleanup program. The groundwater remedy is achieving cleanup standards for the known groundwater contaminants addressed within the Record of Decision and the vapor intrusion studies and mitigation methods have helped minimize exposure. However, vapor intrusion potential continues to be studied near Area 7. In addition, he mentioned that groundwater remediation infrastructure is aging, and some equipment has worn out and requires replacement. Well maintenance has indicated some issues due to decades of subsurface exposure. There are some items which could be further assessed; namely, the Upper Aquifer Unit includes a persistent contaminant area; a separate, unique contaminant mass is reported in groundwater in the southwestern study area region; and a potential unique source associated with the contaminant mass location. For the South Indian Bend Wash Site, he noted that PFAS chemicals have been detected in select, sampled monitoring wells. The 2019 annual Monitored Natural Attenuation report is the final report as groundwater sampling ceased by 2020.

4.2. Data Review

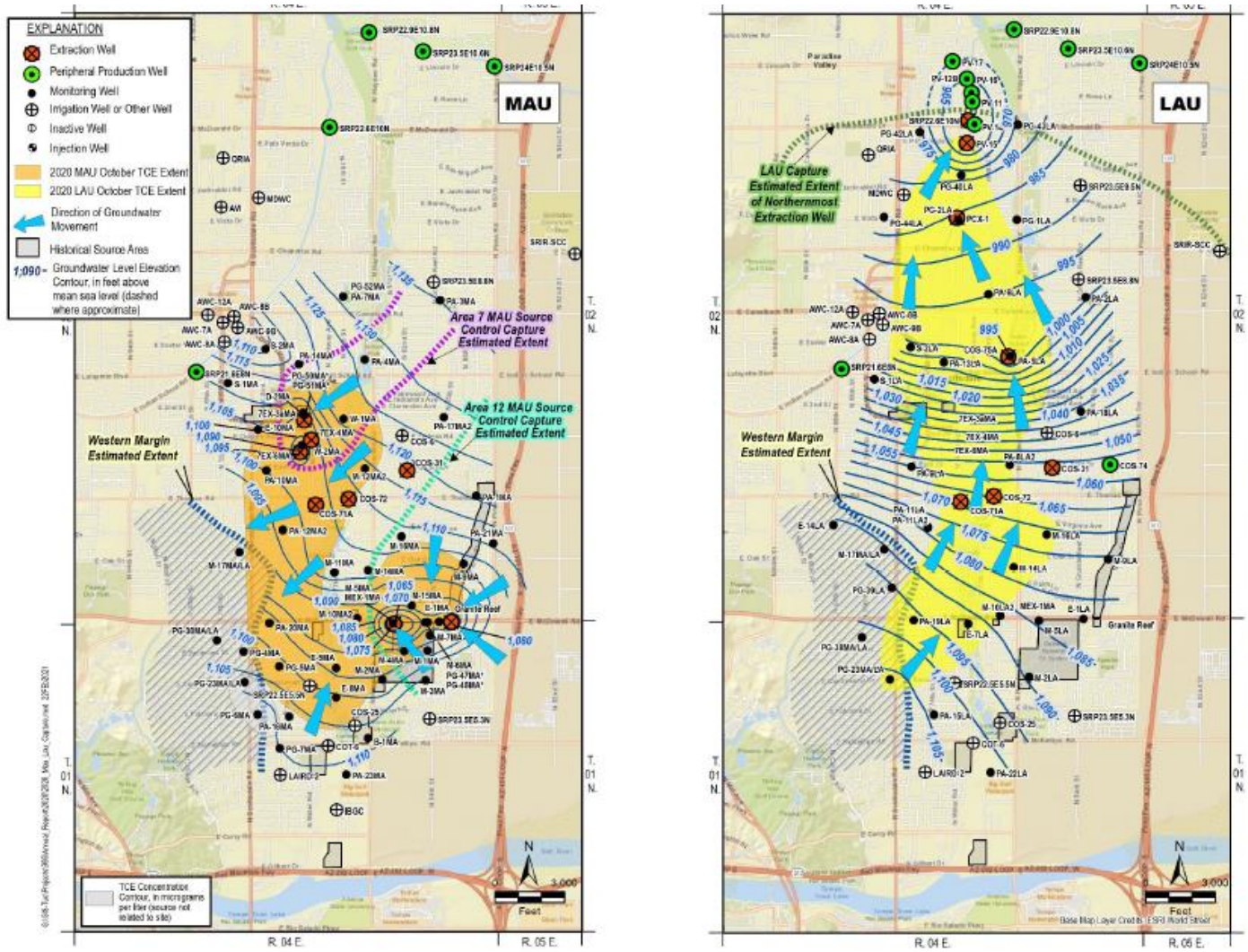
4.2.1. Groundwater

EPA examined data collected over the past five years to evaluate whether the remedial action objectives of plume containment for the Indian Bend Wash Site continues to be effective and protective of human health and the environment.

4.2.1.1 North Indian Bend Wash

Groundwater contamination is found within the upper, middle, and lower alluvial units within the North Indian Bend Wash area, The primary contaminants of concern are DCE, TCE, TCE, and PCE. Over the past five years DCE and TCA concentrations in monitoring wells were below Federal drinking water standards, and in many cases below detection limits; only TCE and PCE were detected at concentrations above the Federal drinking water standards. To date, about 135 billion gallons of groundwater have been extracted to remove an estimated 96,300 pounds of TCE (4.9 billion gallons of groundwater and removal of about 1,860 pounds of TCE in 2020) (Table 7). The most significant declines observed in TCE concentrations are in upper alluvial unit groundwater. In almost all upper alluvial unit wells across the North Indian Bend Wash, DCE and TCA concentrations were below Federal drinking water standards, and in many cases below detection limits, over the entire Five-Year Review period. One well in the upper aquifer (PG-31UA) near Area 7 still has TCE concentrations ranging up to 36 µg/L exceeding the Federal Maximum Contaminant Level drinking water standards (5 micrograms per liter or µg/L). Figure 5 shows the TCE groundwater plume in the upper, middle and lower alluvial units. Groundwater in the middle alluvial unit has the highest TCE concentrations, particularly within the Area 7 capture zone, where concentrations exceed 1,000 µg/L in a localized area. The highest concentrations of TCE occur at wells W-1MA and W-2 MA with maximum TCE concentrations of 520 and 2,100 µg/L respectively for this reporting period (See Appendix D for TCE results). In the Area 12 capture zone near the Granite Reef extraction well TCE concentrations were approximately 150 µg/L in 2019. Groundwater in the middle alluvial unit generally flows northeast to southwest toward the Western Margin, where it merges with the lower alluvial unit and groundwater flow reverses towards the extraction wells to the north.

Figure 5. Groundwater Flow and Estimated Hydraulic Capture in the Middle and Lower Alluvial Units



Source: 2020 Annual Site Monitoring Report, North Indian Bend Wash

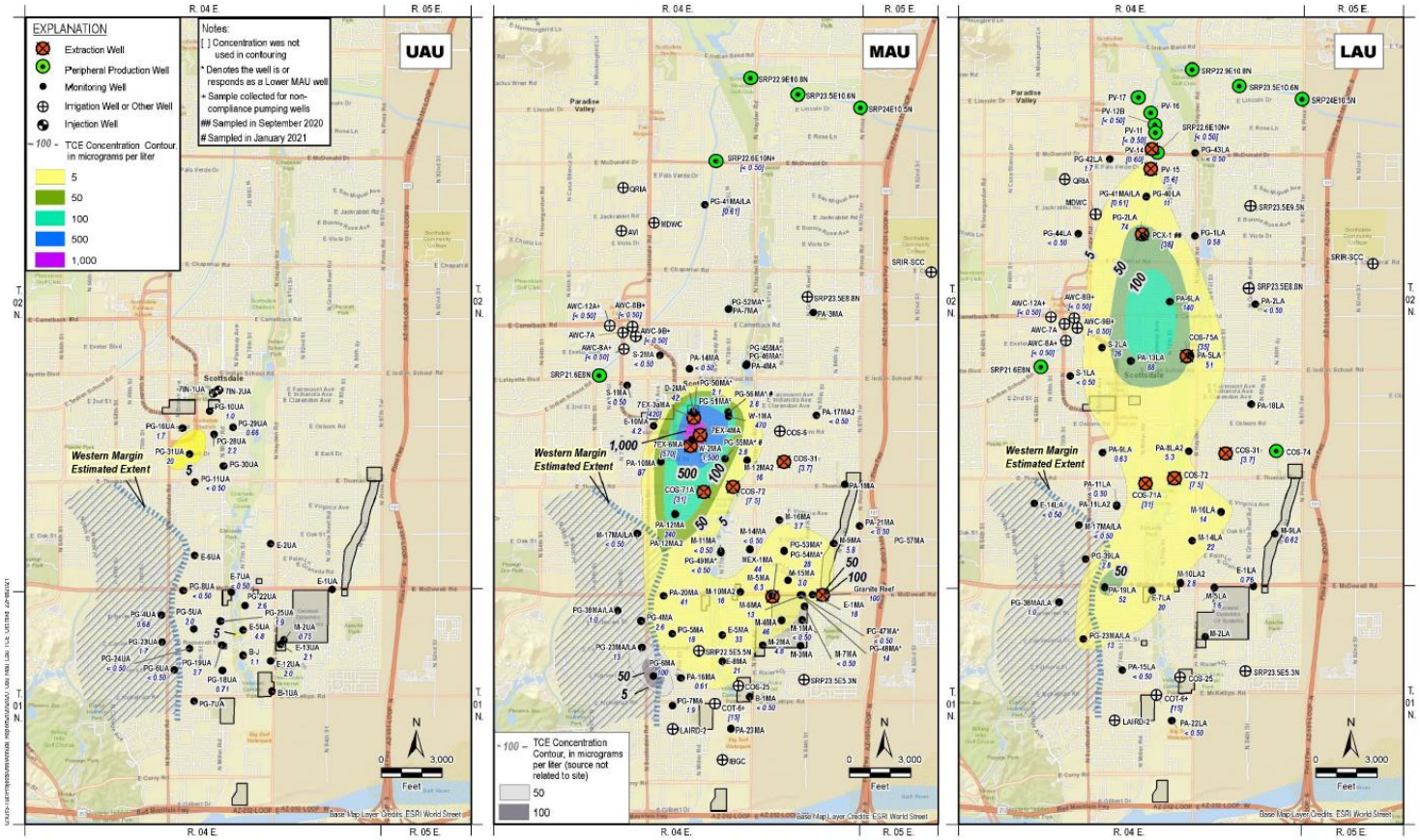
The Participating Companies performed five-year TCE Mann-Kendall trend analyses that show 9 of the 84 monitoring wells had increasing concentrations of TCE across the North Indian Bend Wash area within the upper, middle, and lower alluvial units (NIBW PCs, 2021). Thirteen of the 84 monitoring wells had decreasing concentrations and 62 of the 84 monitoring wells showed no trend (NIBW PCs, 2021). As part of this Five-Year Review, US Army Corps of Engineers performed additional five-year TCE Mann-Kendall trend analyses on behalf of EPA for 32 monitoring wells in the upper, middle, and lower alluvial units with TCE concentrations greater than the TCE Federal drinking water standard of 5 µg/L. TCE data are presented in Appendix D. USACE Mann-Kendall trend analyses show TCE concentrations increasing or probably increasing at 7 monitoring wells, decreasing or probably decreasing at 6 monitoring wells, and there was either no trend or stable at 19 monitoring wells.

Widespread decreases in contaminant concentrations are expected given the ongoing remedial operation. However, the use of concentration trend analysis cannot be readily used to estimate remedy completions since concentrations typically become asymptotic and progress toward aquifer restoration slows down as time goes on. This is particularly true in the middle alluvial unit where the bulk of contamination in the middle alluvial unit is trapped in the fine-grained matrix resulting in low permeability zones (which are sometimes in contact with higher permeability zones) in which the contaminant mass movement is diffusion rate controlled. With the bulk of contamination in the middle alluvial unit trapped in the fine-grained matrix, the effectiveness of extraction wells to remove mass is reduced. A lack of complete plume capture within the middle alluvial unit is evident between the Area 7 and Area 12 (Figure 6) allowing the plume to migrate toward the Western Margin where the groundwater flows from the upper and middle alluvial units down into the lower alluvial unit. It appears that contaminated groundwater in the lower alluvial unit will eventually be captured as groundwater flows northward, However, cleanup will likely be longer than anticipated. Groundwater fate and transport modeling remains to be completed; remedial timeframe estimates have not yet been performed.

In late 2016, the City of Scottsdale notified EPA of the need to reduce pumping at the two extraction wells COS-71A and COS-72A with the highest concentrations of TCE, due to increasing nitrate concentrations exceeding drinking water standards which could not be treated by the Central Groundwater Treatment Plant air strippers to meet the City's blending requirements. Reduced pumping of these wells also effects the hydraulic containment at Area 7, reducing the capture zone, allowing for more westward migration of contaminants. Area 7 extraction well MEX4-MA located in an area with higher TCE concentrations has also not been pumping due to reduced extraction rates. A Remedy Optimization study is underway to evaluate alternatives to address these impacts.

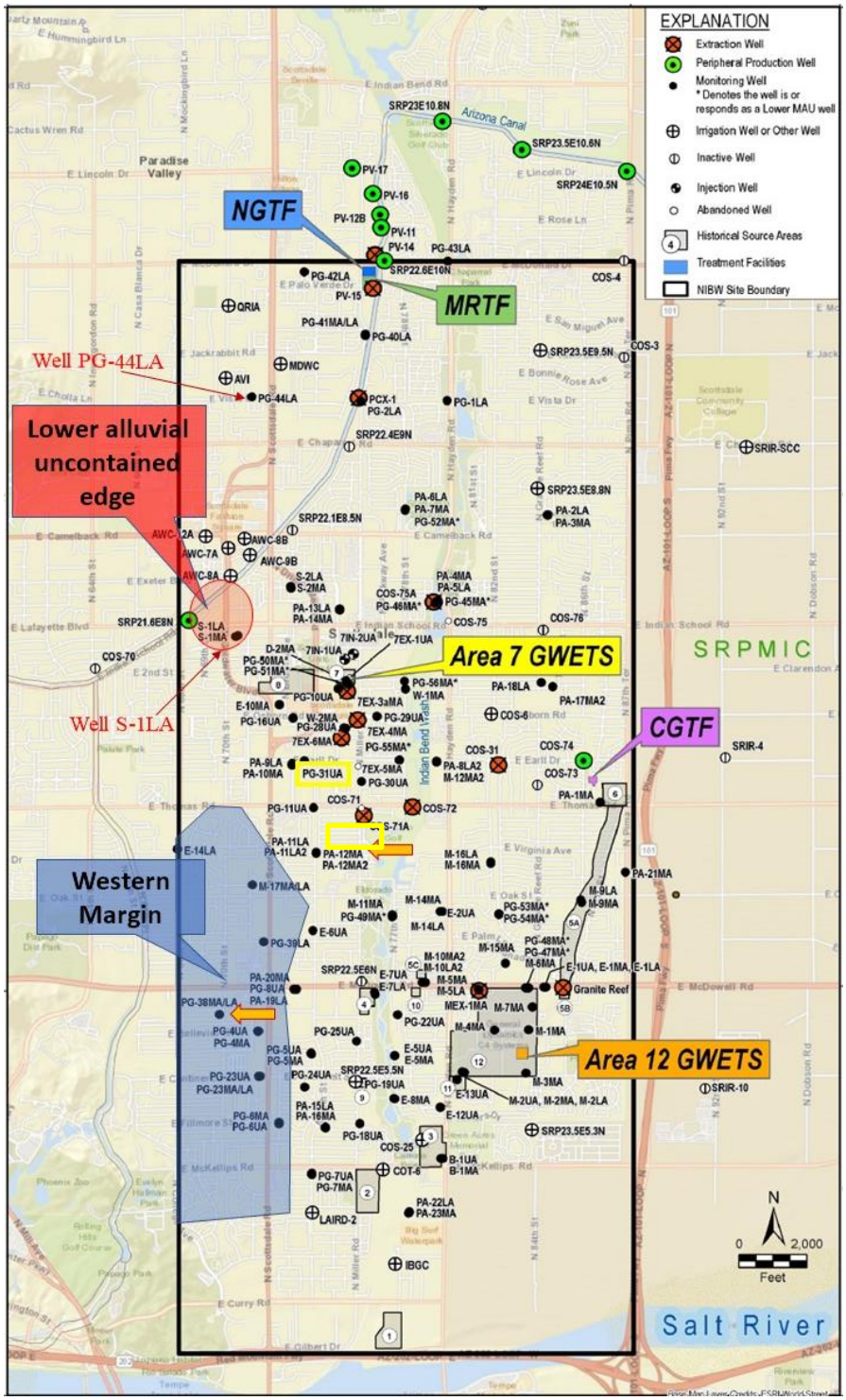
The areas where concentrations are increasing are either in the Western Margin region of the Site or the western edge of the lower alluvial unit. During this five-year reporting period, the US Army Corps of Engineers performed Mann-Kendall trend analyses for several select monitoring wells (See Appendix D). The trend analyses identified increasing PCE concentrations at wells PA-10MA, PG-38MA, and S-1LA, although PA-10MA and PG-38MA are still below EPA drinking water standards. All of these wells are located within the Western Margin. PG38-MA is located near PG-4-UA where there is another PCB source unrelated to the North Indian Bend Wash plume. PA-10MA is outside of the currently reduced Area 7 capture zone, where PCE from this location may migrate to the western margin. Monitoring well S-1LA has increasing PCE concentrations ranging from 21 to 48 µg/L and is also located on the western margin of the plume near groundwater production wells for the Salt River Project and Arcadia Water Company, which are being used for irrigation. Monitoring well S-2LA is to the northeast and downgradient of S-1LA and also has increasing TCE concentrations. The western edge of the lower alluvial unit does not appear to be fully contained by the currently operating extraction well network. Groundwater in this area is poorly defined due inadequate monitoring well network along the periphery of the Western Margin, as shown in Figure 7. Additional characterization is warranted given the proximity of the production wells. Groundwater iso-concentration maps have demonstrated a gradual westward shift over time, as shown on Figure 8.

Figure 6. TCE Concentrations in the upper, middle, and lower alluvial units



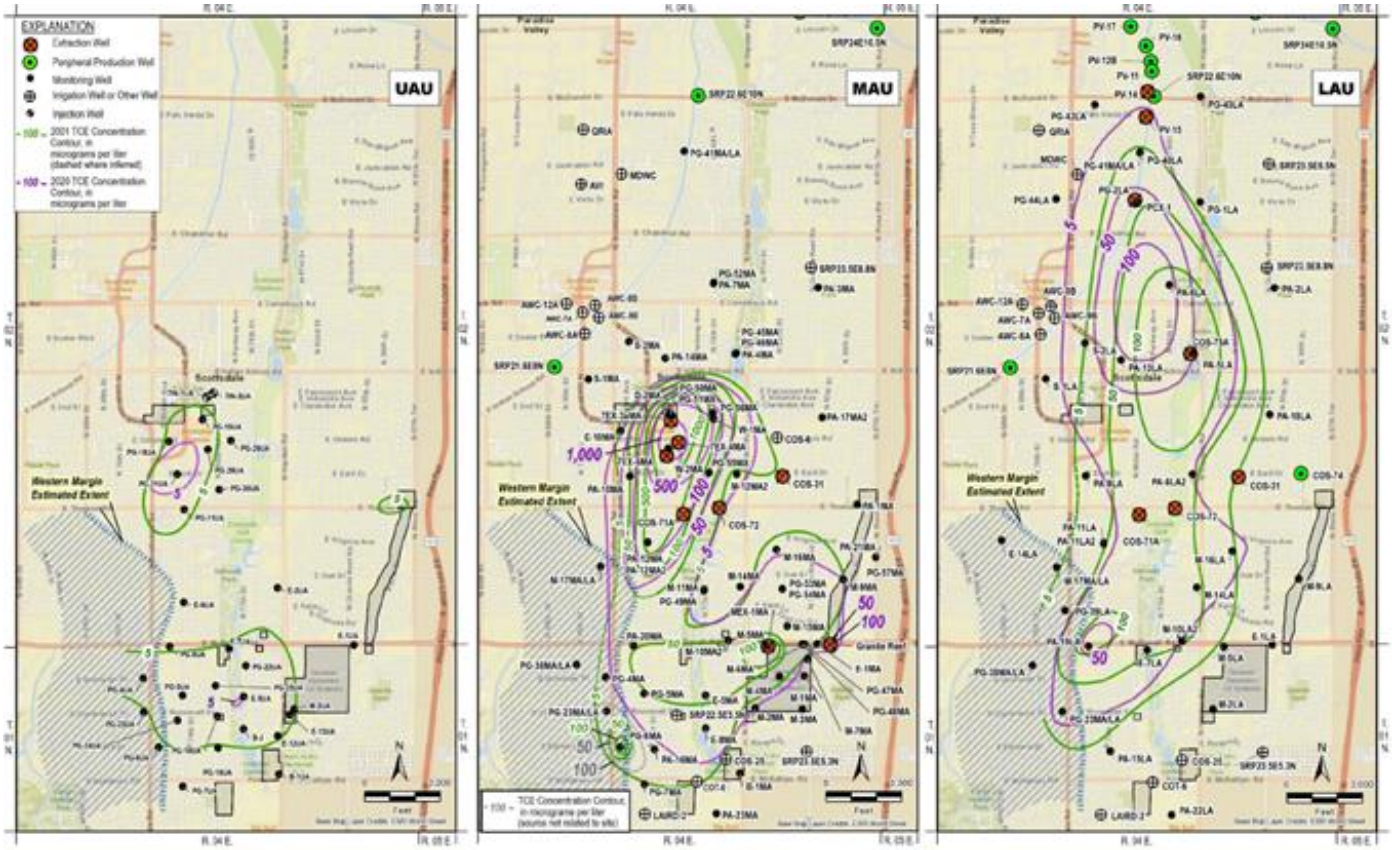
Source: 2020 North Indian Bend Wash Monitoring Report

Figure 7.Regions of Possible Lack of Plume Containment at North Indian Bend Wash



Note: Regions of possible lack of plume containment in the North Indian Bend Wash (red and blue areas). Modified map from 2020 NBIW groundwater report. Orange arrows indicate increasing wells in the middle alluvial unit.

Figure 8. Isoconcentration Contours of TCE in the Three Groundwater Units Comparing October 2001 (shown in green) to October 2020 (shown in purple)



Source: North Indian Bend Wash 2020 Monitoring Report

At present there is no reliable estimate of the time required to achieve remedial action objectives. A statistical Mann-Kendall trend analysis, employing a linear regression analysis of past monitoring data to project future trends, is not reliable due to back diffusion in fine grained matrix controlling the rate of contaminant release and ability of extraction wells to recover mass. The North Indian Bend Wash Participating Companies have prepared a 2021 update to the North Indian Bend Wash groundwater flow model currently under review by EPA. EPA Headquarters is also working on a Remedy Optimization Review which includes a 3D visualization analysis of the North Indian Bend Wash groundwater site. Future groundwater modeling should focus on contaminant fate and transport and quantifying a better estimate of remedial time frames, to enable evaluation of pumping alternatives to optimize the remedy.

4.2.1.2 South Indian Bend Wash

Concentrations of chlorinated solvents TCE and PCE in the upper alluvial unit have been below the Federal drinking water standards for the last ten sampling events in the Central Plume. TCE has not been detected above 1.0 µg/L in the upper alluvial unit wells since 2015, and all current concentrations are below the laboratory reporting limit in the Western Plume. All contaminants of concern in wells in the middle alluvial unit have been below the Federal drinking water standards for the last three years in the

Eastern Plume. The highest concentration of TCE was detected in middle alluvial unit eastern plume monitoring well SW-3 at 4.9 µg/L in April 2019, which is below the Federal drinking water standard of 5.0 µg/L. TCE concentrations in Eastern Plume well SW-3 were below the Federal drinking water standard in both the April 2019 and October/November 2019 groundwater sampling events. The highest concentration of PCE was detected in the Eastern Plume upper alluvial unit monitoring well South Indian Bend Wash-64U at 2.9 µg/L, which is below the Federal drinking water standard of 5 µg/L.

The Remedial Action Completion Report was completed and approved by the EPA in June 2020 indicating all remedial actions were completed and remediation goals defined in the ROD were completed.

The City of Tempe collected samples in 2014 from three municipal supply wells in the South Indian Bend Wash, and those samples showed concentrations of PFOS and PFOA exceeding the EPA Health Advisory Level (>70 nanograms per liter (ng/L) of PFOS or PFOA), individually or combined. The City of Tempe subsequently shut down those three municipal supply wells in 2014.

Based on those results collected by the City of Tempe, Gilbane, on the behalf of EPA, collected groundwater samples to be analyzed for PFAS from eight select South Indian Bend Wash wells in the April 2019. The results from the analytical sampling in April 2019 had results ranging from 5 to 84 ng/L, primarily as PFOS.

Based on the results of the April 2019 sampling event, additional sampling was performed concurrent with the October/November 2019 annual sampling event to better understand the extent of PFAS contamination in the South Indian Bend Wash study area. PFOS was detected above its EPA screening level[4] (40 ng/L) in 12 of the 16 wells; PFOA was detected above its EPA's screening level (40 ng/L) in one of the 16 wells. Total PFOS/PFOA results ranged from 5 to 170 ng/L (Table 8).

Seven of the wells with PFOS/PFOA concentrations above the health advisory levels[3] (70 ng/L) are located in the upper alluvial unit, and five of the wells with PFOS/PFOA concentrations above the health advisory levels are located in the middle alluvial unit. Of the wells with combined PFOS/PFOA concentrations above the health advisory levels, six are located in the upper alluvial unit and two are located in the middle alluvial unit.

[4]EPA's Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS https://www.epa.gov/pfas/interim-recommendations-addressing-groundwater-contaminated-pfoa-and-pfos

Table 8. PFOS/PFOA Results South Indian Bend Wash

WELL	April 2019			October/November 2019		
	PFOS	PFOA	Combined	PFOS	PFOA	Combined
PD-2	NC	NC	NC	129	41.9	170.9
SIBW-5U	66.2	7.69	73.89	45.1	7.41	52.51
SIBW-28U	64.6	16.1	80.7	56.7	15.9	72.6
SIBW-38U	NC	NC	NC	71.1	28.6	99.7
SIBW-60U	19.6	13.1	32.7	11.9	16.4	28.3
SIBW-61U	NC	NC	NC	73.0	16.7	89.7
SIBW-64U	NC	NC	NC	21.7	11.5	33.2
SIBW-64U (DUP)	NC	NC	NC	21.2	10.3	31.5
SIBW-66U	63.9	20.1	84.0	60.8	24.0	84.8
SW-1	NC	NC	NC	103	26.6	129.6
SW-2	NC	NC	NC	87.9	23.3	111.2
SIBW-11MC	33.1	5.03	38.13	29.1	4.89	33.99
SIBW-12L	28.7	10.3	39.0	35.3	9.23	44.53
SIBW-13MC	53.2	12.9	66.1	54.5	13.0	67.5
SIBW-13MC (DUP)	56.4	12.8	69.2	NC	NC	NC
SIBW-56MC	NC	NC	NC	59.2	8.42	67.62
SIBW-56MC (DUP)	NC	NC	NC	58.1	9.05	67.15
SIBW-57MC	NC	NC	NC	101	23.2	124.2
SW-3	49.4	8.29	57.69	46.8	7.35	54.15
			Criteria (ng/L)			
Screening Level	40	40		40	40	
PRG			70			70

Notes:

All results are in nanograms per liter (ng/L) / parts per trillion (ppt)

Unhighlighted wells are screened in the upper alluvial unit (UAU)

Blue highlight indicates well screened in the middle alluvial unit (MAU)

Gold highlight indicates a result above the screening level

Yellow highlight indicates a result above the PRG

DUP = duplicate sample

4.2.2. Soil Gas/Indoor Air

4.2.2.1 North Indian Bend Wash

In 2016, to evaluate the potential risk of vapor intrusion from shallow soil gas, soil gas data from the historical source areas were compiled and evaluated relative to EPA soil vapor intrusion risk-based screening levels. Based on the results of the evaluation, additional soil gas sampling was recommended, and proposed locations for installing shallow soil gas sampling points. In 2017, a total of 50 shallow sampling points were installed and sampled at seven of the historical source areas. With the exception of a few sampling points near Area 7, TCE soil gas concentrations were all below land-use-specific EPA risk-based screening levels. The Fehling Group, on behalf of EPA, completed a vapor intrusion assessment from soil gas samples collected in 2017 and 2018. The Fehling Group identified a small, localized source area in the parking lot north of the Area 7 treatment plant where a soil gas concentration of 850,000 micrograms per cubic meter ($\mu g/m^3$) at ten-foot depth exceeded the EPA human health risk management threshold of 10^{-4} and the hazard index of 100.

In April 2017, EPA deployed its Trace Atmospheric Gas Analyzer (TAGA) mobile lab to sample soil gas and indoor air in residential and commercial buildings near Area 7. A soil gas survey was initially conducted to identify buildings for follow up vapor intrusion sampling. Indoor air samples were then collected and analyzed in real time from twenty-seven residential units and the leasing office of an apartment complex adjacent to the Area 7 groundwater extraction and treatment facility. The TAGA sampling did not identify concentrations of TCE or PCE in any of the apartments that could be attributed to vapor intrusion during the event. Where elevated TCE or PCE concentrations were found during the sampling in some units, the source was identified as dry cleaning or commercial products within the unit. Ten single family homes a block away were also screened for potential vapor intrusion based upon the results of the initial soil gas survey. Of the ten homes sampled in April 2017, only one residence was found to have elevated levels of TCE above the screening level. TCE concentrations were uniform throughout the home and the source was unconfirmed. Air filters were immediately delivered to the home and EPA continued to monitor air concentrations in the home over the next two years as concentrations declined both within the home and soil gas concentrations in the street. The response action for the residence is completed.

Two commercial buildings near the Area 7 GWETS were also sampled with the TAGA in April 2017. One building was completely cleared for vapor intrusion after multiple sampling runs. Vapor intrusion was confirmed in one bathroom of a small studio business next door. An air filter was also delivered to this location.

Apartment Building follow up sampling:

The North Indian Bend Wash Participating Companies conducted additional indoor air sampling using Summa canisters and in the apartment complex in 2018. Indoor air samples collected from ten apartments south of the Area 7 treatment plant in 2018 found TCE concentrations exceeding the lower indoor air

residential screening level[5] for TCE (0.48 µg/m^3 to 2 µg/m^3) in four of those apartments (Table 9). PCE concentrations during these sampling events were non-detect.

Although the source could not be confirmed from Summa canister data, as a protective measure EPA asked the Participating Companies to install a sub-slab depressurization system. Vapor Mitigation Sciences, LLC, on behalf of Motorola, designed and installed sub-slab depressurization systems in April 2018. The system uses a blower to pull vapor from the void spaces below the floor slab, with the goal of creating negative pressures below the slab. These negative pressures allow volatile contaminated vapor to be removed from below the slab. In areas where cracks in the slab may be present, indoor air will flow down from the building interior into the void spaces in the materials beneath the slab, rather than allowing vapors to flow up from the ground into the building, thus eliminating or minimizing the potential for vapor intrusion. Operation of the system started on April 20, 2018.

Table 9. Indoor Air Results for Area 7 Apartments

Location	Sample Date	TCE µg/m^3
	Residential risk range:	*0.48- 2*
Unit A (apartment indoor air)	April 2017	Non-detect
Unit B (apartment indoor air)	April 2017	Non-detect
Unit C(apartment indoor air)	December 2017	Non-detect
Unit D (apartment indoor air)	February 2018	**1.3/ 1.0**
Unit E (apartment indoor air)	April 2017	Non-detect
	December 2017	**1.5**
	February 2018	**1.2/1.6**
Unit F (apartment indoor air)	February 2018	0.1
	August 2019	0.34/**0.55**
Unit G (apartment indoor air)	December 2017	**0.72**
	February 2018	**0.77/0.92**
Unit H(apartment indoor air)	February 2018	Non-detect
	March 2018	Non-detect
Unit I (apartment indoor air)	March 2018	Non-detect
Unit J (apartment indoor air)	April 2017	Non-detect

Vapor Mitigation Sciences, LLC, conducts operation and maintenance checks and verifies that the negative pressure remains as designed. On August 5, 2019, Vapor Mitigation Sciences, LLC conducted a mitigation measure check and determined that the sub-slab depressurization systems are continuing to perform as designed. Concurrent with the August 2019 baseline sub-slab pressure monitoring, indoor air

[5] EPA's acceptable risk range for carcinogenic chemicals range from one in a ten thousand to one in a million excess cancer deaths. The one in a million excess risk concentration for TCE at residential properties is 0.48 µg/m^3, and the one in a ten thousand excess risk concentration is 48 µg/m3. In addition, EPA evaluates the risk from non-carcinogenic risks using the hazard quotient. A hazard quotient of one or lower means adverse noncancer effects are unlikely, and thus can be considered to have negligible hazard. For TCE, a concentration of 2.0 µg/m^3 is considered protective for noncancer risks.

monitoring was conducted at the four apartment units where sub-slab depressurization vapor mitigation systems were installed at the property. Indoor air concentrations of TCE had been lowered to concentrations at the low end of the risk range (Table 10). Outdoor samples were also collected at the time of the indoor air sampling in 2019. TCE was detected at concentrations up 0.45 µg/m^3 in the outdoor sample. Restrictions in travel and access during the COVID pandemic has prevented EPA from collecting follow-up indoor air samples.

Table 10. Indoor Air Results Post-mitigation for Area 7 Apartments

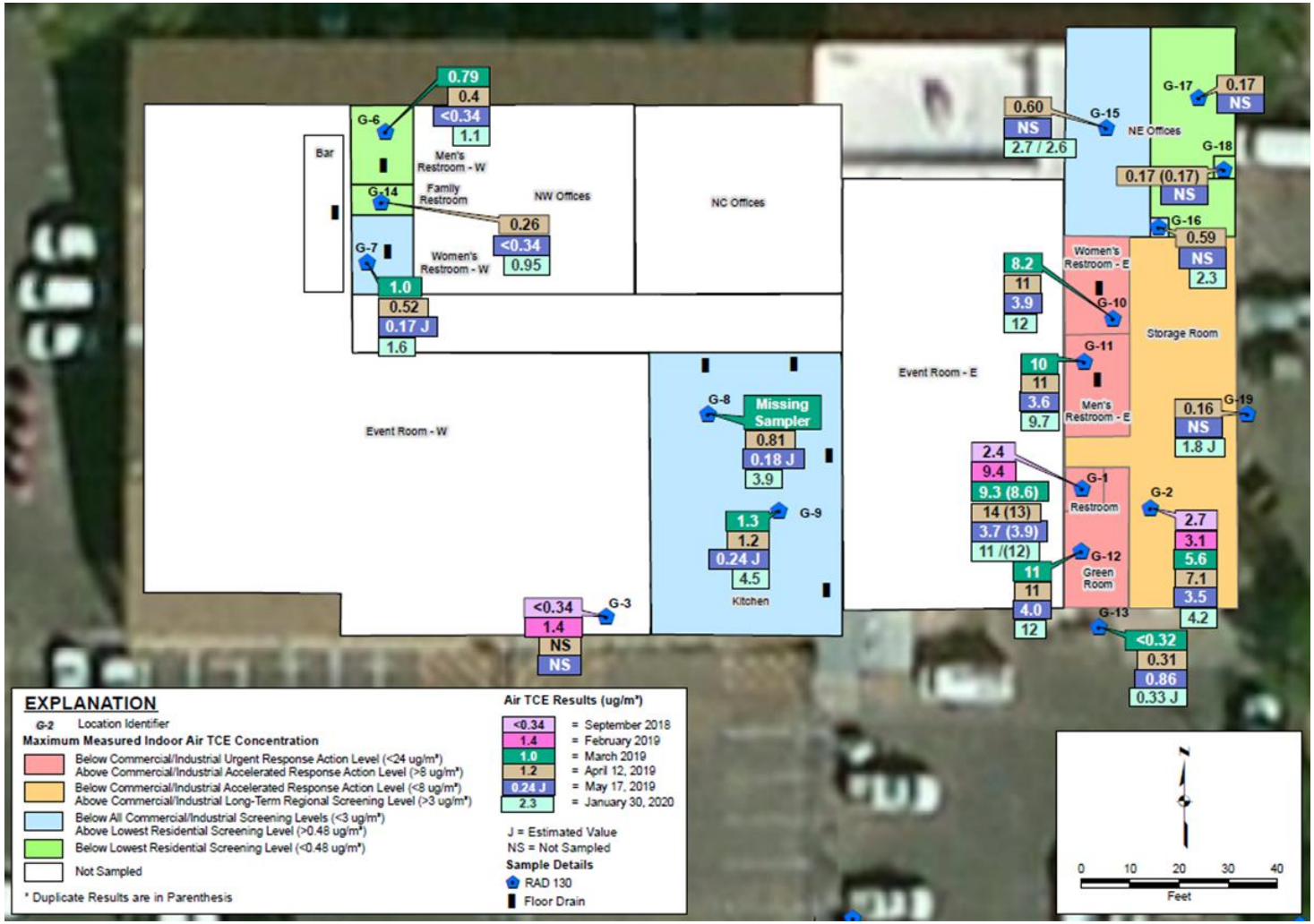
Location	Sample Date	TCE µg/m^3
	Screening Level - Residential (long-term):	0.48
Unit D (apartment indoor air)	August 1, 2018	0.25
	August 5, 2019	0.34
Unit E (apartment indoor air)	August 6, 2018	0.25
	August 8, 2019	Non-detect
Unit F (apartment indoor air)	August 1, 2018	0.34
	August 5, 2019	**0.55**
Unit G (apartment indoor air)	August 1, 2018	1.3
	Sept. 24, 2018	Non-detect
	October 19, 2018	0.26
	August 5, 2019	**0.51**

Event Center

The Participating Companies also sampled several locations within the new event center in 2108. Indoor air samples were also collected at nineteen locations within the event center from 2017 to 2020, which includes the indoor air samples collected during EPA's TAGA sampling event. Three locations within the event center contained TCE concentrations which were outside EPA's acceptable long-term risk for industrial or commercial use (3 µg/m^3 to 8 µg/m^3). These locations were in two event room bathrooms, and the green room used as a dressing room during events. EPA was working with the property owner to seal pathways and adjust the heating, ventilation, and air conditioning system (HVAC) to address vapor intrusion when the building was abruptly closed due to the Covid-19 pandemic.

In August 2021, EPA contacted the event center owner who told EPA that center is now open but has had very few events. The green room generally is not being used, and events often take place with the rollup doors open. Otherwise, the owner runs the HVAC fans all the time during events. EPA provided information on sub-slab depressurization systems and will work with him to install appropriate long-term mitigation measures.

Figure 9. Indoor Air Concentrations in Events Center



4.2.2.2 South Indian Bend Wash

EPA collected soil gas samples of all former source areas in assessing the potential for vapor intrusion. Based upon the soil gas sampling results, all 12 former South Indian Bend Wash source areas were determined to require no further action because analytical results were below regulatory limits given the current commercial/industrial land use.

In the DCE Circuits building, PCE was reported at a soil gas concentration of 0.41 $\mu g/m^3$ in results from the November 2015 sampling event. PCE was not detected in soil gas results from the November 2016 event or the January 2018 event.

Soil gas sampling was performed at four soil vapor monitoring wells located in the parking lot between and to the north of buildings 1300 and 1340 at former DCE Circuits, In addition, one round of soil gas sampling was conducted at two soil gas monitoring wells, DCE-5 and DCE-6, installed in April 2017. Indoor air samples were collected inside Buildings 1300 and 1340. A subsequent risk assessment determined that results of the sampling were within the acceptable incremental lifetime cancer risk and/or hazard index for commercial/industrial land use.

Indoor apartment sampling was performed at a property south of the DCE Circuits Building in April 2017, and the results indicated that concentrations of TCE and PCE were below detection limits for indoor air samples collected in Residential Unit 1 and Residential Unit 3. TCE and PCE were detected at in Residential Unit 2. The maximum concentrations detected in the Unit were in a sample in the unit's closet with PCE at 3.2 $\mu g/m^3$, and a sample in the Unit's bedroom contained TCE at an estimated concentration of 0.47 $\mu g/m^3$. Both PCE and TCE concentrations were both within EPA's acceptable risk range.

Follow-up sampling was conducted for Residential Unit 2 in May 2017. The results indicated that TCE had concentration of 0.52 $\mu g/m^3$, exceeding its regional screening levels, but within EPA's acceptable risk range. PCE was not detected.

Additional indoor air samples were collected in three residential apartment units each in January and February 2018. These results indicated that PCE and TCE concentrations were below their respective residential regional screening levels. Additionally, benzene and ethylbenzene, which are not Indian Bend Wash contaminants, were detected. Outdoor air samples had benzene concentrations similar to those in the indoor air samples. These indoor and outdoor detections are not associated with Indian Bend Wash contaminants and were attributed to off-site sources.

The Remedial Action Completion Report was completed and approved by the EPA in June 2020 indicating all remedial actions were completed and remediation goals defined in the various RODs were completed.

4.3. Site Inspection

A formal site inspection was not completed for this Five-Year Review due to travel restrictions resulting from the COVID-19 pandemic. USACE reviewed the October 6, 2020 annual video inspection and treatment plant operator interviews conducted by EPA's contractor, Gilbane in October 2020. USACE reviewed the video information in the June 2020 Remedial Action Completion Report for South Indian Bend Wash Site. No information presented in the videos or interviews was indicative of site protectiveness issues.

5. Technical Assessment

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

Yes, the remedy is generally functioning as intended. The collective remediation efforts have achieved significant progress toward the long-term goal of aquifer restoration while providing plume containment and beneficial use of vital groundwater resources.

North Indian Bend Wash

The TCE plume in the North Indian Bend Wash does not appear to have expanded beyond historical limits and is migrating towards the extraction wells tied to remediation in most cases. However, there are data that suggest the plume may not be fully laterally contained in the northwestern edge of the plume in the lower alluvial unit, especially as the pumping of Central Groundwater Treatment Facility remediation wells have been reduced. PCE concentrations are increasing in monitoring well S-1LA and are above Federal drinking water standards. The North Indian Bend Wash does not have additional sentinel wells to track the movement or determine the groundwater hydraulic gradient past this monitoring well location and the groundwater hydraulic gradient in this area is poorly defined. There are two wells potentially downgradient of monitoring well S-1LA, but they may not be able to detect the complete extent of the plume.

Groundwater extraction and treatment activities at the North Indian Bend Wash have been removing contaminant mass from groundwater. In 2020, the North Indian Bend Wash remedial actions resulted in the extraction and treatment of 4.9 billion gallons of groundwater and removal of over 1,860 pounds of TCE. The Area 7 remedy has reduced the upper alluvial unit contaminant mass in groundwater and concentrations in the upper alluvial unit plume has decreased significantly; however, removal rates have not declined, indicating that substantial mass still remains. Reduced extraction in the vicinity of the Central Groundwater Treatment Facility may impact the effectiveness of the containment system, which is still under evaluation. The groundwater model is currently being revised and the remedy is under an optimization review by EPA headquarters. The remedial time frame to achieve the objective of aquifer restoration has not been quantified.

Water level data continue to demonstrate that the groundwater flow direction within the middle and lower alluvial units' plume is generally toward North Indian Bend extraction wells or the western margin, limiting lateral migration of contaminants in the groundwater. The Area 7 and Area 12 groundwater extraction and treatment systems in the middle alluvial unit have mostly contained the localized areas with the highest TCE concentrations and reduced migration toward the southwestern margin and into the lower alluvial unit. Additional data is needed to confirm if the contamination is vertically contained, and contaminants are not migrating deeper.

South Indian Bend Wash

At South Indian Bend Wash, monitored natural attenuation was successful in reducing concentrations of all contaminants below cleanup levels. As a result, the Remedial Action Completion Report was completed for the South Indian Bend Wash and approved by the EPA in June 2020, indicating that all remedial actions required by the various RODs were completed and all remediation goals met.

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

Although the remedial action objectives, toxicity data, and cleanup standards used at the time of remedy selection are still valid, the exposure assumptions have changed.

North Indian Bend Wash

Soil gas investigations found a significant source of mass still remains at Area 7, and vapor intrusion was identified in the adjoining apartment building and event center. In April 2018, a sub-slab depressurization system was installed beneath the apartment building, and subsequent sampling in 2018 and 2019 indicate that the mitigation system was working as intended. The indoor air sampling at the event center indicated unacceptable risk of TCE inhalation in two event room bathrooms and green room . In 2019, EPA was working with the owner to implement short-term HVAC adjustments and long-term mitigation measures. The event center shutdown in 2019 due to restrictions imposed during COVID-19 pandemic. The event center has recently reopened for a few events. EPA confirmed that the owner is operating the HVAC system during those events to mitigate risk, and EPA has resumed working with the owner for more permanent measures.

South Indian Bend Wash

A vapor intrusion study in the South Indian Bend Wash was conducted in 2019. The vapor intrusion risk assessment concluded that risk values associated with soil vapor samples were below benchmark levels that commonly trigger additional action given the current commercial/industrial land use.

Recently, PFAS has been detected in multiple in South Indian Bend Wash monitoring wells; the extent of the PFAS plume is unknown. The current remedy of monitoring natural attenuation is not expected to be effective for PFAS contaminants which do not naturally degrade. However, there is currently no exposure

to untreated water as municipal supply wells impacted by PFAS have been removed from service. The Water Utilities Division of Tempe's Municipal Utilities Department supplies municipal water service to the residents in the Tempe area. In addition, the Arizona Department of Water regulates all groundwater wells in Arizona to ensure proper management and protection of our groundwater. EPA searched the Arizona Department of Water well water database for wells within the area of South Indian Bend Wash, and no private drinking water wells in the area were identified.

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

Current assumptions regarding protectiveness of remediation and containment methods may not reflect changing climate impacts. Periodic evaluations of implemented remedies may not incorporate all climate change impacts, including changes in frequency and intensity that may impact remedy effectiveness. The GAO Superfund Climate Change report was accessed, and it indicated that no hazards were identified for the Indian Bend Wash Site. However the potential for increasing reliance on groundwater supplies is a likely future concern, given that Phoenix is rapidly warming at a rate of 1 degree Celsius per decade, and the incidence of widespread summer drought, reduced snowpack, and increasing evaporation rates with higher temperatures may reduce the availability of surface water resources.

The southern portion of the North Indian Bend Wash is located within the 100-year flood zone of the Salt River and the Indian Bend Wash and associated green belt areas are designated as a regulatory floodway. The northern portion of the South Indian Bend Wash is located within the 100-year flood zone of the Salt River. The Salt River flows are regulated by releases from the Roosevelt Dam approximately 40 miles upstream so flooding, would not have a significant impact on the Indian Bend Wash Site. However, as operation of some of the NIBW treatment plants is dependent upon canal capacity to accept treated water, the remedy may be affected by increased potential for flash floods due to climate change. Also, thunderstorms frequently result in power outages and accidental releases at the NIBW treatment plants, and these may increase in frequency and intensity with the changing climate.

6. Issues and Recommendations

Table 11: Issues and Recommendations Identified in the Five-Year Review

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): North Indian Bend Wash	**Issue Category: Monitoring**			
	Issue: The trend of increasing concentrations of PCE in the lower aquifer monitoring well S1LA in the North Indian Bend Wash could indicate that the plume may not be contained on the western edge of the lower aquifer potentially impacting peripheral production wells.			
	Recommendation: Model the impact of pumping of peripheral production wells on plume containment in the vicinity of well S-1LA. Perform additional field investigation as warranted to determine if groundwater is contained or migrating off-site north and west of monitoring well S1LA			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	5/31/2023

OU(s): North Indian Bend Wash	**Issue Category: Remedy Performance**			
	Issue: The NIBW groundwater flow and 3D visualization models are still under review. An independent Remedy Optimization Study is currently underway by EPA Headquarters to improve the conceptual site model, identify data gaps and recommend specific actions that could be implemented to improve long term protectiveness and cost-efficiency to facilitate progress towards site completion.			
	Recommendation: Complete the review of the groundwater model and Remedy Optimization Study.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	5/31/2022

OU(s): North Indian Bend Wash	**Issue Category: Remedy Performance**			
	Issue: Although the remedy has been in operation for several years, the timeframe to achieve remedial action objectives is unknown, which complicates evaluation of remedy effectiveness or effectiveness of optimization enhancements.			
	Recommendation: Integrate a contaminant fate and transport model into the existing groundwater flow model and estimate remedial timeframes.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/30/2023

Issues and Recommendations Identified in the Five-Year Review:

OU(s): North Indian Bend Wash	**Issue Category:** Remedy Performance			
	Issue: There is a remaining small, localized mass of contamination source within Area 7. A confirmed complete pathway for vapor intrusion exists near this source area. Soil Vapor Extraction has been previously employed at Area 7 to address impacts to groundwater but did not remove contamination within the tight caliche soils in the shallow vadose zone.			
	Recommendation: Collect soil core samples within the vicinity of the source area using high resolution site characterization to better delineate the extent of contamination in this area. Consider conducting a pilot test of thermal remediation to permanently reduce contaminant concentrations and vapor intrusion risk.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/30/2023

OU(s): North Indian Bend Wash	**Issue Category:** Remedy Performance			
	Issue: There continues to be system communication issues between the extraction network and treatment system at the Central Groundwater Treatment Facility which have resulted in additional accidental leaks at the air relief valves.			
	Recommendation: Complete the upgrade for the communications system for the Central Groundwater Treatment Facility.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/30/2022

OU(s): North Indian Bend Wash	**Issue Category**: Remedy Performance			
	Issue: Pumping efficiency at Area 7 has been reduced since the shutdown of higher concentration well 7EX-4MA in 2016 due to reduced pumping efficiency; rehabilitation of Well 7EX4-MA has yet to be completed.			
	Recommendation: Complete the rehabilitation of well 7EX-4MA as soon as possible or consider well replacement to optimize the hydraulic capture and remediate the highest concentrations.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/30/2023

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): South Indian Bend Wash	**Issue Category**: Changed Site Conditions			
	Issue: PFAS were detected in the South Indian Bend Wash monitoring wells above the EPA health advisory level, warranting additional investigation beyond the scope of the RODs.			
	Recommendation: Initiate a new Remedial Investigation and Feasibility Study and the selection of a new remedy to address PFAS.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	9/30/2022

6.1. *Other Findings*

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

- Field work to collect additional confirmation indoor samples from the apartments has been on hold due to travel and access issues resulting from the COVID-19 pandemic. EPA will resume working with the property owner to improve mitigation measures for vapor intrusion in the event center as restrictions are lifted.

7. Protectiveness Statement

Table 12. Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: North Indian Bend Wash	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The North Bend Indian Wash remedy is currently protective of human health and the environment. Short-term vapor intrusion mitigation measures are in place at the two buildings adjacent to Area 7. However, to be protective in the long term, the vapor intrusion concerns at Area 7 need to be permanently addressed. The extent of the vapor intrusion source at Area 7 needs to be defined and remediated. The Northern Groundwater Treatment Facility provides plume containment for the northern extent of the groundwater plume and prevents the groundwater plume from moving further north into the production wells. For the remedy to be protective in the long-term, the extent of the groundwater flow at the Western Margin needs to be more thoroughly defined. The communication system at the Central Groundwater Treatment Facility needs to be upgraded to prevent further accidental releases. The Remedy Optimization study, once completed is expected to provide specific recommendations that to ensure long term protectiveness.	
Protectiveness Statement(s)	
Operable Unit: South Indian Bend Wash	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The South Indian Bend Wash remedy is currently protective, following successful attainment of remedial action objectives for volatile organic contaminants, which now meet drinking water standards. The vapor intrusion evaluation required by the second Five Year Review has been completed; the results of recent soil gas sampling concluded no further action was necessary to address vapor intrusion risk as health-based criteria were not exceeded for either commercial/industrial or residential use at any of the former source areas. However, for the remedy to be protective in the long term, a new remedial investigation and ultimately a new remedy is necessary to address newly discovered PFAS in SIBW monitoring wells. The monitored natural attenuation remedy is not expected to be effective for PFAS contaminants that do not naturally degrade. The PFAS Remedial Investigation is expected to begin next year.	

8. Next Review

The next Five-Year Review report for the Indian Bend Wash Superfund Site is required five years from the completion date of this review.

Appendix A: List of Documents Reviewed

AZ Central. https://www.azcentral.com/story/news/local/tempe/2019/05/02/water-9-arizona-systems-have-tested-high-toxins-found-luke-air-force-base/3485082002/

EPA. September 2016. Second Five-Year Review Report for Indian Bend Wash Superfund Site Maricopa County, Arizona

EPA. March 2012. Explanation of Significant Differences North Indian Bend Wash Superfund Site Remedy Well PCX-1, Scottsdale, Maricopa County, Arizona

EPA. June 2004. Record of Decision Amendment for the South Indian Bend Wash Superfund Site, Tempe, Arizona

EP. September 1998. Record of Decision VOCs in Groundwater Operable Unit Indian Bend Wash Superfund Site, South Area Tempe, Arizona

EPA. September 1993. Record of Decision Operable Unit: VOCs in Vadose Zone Indian Bend Wash Superfund Site, South Area Tempe, Arizona

EPA. September 1991. Record of Decision North Indian Bend Wash Superfund Site

EPA. September 1988. Final Record of Decision Scottsdale Ground Water Operable Unit Indian Bend Wash Superfund Site, Scottsdale, Arizona

Federal Emergency Management Agency. Flood Maps.

Gilbane. June 2020. Remedial Action Completion Report South Indian Bend Wash Superfund Site Tempe, Arizona

Gilbane. May 2020. South Indian Bend Wash Monitored Natural Attenuation Monitoring Report

Gilbane. May 2020. Vapor Intrusion Assessment Update Indian Bend Wash-South Superfund Site Tempe, Arizona

Gilbane. July 2019. Final Remedial Action Completion Report DCE Circuits Subsite, South Indian Bend Wash Superfund Site Tempe, Arizona

NIBW Participating Companies August 13, 2021. Technical Memorandum: Summary of Fluid Movement Investigations at SRP Well 23.6E-6.0N (Granite Reef Well) April through October 2020, North Indian Bend Wash Superfund Site, Scottsdale Arizona

NIBW Participating Company. February 2021. Operation and Maintenance Plan Groundwater Extraction Well Network North Indian Bend Wash Superfund Site

NIBW Participating Company. February 2021. 2020 Site Monitoring Report North Indian Bend Wash Superfund Site

NIBW Participating Companies. January 2021. Draft Conceptual Site Model Update

NIBW Participating Companies. February 2020. 2019 Site Monitoring Report North Bend Indian Wash Superfund Site.

NIBW Participating Companies, December 9, 2019. Technical Memorandum: Rehabilitation of Remedial Extraction Well MEX-1MA

Pure Technologies, US Inc, September 2017, Smart Ball Survey Inspection Report, Lines A and D Raw Water Transmissions Mains, prepared for City of Scottsdale

United States Fish and Wildlife Service. National Wetlands Inventory Wetlands Mapper. https://www.fws.gov/wetlands/Data/Mapper.html

Appendix B: Site Chronology

Event	Date
Trichloroethylene (TCE) is detected in groundwater samples from several City of Scottsdale and City of Phoenix municipal wells exceeding state standards	October 1981
Indian Bend Wash listed on EPA's NPL	September 8,1983
Remedial Investigation initiated by EAP	July 1984
Remedial Investigation and Feasibility Study(RI/FS) for Operable Unit 1 (OU1) completed	April 1988
EPA divides the Indian Bend Wash (IBW) Site into the North Indian Bend Wash (NIBW) and the South Indian Bend Wash (SIBW)	1987
Record of Decision issued for OU1	September 1988
EPA issues a Unilateral Administrative Order to Scottsdale parties to install and sample four groundwater monitor wells in the NIBW.	July 1989
EPA issues the NIBW RI/FS for the upper alluvial unit and the vadose zone (OU2).	April 1991
Record of Decision (ROD) issued for Operable Unit 2 (OU2)	September 1991
Remedial Investigation and Feasibility Study for OU2 completed	1991
Consent Decree is signed to implement cleanup actions selected in the 1988 ROD for NIBW Groundwater	April 1992
Central Groundwater Treatment Facility construction begins.	September 1992
EPA issued a ROD at 8 soil facilities in SIBW	1993
EPA issues a Certificate of Completion for NIBW Areas 5B and 9.	December 1993
NIBW Central Groundwater Treatment Facility begins operation to extract and treat groundwater from the middle and lower alluvial units.	February 1994
EPA issues a Letter of Determination that performance standards have been achieved at NIBW Area 5C.	April 1994
Construction of a soil vapor extraction (SVE) system for NIBW Area 7 is completed and start up begins	July 1994
EPA issues a Letter of Determination that the performance standards have been achieved at NIBW Area 5A.	March 1995
Consent Decree for OU1	1995
Construction begins on the NIBW Miller Road Treatment Facility	March 1996
NIBW Area 8 SVE system is decommissioned upon achieving performance goals	July 1997
Final SIBW Groundwater Feasibility Study is released for the three groundwater plumes	August 1997
Construction of Area 12 groundwater extraction and treatment system completed	December 1997
EPA issues ROD SIBW VOCs in Groundwater	September 1998
EPA issues Area 12 SVE attained remedial performance standards	August 2000
EPA issues Area 6 closure letter and SVE system decommissioned	October 2000
Feasibility Study Addendum for OU1 completed	November 2000
NIBW Miller Road Treatment Facility experiences control malfunction following area wide power loss	January 2001
Monitoring wells installed to determine southern boundary of Western Plume SIBW	February 2001
EPA issues amended ROD	September 2001
EPA issues a second SIBW "plug-in" document to seven additional PRPs requiring SVE in the vadose zone	January 2002

Event	Date
Monitoring wells installed for Eastern Plume SIBW	March 2002
Amended ROD completed for SIBW	June 2003
Amended Consent Decree finalized	June 2003
EPA and ADEQ enter into discussions regarding air emission control systems	February 2004
EPA determines that all physical construction of cleanup systems complete for both OUs	September 2006
SIBW Consent Decree signed with Unitog Rentals, IMC Magnetics, Circuit Express, Janstar, K&S Interconnect, Sherman Leibovitz, Prestige Cleaners, Service & Sales	March 2007
Rehabilitation of the Miller Road Treatment Facility completed	May 2010
First Five-Year Review completed	September 2011
North Groundwater Treatment Facility completed	2013
25 monitoring wells in SIBW abandoned due to contaminants below standards	2013
45 monitoring wells in SIBW abandoned due to contaminants below standards	2014
Area 7 SVE system decommissioned with EPA approval	April 2015
Second Five-Year Review completed	September 29, 2016
City of Tempe designates all land use in the SIBW as industrial/commercial	2019
Shallow soil investigations at all 12 SIBW subsites were completed	2019
The Remedial Action Completion Report was completed and approved by EPA indicating all remedial actions were completed and remediation goals defined in the ROD were completed for SIBW Site.	June 2020

Appendix C: Public Notice

EPA WANTS TO HEAR FROM YOU ABOUT THE
NORTH AND SOUTH INDIAN BEND WASH SUPERFUND CLEANUP

The U.S. Environmental Protection Agency (EPA) has started a Five-Year Review of the cleanup plan for the North and South Indian Bend Wash Superfund sites. The site includes areas of groundwater contamination in Scottsdale and Tempe, Ariz. This review will evaluate if the cleanup plan is working as EPA intended.

Federal law requires EPA to review its cleanup plans every five years if:

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

During the last such review, completed in 2016, EPA found that more investigations were needed to figure out if contamination in soil could potentially enter buildings. This process, called vapor intrusion, occurs when chemical vapors pass through cracks and other openings in the foundation of a building and enter the indoor air. Those prior investigations found that only one area in Scottsdale needed action to address vapor intrusion. EPA will resume addressing this area when it is safe to do so.

What is Included in the Current Review?

- reviewing site information, data and facility maintenance records;
- inspecting of the site and evaluation of cleanup progress; and
- reviewing any new laws, cleanup standards or other requirements that could affect the cleanup.

EPA Would Like to Hear from You!

As part of the review process, EPA invites community members to answer a short survey about how you think the site cleanup is going. If you would like to participate in the survey, please respond **before May 31, 2021**. For this and other inquiries, or to be added to the mailing list to receive future updates, please contact:

Carlin Hafiz, Community Involvement Coordinator, at 213-244-1814 or hafiz.carlin@epa.gov

Where Can I Learn More?

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

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

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

Background

Indian Bend Wash Superfund site includes two areas (North and South) of groundwater contamination in Scottsdale and Tempe, Ariz. Five groundwater removal and treatment plants were built in the North Indian Bend Wash site to treat groundwater, with that part of the cleanup still ongoing. At the South Indian Bend Wash site, EPA's groundwater cleanup standards were met, and vapor intrusion investigations were completed with no further action recommended. However, EPA has started a new investigation there on Per and Poly-Fluoroalkyl Substances (PFAS) in groundwater. The investigation will find where the PFAS is as well as its sources. EPA will work with State of Arizona to address the challenges related to PFAS at the site and safeguard the community.

CNSB#3467251

Ex-coach disputes SUSD version of his actions

BY WAYNE SCHUTSKY
Progress Managing Editor

The former coach of the Chaparral High School wrestling team has disputed allegations in a district investigation that led to his dismissal.

Jamie Varner resigned from the coaching position on March 24 after being told by district administrators his contract would not be renewed.

That came after a district investigation into Varner stemming from his alleged use of inappropriate language with wrestlers and actions during an end of season tournament in March.

In an interview with the Progress, Varner said he was a dedicated coach who cared for his wrestlers.

"I'm the one that takes time out of my day, my job, away from my family to go do that because I love these kids," he said. "I love them; my high school coach...absolutely changed my life and my goal as a coach was to pay that forward."

Varner denied most of the allegations included in the district's investigation, including that he called a wrestler a homophobic slur.

Varner said the comment in question occurred during a crowded tournament when wrestlers and coaches were wearing masks. He said the masks made it difficult to hear and that the wrestler misheard what he said.

Varner said he has friends and family members who are homosexual "so it's really weird for them to kind of come at it from this angle."

"I always let the guys, the kids know that if I ever said something like that, it was never meant in the homosexual way," he said. "I would often say like how we used to use it, like synonymous with being a sissy or being a bitch or whatever."

Varner also denied another allegation made in the district's report, which alleged told a wrestler from another school "thank you for bringing out the bitch in my wrestler."

Varner told district administrators he said "thank you for bringing out the best in my wrestler."

Varner did not deny another complaint in the report that found he left the team to sit in the stands during several matches at an end-of-season tournament after becoming frustrated with his team.

Varner, a former professional mixed martial arts fighter, said he had set lofty expectations for some of his wrestlers and became upset after they performed poorly during the meet.

He acknowledged he took the wrestlers' performance too personally at the time.

"And this was a really, really rough day for me emotionally...we got hammered," he said. "We had beat kids in the previous two weeks, and then they just came out there and crushed us."

"It was like the moment was too big for all the kids, and I had probably bitten off more than I could chew with telling the parents we're for a tough team, I had set some pretty high expectations."

> "I'm the one that takes time out of my day, my job, away from my family to go do that because I love these kids. I love them; my high school coach...absolutely changed my life and my goal as a coach was to pay that forward."

Varner also admitted to calling another team's wrestler a "coward" at the tournament, but said it was a gut reaction after he witnessed an older wrestler head butt one of his sophomore wrestlers during a match.

"Was it the right thing to do? No. Was it the professional thing to do? No," Varner said.

"Was it a reaction to someone I love getting hurt unnecessarily, undeservingly? Yeah."

While he acknowledged those missteps, Varner said he did not believe they warranted a dismissal.

He said he believed the district's investigation was the result of complaints from two parents with whom he had disagreements with over the past year.

Varner alleged those parents took his comments at the tournament and screenshots of Snapchat conversations he had with wrestlers out of context in order to put pressure on Chaparral administrators to dismiss him.

According to the district's report, Chaparral and district administrators did cite Varner's alleged comments and behavior during the tournament as reasons not to renew his contract.

They also took issue with Varner's participation in private Snapchat conversations with wrestlers.

Varner said he did not think there was anything wrong with those conversations.

He said Snapchat was simply the easiest way to communicate with his team and that he also participates in groups with Chaparral alumni he has coached in the past.

Scottsdale Unified School District declined a request to comment on Varner's version of events.

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San Francisco, CA 94105
Phone: (415) 947-8717
Email: r9records@epa.gov
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Background

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CNSB9467251

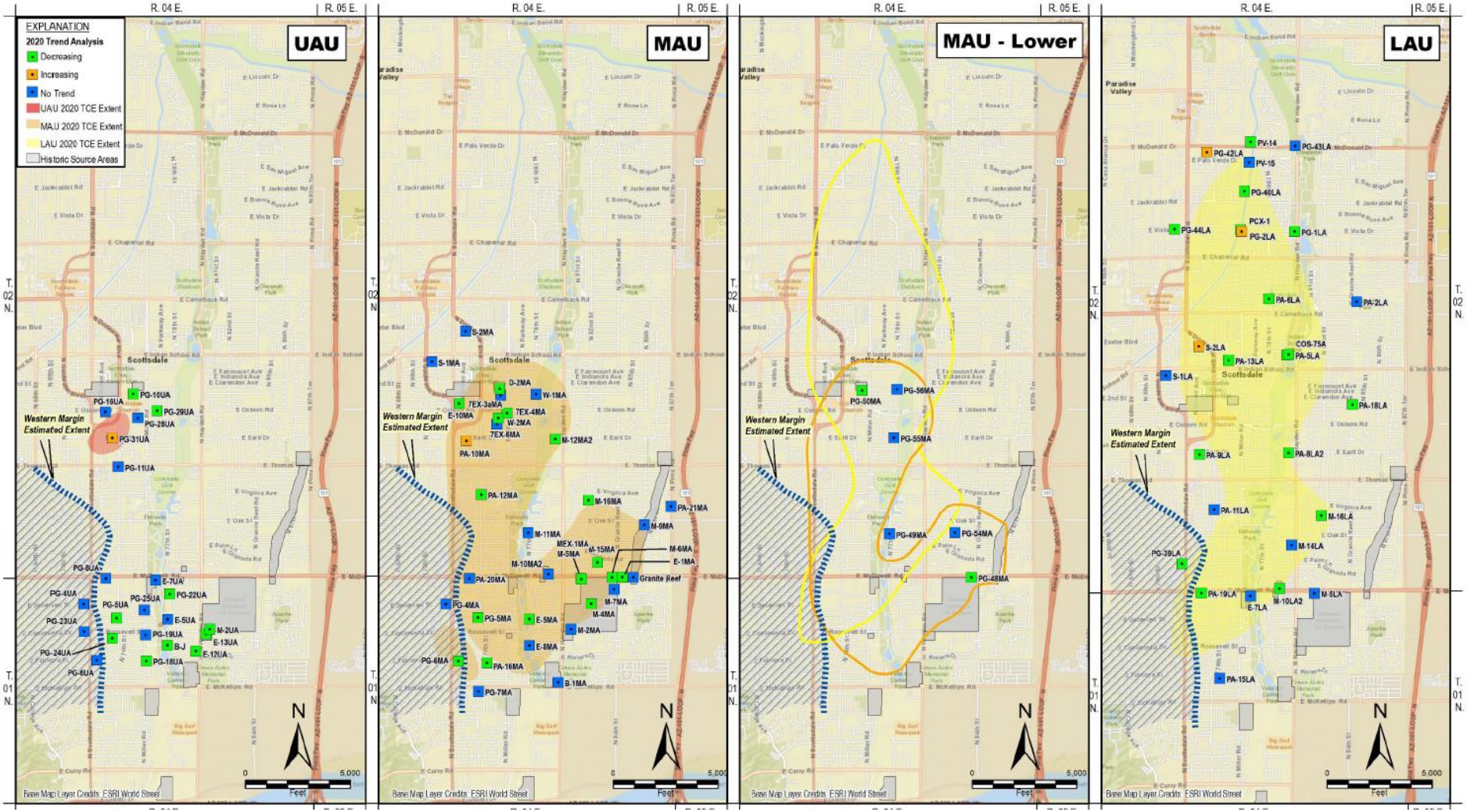
Appendix D: Data Review

North Indian Bend Wash

This data review examined data collected over the past five years to evaluate whether the remedial action objectives of plume containment for the Indian Bend Wash Site (Site) continue to be effective and protective of human health and the environment. The Participating Companies (PCs) operate five groundwater extraction well and treatment systems within the North and South Bend Indian Wash areas, to contain the plume and treat extracted groundwater.

For the North Indian Bend Wash, the main contaminants of concern are DCE, TCA, TCE, and PCE. Over the past five years only TCE and PCE were detected at concentrations above the Federal drinking water standards. Groundwater within the North Indian Bend Wash area in the upper and middle alluvial units generally flows from northeast to southwest and toward the Western Margin. Near the Western Margin, groundwater from the upper and middle alluvial units flows downward into the Lower Alluvial Unit. Groundwater in the lower alluvial unit then flows from south to north. Contamination, primarily as PCE and TCE, can be found in the upper, middle and lower alluvial units. Incomplete plume capture within the middle alluvial unit particularly between Area 7 and Area 12 allows the plume to migrate towards the Western Margin where groundwater flows downward into the lower alluvial unit. It appears that groundwater will eventually be captured as it flows backwards towards the northern extraction wells. However, there are only a few periphery monitoring wells on the western and northwestern portion of the plume. While this portion of the plume near S1-LA and S2-LA appears to be partially captured by three of the northern extraction wells, there is a data gap resulting in poorly defined groundwater contours on the periphery of the plume to the west and northwest. This data gap needs to be evaluated and is essential for understanding overall impacts of westward migration of the plume and possible future impacts to groundwater production wells for the Salt River Project (SRP) and Arcadia Water Company (AWC). Two key aspects of plume containment cited in the 2001 Record of Decision Amendment are (1) preventing the middle alluvial unit groundwater contamination from reaching he southwest margin, where the impacted groundwater moves downward to the lower alluvial unit and (2) preventing the northern migration of the lower alluvial unit plume. Allowing the plume to migrate westward through the middle alluvial unit then vertically down into the lower alluvial unit allows contamination to be in the environment for a much longer time. Remedial time frame estimates have not been performed to evaluate the remedy performance.

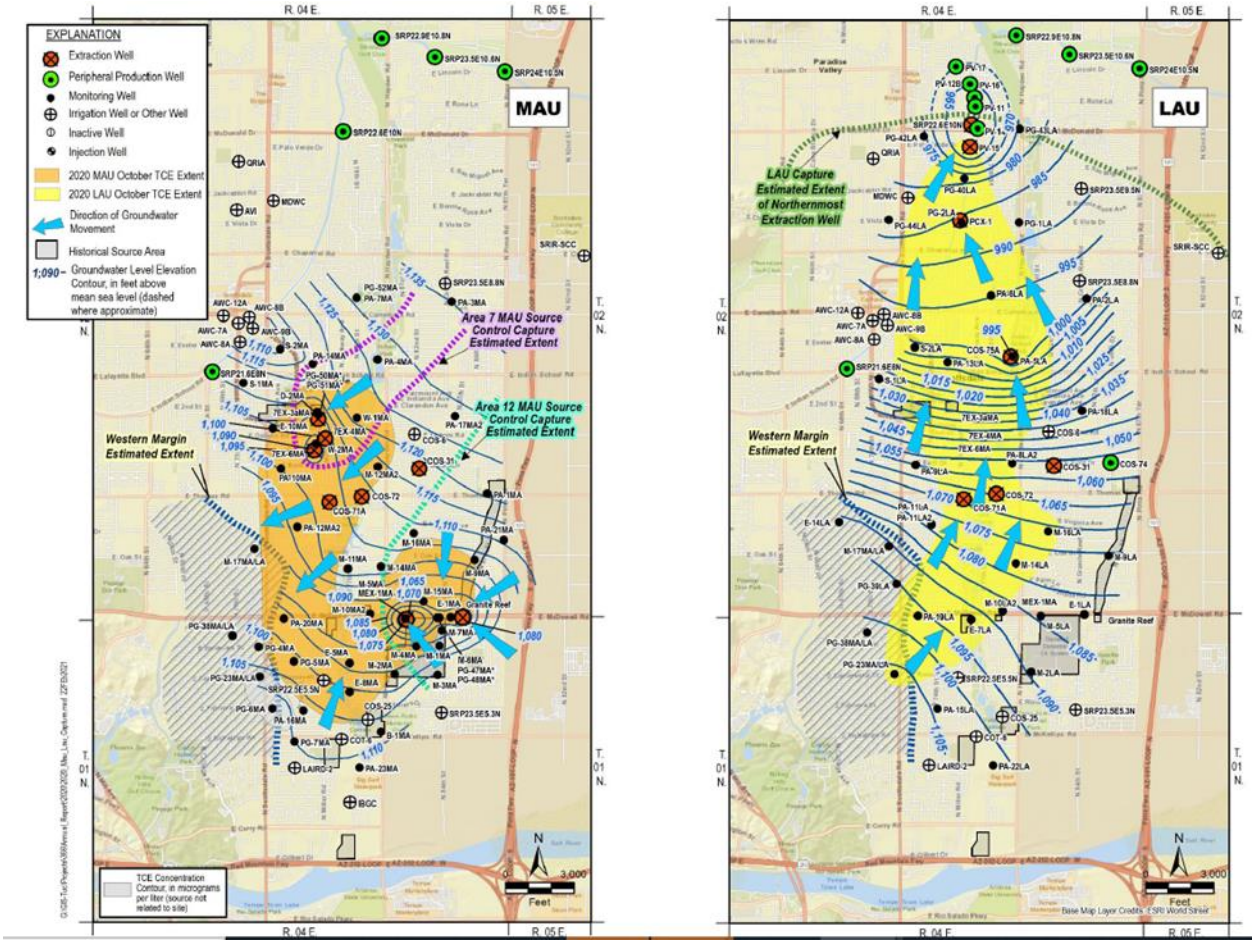
Figure D-1. Ten-year Mann- Kendall Trend Analysis for Upper, Middle, Lower Middle and Lower Alluvial Unit wells.



Source: 2020 Annual Site Monitoring Report, North Indian Bend Wash

Figure D-2. Estimated Hydraulic Capture of TCE Plume by middle alluvial unit source Control and Northernmost lower alluvial unit Extraction Wells October 2020.

Source 2020 SMR (NIBW PCs, 2021).



The Participating Companies have performed five-year TCE Mann- Kendall trend analyses that show that 9 of the 84 monitoring wells had increasing concentrations TCE across the North Indian Bend Wash area within the middle and lower alluvial units. Thirteen of the 84 monitoring wells had decreasing concentrations and 62 of the 84 monitoring wells showed no trend. (NIBW Participating Companies, 2021.) Five-Year Mann- Kendall analyses were also independently performed by USACE for EPA on 32 select wells in the upper, middle and lower alluvial unit wells with concentrations exceeding the federal drinking water standard of 5 µg/L. These data are presented in Figures D-3 to D-8. These trend analyses show TCE concentrations increasing at 7 of the selected wells, decreasing or probably decreasing at 6 monitoring wells and stable or no trend at 19 monitoring wells.

During this five-year reporting period, Mann-Kendall trend analyses show PCE concentrations increasing at three of six monitoring wells shown in Figure D-3, below. These six monitoring wells are aligned north –south along the western portion of the sites. Two of the six monitoring wells with increasing trends, PA-10MA and PG-38MA were at or below the EPA drinking water Maximum Contaminant Level (MCL) for

PCE of 5 µg/L. As shown on Figure D-2, PG38-MA is located on the far Western Margin, and although PCE concentrations are below MCLs (Figure D-3) this well is located near vicinity of PG-4UA. PG-4UA is located within a PCE source area unrelated to the Superfund site. PA-10MA may not be captured by the reduced CGTF Area 7 capture zone following removal of 7EX-4MA and COS-71A from the extraction program and PCE contamination from this well migrates towards the Western Margin. Monitoring well S-1LA is located on the northwest edge of the plume near groundwater production wells for the Salt River Project and Arcadia Water Company. Northeast and down gradient of S-1LA is monitoring well S-2LA with increasing TCE concentrations (see TCE discussion below).

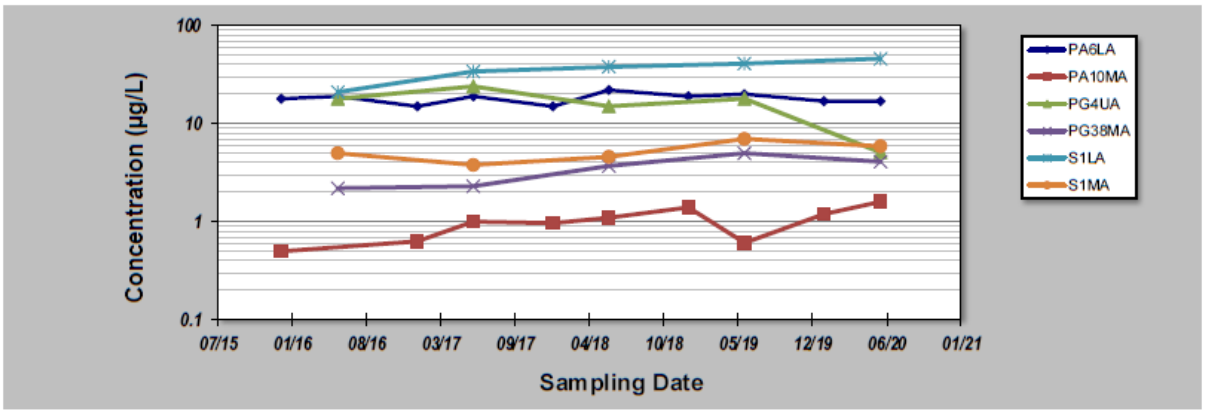
Figure D-3. PCE concentration trend plot since the previous five-year review of middle and lower alluvial wells. Three wells are increasing in PCE concentrations, with S1LA as one of the wells that may indicate the plume is not bounded in the west. The Federal drinking water standard for PCE is 5µg/L.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 9-Mar-21
Facility Name: Indian Bend
Conducted By: USACE

Job ID:
Constituent: PCE
Concentration Units: µg/L

Sampling Point ID:		PA6LA	PA10MA	PG4UA	PG38MA	S1LA	S1MA	
Sampling Event	Sampling Date	PCE CONCENTRATION (µg/L)						
1	Jan-16	18	0.5					
2	Jun-16	19		18	2.2	21	5	
3	Jan-17	15	0.63					
4	Jun-17	19	1	24	2.3	34	3.8	
5	Jan-18	15	0.97					
6	Jun-18	22	1.1	15	3.7	38	4.6	
7	Jan-19	19	1.4					
8	Jun-19	20	0.61	18	5	41	7	
9	Jan-20	17	1.2					
10	Jun-20	17	1.6	5.1	4.1	46	5.9	
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.12	0.37	0.43	0.35	0.26	0.23	
Mann-Kendall Statistic (S):		2	22	-5	8	10	4	
Confidence Factor:		53.5%	98.8%	82.1%	95.8%	99.2%	75.8%	
Concentration Trend:		No Trend	Increasing	Stable	Increasing	Increasing	No Trend	



Notes:

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

Of the seven selected wells with trends of increasing TCE concentrations, only three of these monitoring wells are within extraction well capture zones. M-9MA and E-1MA are within the Area 12 capture zone and PG-2LA is located near northern PCX-1 extraction well. PA-10MA and PA-12 MA monitoring wells are outside of the reduced CGTF/Area7 capture zone and TCE from these wells may be migrating to the Western Margin. M-14LA and E-7 LA are located within the southeast portion of the TCE plume (Figure D-2) TCE migrating from these two monitoring wells will eventually migrate northward toward the PCX-1 extraction well (see Figures D-4 and D-5).

Regarding the increasing TCE concentrations at S-1LA mentioned above, a general shift of the TCE plume west and northwest of monitoring wells S-1LA and S2-LA has been observed since 2011 (Figure D-10) This west/northwest shift has been attributed to the lower alluvial unit migrating toward the northern capture wells (NIBW Participating Companies, 2021). TCE concentrations in S-2-LA have consistently exceeded the TCE performance monitoring criterion of 15 µg/L (NIBW Participating Companies, 2021) and for this five-year reporting period TCE concentrations have ranged from 21 to 41 µg/L (See Figure D-8). The poorly defined groundwater contours and identified data gap due to lack of monitoring wells on the periphery in the west and northwest illustrate the uncertainty in ascertaining whether groundwater flow from S-1LA and S-2LA is toward the northern extraction wells or if it is impacted by pumping from AWC or SRP production wells.

Figure D-10 shows that groundwater within the upper alluvial unit has the lowest TCE concentrations, with a maximum of 36 µg/L in well PG-31 UA. The highest TCE concentrations are in the middle alluvial unit, particularly within the Area 7 capture zone where concentrations exceed 1000 ug/L The highest concentrations of TCE occur at wells W-1MA and W-2MA with concentrations of 520 and 2100 µg/L respectively for this reporting period. (Figures D-8 and D-10). In the Area 12 capture zone near the Granite Reef extraction well TCE concentrations were approximately 150 µg/L in 2019. Groundwater in the lower alluvial unit has the second highest TCE concentrations, ranging up to 170 µg/L at PA-6LA for this five-year reporting period. Groundwater in the middle alluvial unit has the highest contaminant concentrations of the three aquifer units, particularly near Area 7 extraction wells, where concentrations are greater than 1,000 µg/L in a localized area. A very small area of higher concentrations in the middle alluvial unit is present near the Area 12 Granite Reef extraction well, with concentrations around 150 µg/L in 2019. Groundwater in most of the middle alluvial unit TCE plume is now between 5 and 50 µg/L. The lower alluvial unit TCE plume ranges from 5 to 50 µg/L.

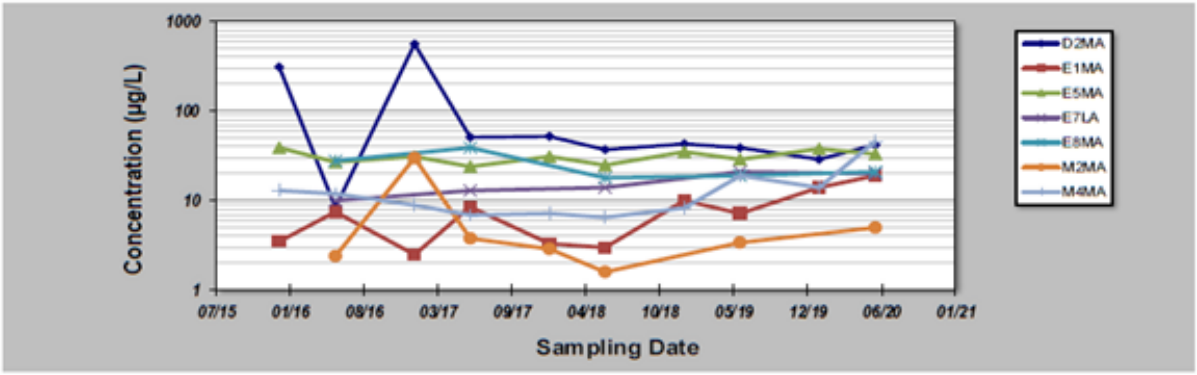
Figure D-4. TCE concentration trend plot since the previous five-year review of middle and lower alluvial wells. Two wells are increasing in TCE concentrations, but both wells are near extraction well systems. The Federal drinking water standard for TCE is 5µg/L.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 9-Mar-21
Facility Name: Indian Bend
Conducted By: USACE

Job ID:
Constituent: TCE
Concentration Units: µg/L

Sampling Point ID:		D2MA	E1MA	E5MA	E7LA	E8MA	M2MA	M4MA
Sampling Event	Sampling Date	TCE CONCENTRATION (µg/L)						
1	Jan-16	310	3.5	39				13
2	Jun-16	8.4	7.5	27	10	28	2.4	12
3	Jan-17	560	2.5	31			30	8.9
4	Jun-17	51	8.5	24	13	39	3.8	6.9
5	Jan-18	52	3.3	31			2.9	7.2
6	Jun-18	37	3	25	14	18	1.6	6.5
7	Jan-19	43	10	35				8.3
8	Jun-19	39	7.2	29	21	19	3.4	19
9	Jan-20	29	14	38				14
10	Jun-20	42	19	33	20	21	5	46
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.52	0.68	0.16	0.30	0.35	1.45	0.84
Mann-Kendall Statistic (S):		-15	21	6	8	-2	1	9
Confidence Factor:		89.2%	96.4%	66.8%	95.8%	59.2%	50.0%	75.8%
Concentration Trend:		No Trend	Increasing	No Trend	Increasing	Stable	No Trend	No Trend



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

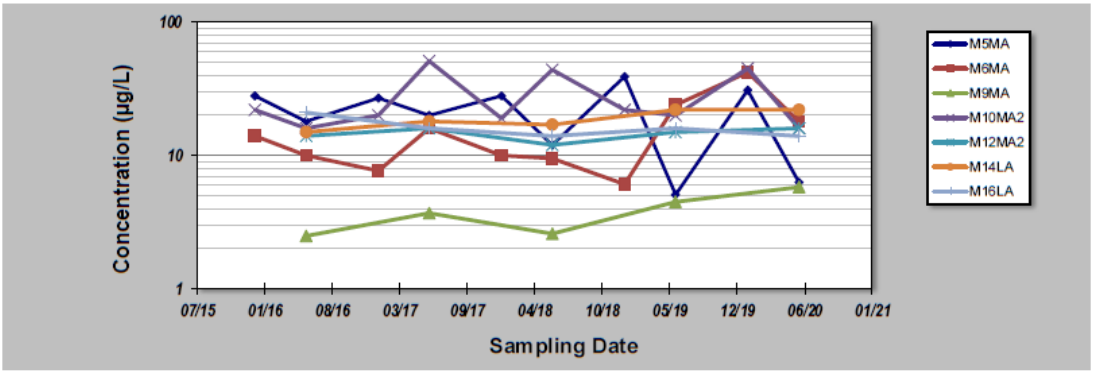
Figure D-5. TCE concentration trend plot since the previous five-year review of middle and lower alluvial wells. Two wells are increasing in TCE concentrations, but M14LA is upgradient from an extraction well and M9MA is upgradient of the Granite Reef extraction well. The Federal drinking water standard for TCE is 5µg/L.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 9-Mar-21
Facility Name: Indian Bend
Conducted By: USACE

Job ID:
Constituent: TCE
Concentration Units: µg/L

Sampling Point ID:		M5MA	M6MA	M9MA	M10MA2	M12MA2	M14LA	M16LA
Sampling Event	Sampling Date	TCE CONCENTRATION (µg/L)						
1	Jan-16	28	14		22			
2	Jun-16	18	10	2.5	16	14	15	21
3	Jan-17	27	7.7		20			
4	Jun-17	20	16	3.7	51	16	18	16
5	Jan-18	28	10		19			
6	Jun-18	12	9.5	2.6	44	12	17	14
7	Jan-19	39	6.1		22			
8	Jun-19	5.1	24	4.5	20	15	22	16
9	Jan-20	31	42		45			
10	Jun-20	6.3	18	5.8	16	16	22	14
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.52	0.68	0.36	0.49	0.11	0.17	0.18
Mann-Kendall Statistic (S):		-6	10	8	0	3	7	-6
Confidence Factor:		66.8%	78.4%	95.8%	45.6%	67.5%	92.1%	88.3%
Concentration Trend:		Stable	No Trend	Increasing	Stable	No Trend	Prob. Increasing	Stable



Notes:

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

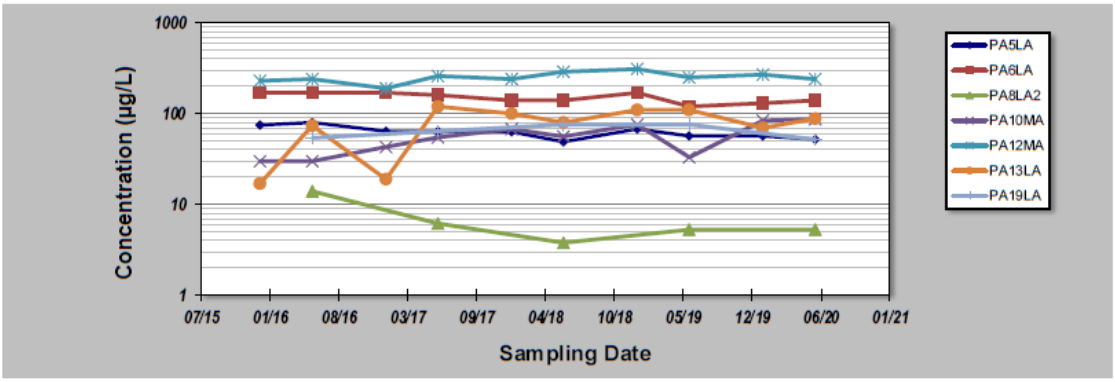
Figure D-6. TCE concentration trend plot since the previous five-year review of middle and lower alluvial wells. Two wells are increasing in TCE concentrations, PA12MA is downgradient from an extraction well, indicating a possible weakness in COS71 and PA10MA is downgradient and cross gradient to two extraction wells. The Federal drinking water standard for TCE is 5µg/L.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 9-Mar-21
Facility Name: Indian Bend
Conducted By: USACE

Job ID:
Constituent: TCE
Concentration Units: µg/L

Sampling Point ID:		PA5LA	PA6LA	PA8LA2	PA10MA	PA12MA	PA13LA	PA19LA
Sampling Event	Sampling Date	TCE CONCENTRATION (µg/L)						
1	Jan-16	75	170		30	230	17	
2	Jun-16	80	170	14	30	240	74	54
3	Jan-17	64	170		43	190	19	
4	Jun-17	64	160	6.2	55	260	120	64
5	Jan-18	63	140		68	240	100	
6	Jun-18	49	140	3.8	56	290	80	76
7	Jan-19	68	170		76	310	110	
8	Jun-19	57	120	5.3	33	250	110	76
9	Jan-20	57	130		84	270	70	
10	Jun-20	52	140	5.3	87	240	88	52
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.15	0.13	0.59	0.39	0.13	0.46	0.18
Mann-Kendall Statistic (S):		-27	-24	-5	32	16	12	1
Confidence Factor:		99.2%	98.2%	82.1%	99.9%	90.7%	83.2%	50.0%
Concentration Trend:		Decreasing	Decreasing	Stable	Increasing	Prob. Increasing	No Trend	No Trend



Notes:

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

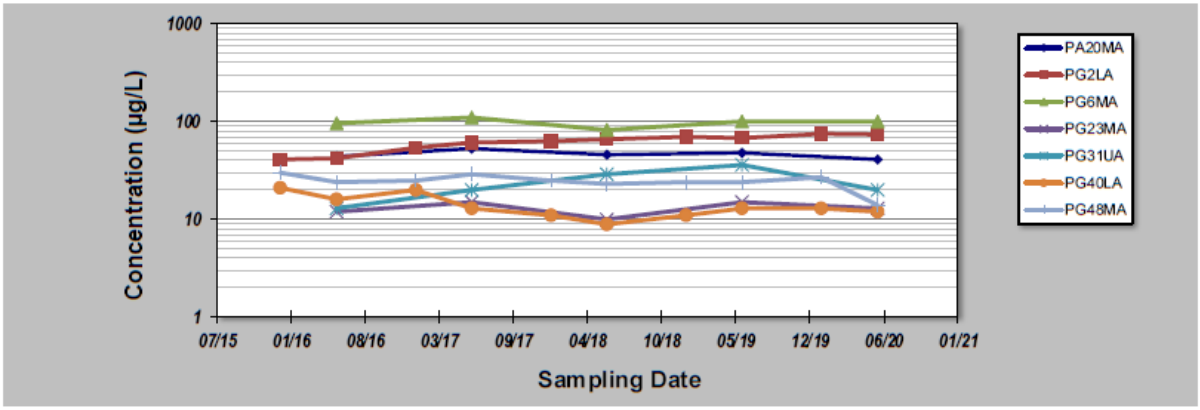
Figure D-7. TCE concentration trend plot since the previous five-year review of upper, middle, and lower alluvial wells. One well is increasing in TCE concentration, PG2LA is near an extraction well, so it is expected to be increasing. The Federal drinking water standard for TCE is 5µg/L.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 9-Mar-21
Facility Name: Indian Bend
Conducted By: USACE

Job ID:
Constituent: TCE
Concentration Units: µg/L

Sampling Point ID:		PA20MA	PG2LA	PG6MA	PG23MA	PG31UA	PG40LA	PG48MA
Sampling Event	Sampling Date	TCE CONCENTRATION (µg/L)						
1	Jan-16		41				21	30
2	Jun-16	44	42	96	12	13	16	24
3	Jan-17		54				20	25
4	Jun-17	53	61	110	15	20	13	29
5	Jan-18		63				11	25
6	Jun-18	46	66	82	10	29	8.9	23
7	Jan-19		70				11	24
8	Jun-19	48	68	100	15	36	13	24
9	Jan-20		75				13	27
10	Jun-20	41	74	100	13	20	12	14
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.10	0.20	0.10	0.16	0.38	0.28	0.18
Mann-Kendall Statistic (S):		-2	41	1	1	5	-19	-17
Confidence Factor:		59.2%	>99.9%	50.0%	50.0%	82.1%	94.6%	92.2%
Concentration Trend:		Stable	Increasing	No Trend	No Trend	No Trend	Prob. Decreasing	Prob. Decreasing



Notes:

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

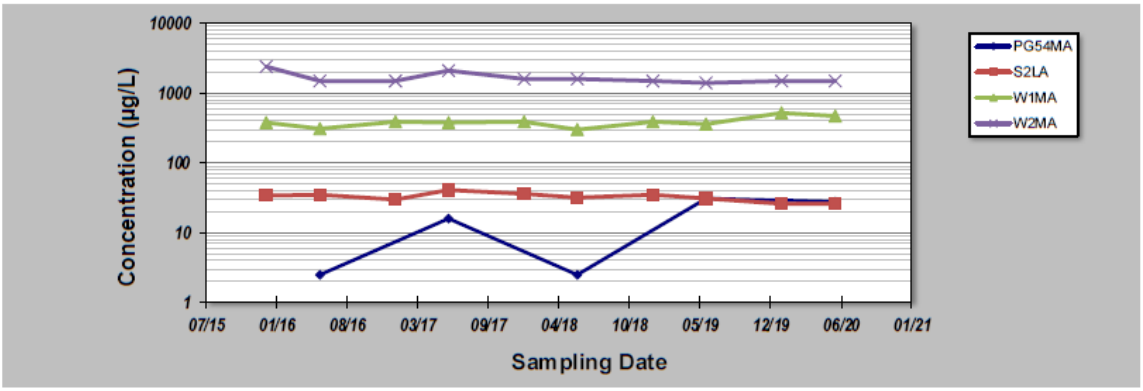
Figure D-8 TCE concentration trend plot since the previous five-year review of middle and lower alluvial wells. These wells are near the Area 7 groundwater extraction treatment systems and extraction wells and have some of the highest TCE values recorded across the Site. The Federal drinking water standard for TCE is 5µg/L.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 9-Mar-21
Facility Name: Indian Bend
Conducted By: USACE

Job ID:
Constituent: TCE
Concentration Units: µg/L

Sampling Point ID:		PG54MA	S2LA	W1MA	W2MA			
Sampling Event	Sampling Date	TCE CONCENTRATION (µg/L)						
1	Jan-16		34	380	2400			
2	Jun-16	2.5	35	310	1500			
3	Jan-17		30	390	1500			
4	Jun-17	16	41	380	2100			
5	Jan-18		36	390	1600			
6	Jun-18	2.5	32	300	1600			
7	Jan-19		35	390	1500			
8	Jun-19	31	31	360	1400			
9	Jan-20		26	520	1500			
10	Jun-20	28	26	470	1500			
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.85	0.14	0.17	0.20			
Mann-Kendall Statistic (S):		5	-19	15	-18			
Confidence Factor:		82.1%	94.6%	89.2%	93.4%			
Concentration Trend:		No Trend	Prob. Decreasing	No Trend	Prob. Decreasing			



Notes:

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

The North Indian Bend Wash Participating Companies ran a particle tracking modeling of the horizontal groundwater movement towards the extraction wells. As shown below, the empty space west of MEX-1MA well shows the area of uncertainty regarding the movement of groundwater from the upper and middle alluvial units into the lower alluvial unit (Figure D-9).

Figure D-9 Particle flow groundwater modeling gradients

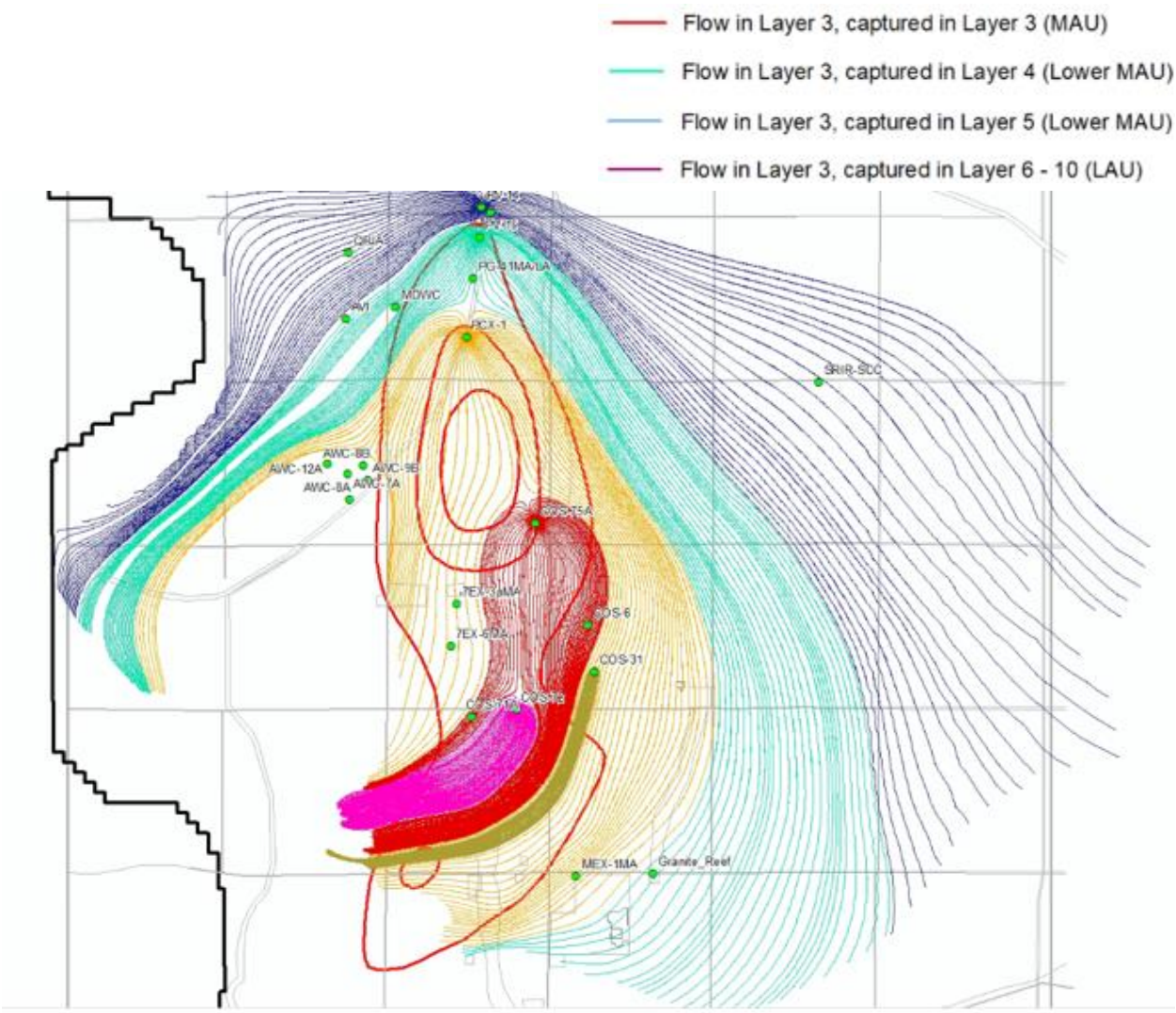
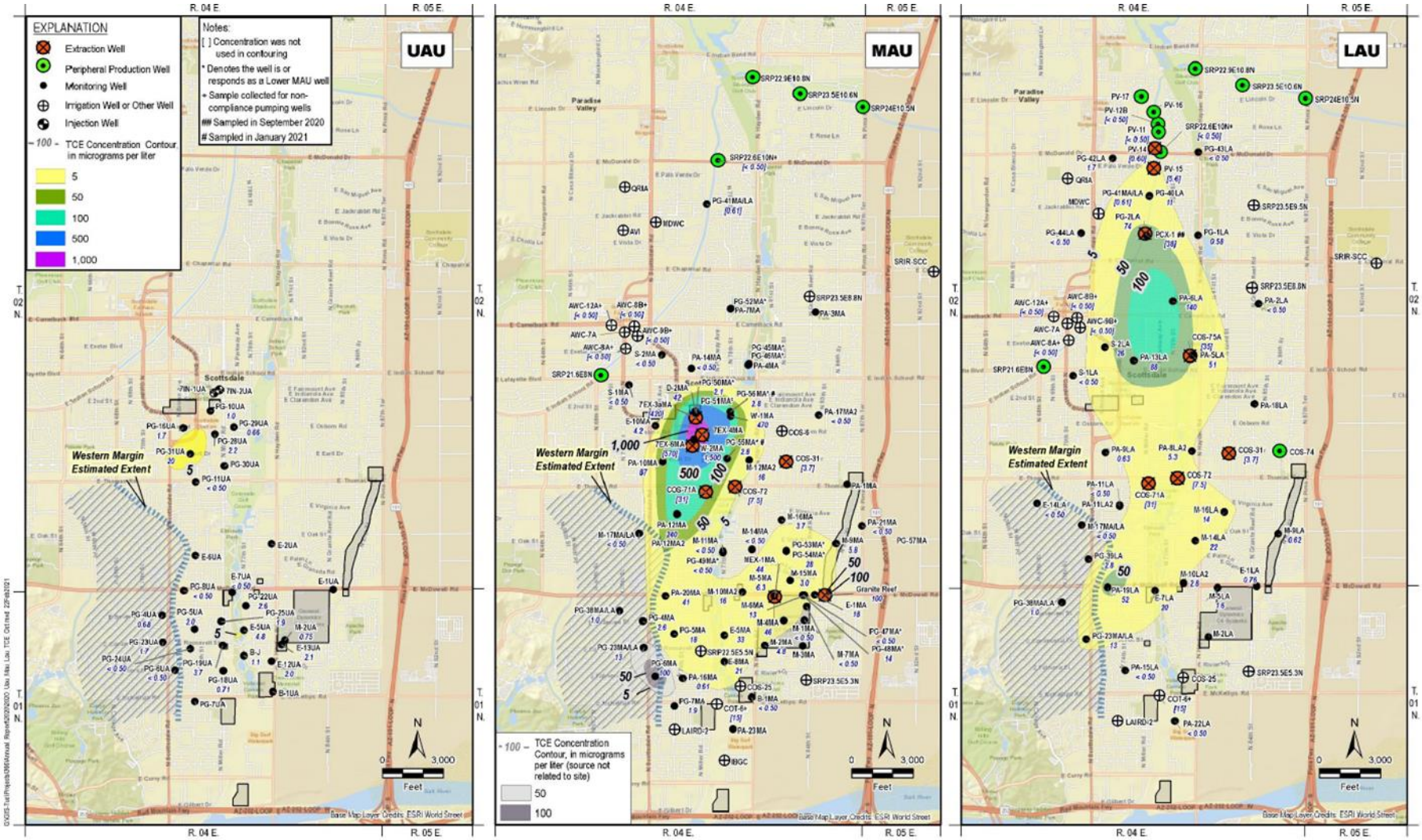


Figure D-10 TCE concentrations in the Upper (UAU), Middle (MAU) and Lower (LAU) Alluvial Units

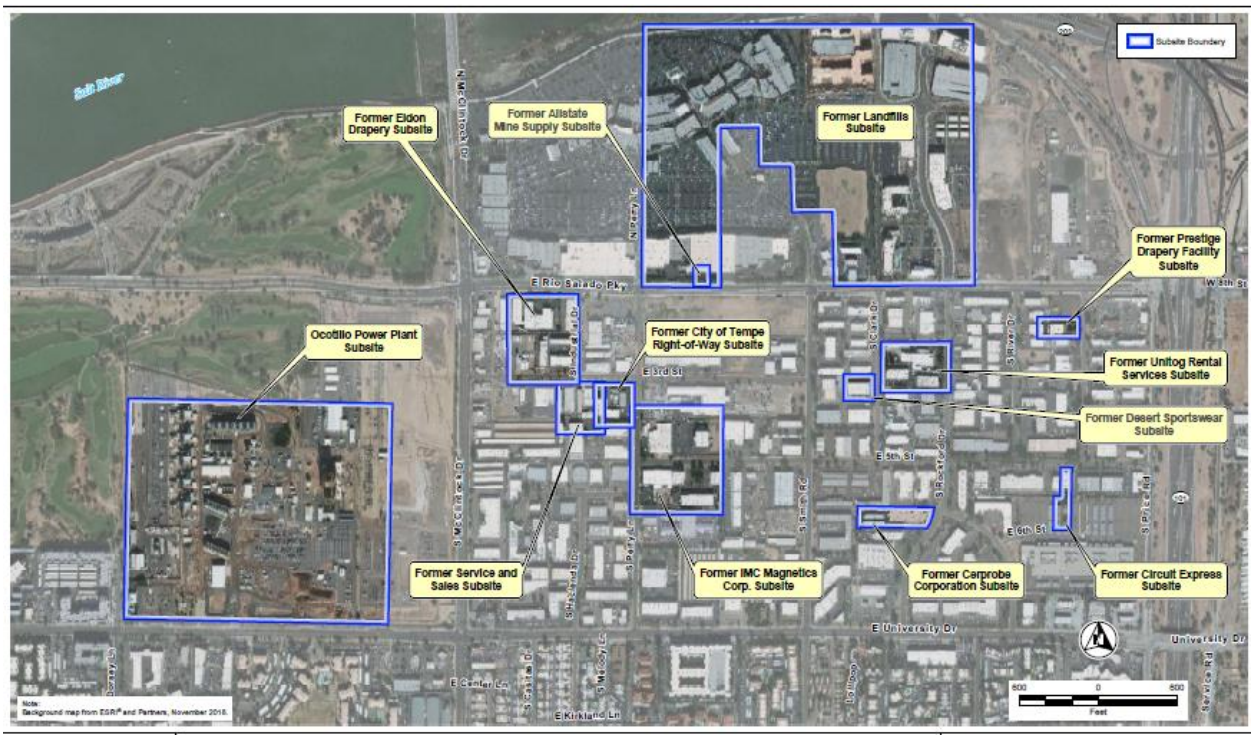
Source: 2020 Annual Site Monitoring Report, North Indian Bend Wash



South Indian Bend Wash

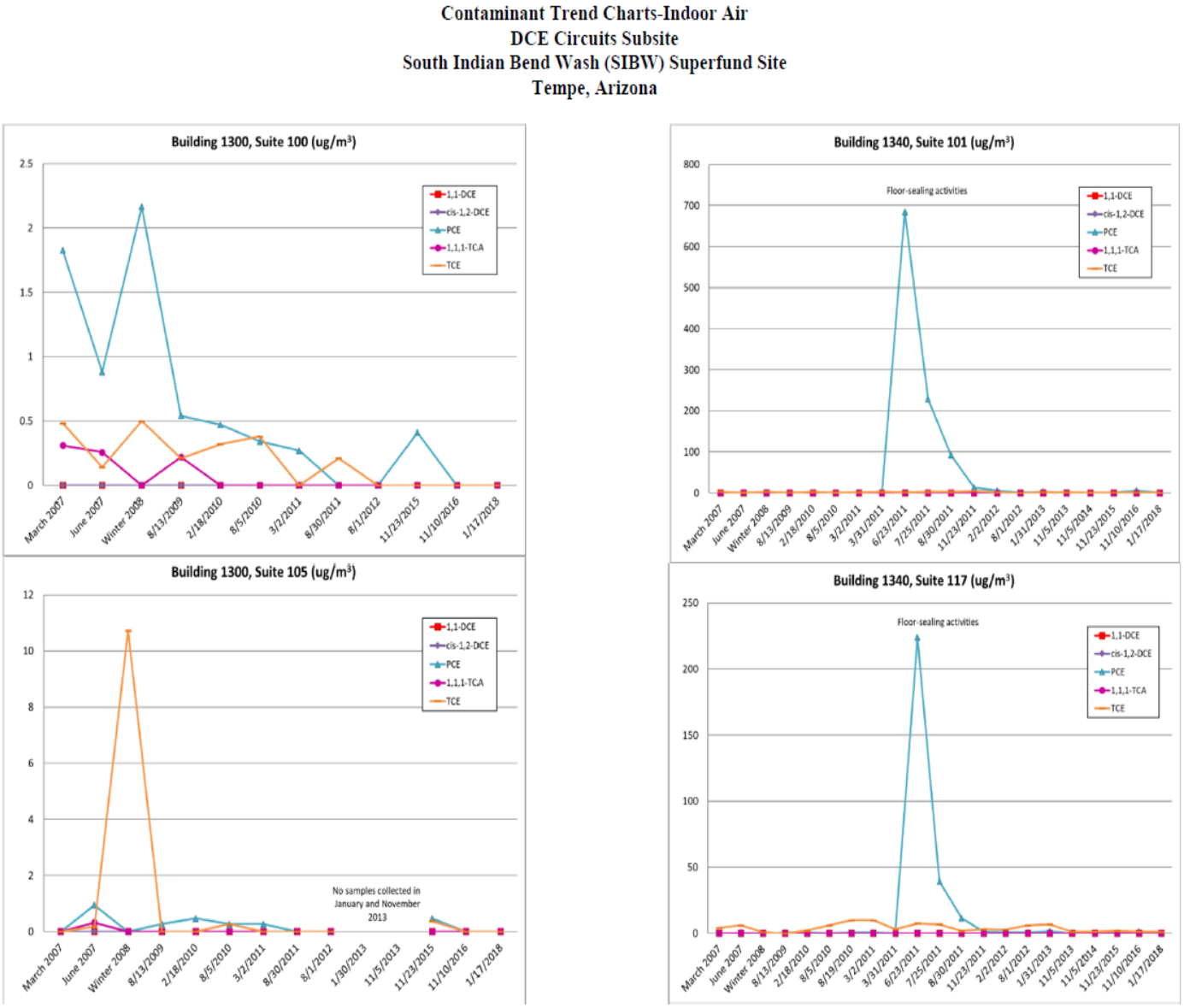
The Remedial Action Completion Report was completed and approved by the EPA in June 2020 indicating all remedial actions were completed and remediation goals defined in the ROD were completed. It found that all response actions have been successfully completed in accordance with Comprehensive Environmental Response, Compensation, and Liability Act of 1980, the National Oil and Hazardous Substances Pollution Contingency Plan, and EPA policy and guidance. No further Superfund response is necessary at the South Indian Bend Wash subsites to protect human health and the environment.

Figure D-11. Locations of Subsites in South Indian Bend Wash



EPA collected soil gas samples of all former source areas with respect to the vapor intrusion pathway. Based upon the soil gas sampling results, all twelve former South Indian Bend Wash source areas were determined to require no further action for vapor intrusion. A vapor intrusion assessment for the DCE Circuits Subsite was conducted in April 2019 to assess the risk to human health. Neither the accelerated response action level or urgent response action level was exceeded in any of soil gas indoor/outdoor air samples for TCE for commercial/industrial or residential use (Figure D-12).

Figure D-12. Indoor Air Trends in Commercial Suites at DCE Circuits Subsite



Notes: 1,1-DCE - 1,1-dichloroethene, 1,1,1-TCA - 1,1,1-trichloroethane, cis-1,2-DCE - cis-1,2-dichloroethene, PCE – tetrachloroethylene, RSL - regional screening level, TCE – trichloroethylene, µg/m^3 - micrograms per cubic meter

Industrial RSL or Indoor Air Protective Risk Ranges: 1,1-DCE = 880 µg/m^3, 1,1,1-TCA = 22,000 µg/m^3, cis-1,2-DCE = not listed, PCE = 47-180 µg/m^3, TCE = 3.0-8.8 µg/m^3

EPA is continuing the investigation of emerging contaminants including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). The concentrations of PFOS and PFOA, and their combined

results, are above the preliminary remediation goals in several wells in the South Indian Bend Wash sampling network. Therefore, it was recommended leaving these wells intact and continuing to monitor PFOS/PFOA in groundwater until EPA develops additional guidance. Per- and polyfluoroalkyl substances, particularly PFOS and PFOA, are EPA emerging contaminants. The City of Tempe collected samples in 2019 from nineteen wells in the South Indian Bend Wash, and those samples showed concentrations of PFOS and PFOA ranging from below to exceeding the EPA Health Advisory Level (70 ppt of PFOS or PFOA), individually or combined (Table D-1).

Figure D-13. PFOS/PFOA concentrations 2019 South Indian Bend Wash

Groundwater Sampling Analytical Results - PFOS/PFOA
Spring and Annual Sampling Events 2019
South Indian Bend Wash Superfund Site
Tempe, Arizona

WELL	April 2019			October/November 2019		
	PFOS	PFOA	Combined	PFOS	PFOA	Combined
PD-2	NC	NC	NC	129	41.9	170.9
SIBW-5U	66.2	7.69	73.89	45.1	7.41	52.51
SIBW-28U	64.6	16.1	80.7	56.7	15.9	72.6
SIBW-38U	NC	NC	NC	71.1	28.6	99.7
SIBW-60U	19.6	13.1	32.7	11.9	16.4	28.3
SIBW-61U	NC	NC	NC	73.0	16.7	89.7
SIBW-64U	NC	NC	NC	21.7	11.5	33.2
SIBW-64U (DUP)	NC	NC	NC	21.2	10.3	31.5
SIBW-66U	63.9	20.1	84.0	60.8	24.0	84.8
SW-1	NC	NC	NC	103	26.6	129.6
SW-2	NC	NC	NC	87.9	23.3	111.2
SIBW-11MC	33.1	5.03	38.13	29.1	4.89	33.99
SIBW-12L	28.7	10.3	39.0	35.3	9.23	44.53
SIBW-13MC	53.2	12.9	66.1	54.5	13.0	67.5
SIBW-13MC (DUP)	56.4	12.8	69.2	NC	NC	NC
SIBW-56MC	NC	NC	NC	59.2	8.42	67.62
SIBW-56MC (DUP)	NC	NC	NC	58.1	9.05	67.15
SIBW-57MC	NC	NC	NC	101	23.2	124.2
SW-3	49.4	8.29	57.69	46.8	7.35	54.15
			Criteria (ng/L)			
Screening Level	40	40	N/A	40	40	N/A
PRG	N/A	N/A	70	N/A	N/A	70

Notes:
All results are in nanograms per liter (ng/L) / parts per trillion (ppt)
Unhighlighted wells are screened in the upper alluvial unit (UAU)
Blue highlight indicates well screened in the middle alluvial unit (MAU)
Gold highlight indicates a result above the screening level
Yellow highlight indicates a result above the PRG
DUP = duplicate sample
N/A = not applicable
NC = not collected (gray highlight)
PFOA = perfluorooctanoic acid
PFOS = perflurooctanesulfonic acid
PRG = preliminary remediation goal

Appendix E: ARAR Assessment

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

Changes (if any) in ARARs are evaluated to determine if the changes affect the protectiveness of the remedy. Each ARAR and any change to the applicable standard or criterion are discussed below.

Changes to the chemical specific ARARs identified in the selected remedies for the South Indian Bend Wash and the North Indian Bend Wash within their respective RODs and subsequent ROD Amendment or ESD for groundwater treatment were considered for this Five-Year Review. For Arizona, the drinking water standards are applied as aquifer standards. The South Indian Bend Wash ROD contains a standard for chloroform however, the Federal drinking water standard was changed to total trihalomethanes in 1979. The federal standard for trihalomethane is 100 µg/L which is higher than the ROD criteria (6 µg/L). There have been no chemical specific ARAR changes during this Five-Year Review period (Table E-1 and E-2).

Table E-1. Groundwater Chemical Specific ARARs for the North Indian Bend Wash

Chemical	Decision Document Cleanup Levels µg/L	Basis for Cleanup Level	Drinking Water Standards (µg/L)		ARARs More or Less Stringent than Cleanup Levels?	Year ROD Standard Enacted
			State	Federal		
PCE	5	MCL	5	5	same	1991
1,1-DCE	6	MCL	7	7	less	2001
1,1,1,-TCA	200	MCL	200	200	same	1998
Chloroform (trichloromethane)	6	Federal Ambient Water Quality Criteria	80	100	less	1991
TCE	5	MCL	5	5	same	1991

MCL = Maximum Contaminant Level, which is a federal or state drinking water standard

Table E-2. Groundwater Chemical Specific ARARS for the South Indian Bend Wash (no longer applicable as RACR approved by EPA June 2020)

Chemical	Decision Document Cleanup Levels µg/L	Basis for Cleanup Level	Drinking Water Standards µg/L		ARARs More or Less Stringent than Cleanup Levels?	Year ROD Standard Enacted
			State	Federal		
Tetrachloroethylene (PCE)	5	MCL	5	5	same	2004
Trichloroethylene (TCE)	5	MCL	5	5	same	2004

MCL = Maximum Contaminant Level, which is a federal or state drinking water standard

Federal and State laws and regulations other than the chemical specific ARARs that have been promulgated or changed during this Five-Year Review are described below. There have been no revisions to laws or regulations that affect the protectiveness of the remedy.

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

- Arizona Administrative Code Section 18-11-406 Numeric Aquifer Water Standards: Drinking Water Protected Use
- Arizona Groundwater Management Act (ARS Section 45-454.01)
- Safe Drinking Water Act (42 U.S.C. 300f)
- Clean Water Act (Pub. L. 92-500)
- RCRA standards for miscellaneous units (e.g., air strippers) (40 CFR Subparts AA, BB & X)
- Clean Air Act (42 U.S.C 7401; 40 CFR 50-99)
- Underground injection of treated groundwater (UIC Permit) (40 CFR 144-146)
- Arizona Aquifer Protection Permit (APP) (49 ARS 242-249, and AAC R18-9-102 to R18-9-403)
- RCRA Hazardous Waste Management System (40 CFR Part 260)
- Groundwater Monitoring (40 CFR 265 Subpart F)
- Arizona Human Health-Based Guidance Levels (HBGLs) set by Arizona Department of Health Services
- Maricopa County Rules 200, 270, 320 and 330-Control of volatile organic compounds and gaseous contaminants
- EPA OSWER Directive 9355.0-28-Control of emissions from air strippers exceeding 3 pounds/hour

Table E-2. Summary of ARAR Changes for Site in the Past Five Years

Requirement and Citation	Document	Description	Effect on Protectiveness	Comments	Recent Amendment Date
Safe Drinking Water Act Regulations, 40 C.F.R. §§ 141.24, 141.61, and 300.430	1988 and 1991 ROD Amendment	Federal MCLs are ARARs for the site and were used to establish groundwater cleanup levels.	Changes do not affect protectiveness.	Change to alternate testing procedures for analysis of some contaminants.	October 12, 2018
Arizona Administrative Code 18 AAC 8 Department of Environmental Quality Hazardous Waste Management	All RODs, Amended RODs, and ESD	Incorporated 40 CFR 124, 260 through 266, 268, 270 and 273 or portions of these regulations, are incorporated by reference.	None	Administrative changes	December 31, 2020
Arizona Revised Statues 49-250	All RODs, Amended RODs, and ESD	Describes exemptions for CERCLA actions from aquifer protection permit	None	Administrative changes	January 1, 2020

Appendix F: Interview Forms

Five-Year Review Interview Record				
Site: North Indian Bend Wash Superfund Site			**EPA ID No:**	
Interview Type: Email response Date: 21 June 2021				
Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Suzanne Grendahl	City of Scottsdale	Water Quality Director	480.312.8719	sgrendahl@scottsdaleaz.gov

Summary of Conversation

1) What is your overall impression of the project success towards meeting cleanup standards?
The project has been very successful toward meeting clean-up standards. We have seen concentrations in the impacted productions wells drop steadily over the years. The stakeholders work very well together and communicate regularly about possible improvements to the project.

2) Is the remedy functioning as expected? How well is the remedy performing?
Yes, the remedy is functioning as designed and the remedy is performing well. The stakeholders are working on some potential voluntary improvements to the remedy. Testing is currently underway.

3) What does the monitoring data show? Is contaminant containment occurring?
The data indicates that mass is being removed and the plume is operating as designed and is providing containment. There are no new wells impacted that are not already tied to treatment.

4) Are new measures/actions being used in the past five years for containment?
There are new voluntary measures that are being tested and considered at this time. If successful, the new measures will provide pumping redundancy.

5) Is there a continuous Operations & Maintenance 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 is continuous O&M performed at city facilities. Staff continue to operate the plants in-person during the day and remotely after hours. Therefore, there is 24/7 coverage of the treatment plants. In addition, multiple redundant alarms are in place if the treatment system excursions are encountered.

6) Have there been any significant changes in the Operations & Maintenance 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.
Sampling, maintenance and operations have stayed essentially the same over the last five years. Operation of the city treatment plants at times is impacted by the demand in our system. The NIBW wells are made a priority, but seasonally there is more water available in south Scottsdale than there is demand. At those times we are forced to shut a well down, or with PCX-1 it is discharged into the Arizona Canal. The protectiveness of the remedy is not impacted by these actions.

7) Have there been unexpected Operations & Maintenance difficulties or costs at the site in the last five years? If so, please give details.
No

8) Have there been opportunities to optimize Operations & Maintenance or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
Since the last Five-Year Review, significant maintenance was performed at the Central Groundwater Treatment Facility. This maintenance is done every 10+ years and is a cooperative effort between the City and the Participating Companies.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?
The are no changes to the laws, but there has been degradation to the quality of the water for non-remedy contaminants. This caused one remedy well to be shut down because the water exceeded the primary drinking water standard for nitrate. This well is thought by some to help with containment in the middle alluvial unit. A stakeholder solution has been developed, and if successful should bring the well back online.

10) Are there changes to the remedy that you would like to see acted on?
No

11) Do you have any comments, suggestions, or recommendations regarding the project effectiveness?
The Arizona Legislature recently passed a bill that extends the period for the exemption the City maintains for remediated groundwater withdrawals. This exemption is an incentive for the city to continue to pump remedy wells because the pumping does not go against our ability to achieve Safe Yield under the 1980 Groundwater Management Act.

NORTH INDIAN BEND WASH

Respondent Name: Wayne Miller
Title: Project Manager
Organization: Arizona Department of Environmental Quality (ADEQ)
Telephone number: 602.771.4121
Email address: miller.wayne@azdeq.gov

Questions:

1. What is your overall impression of the project success towards meeting cleanup standards?

Overall impression is favorable. The Participating Companies are providing multiple remedial actions and are implementing a generally successful cleanup program. The stakeholders are cooperating and considerate with other team members. The annual groundwater monitoring reports indicate successful contaminant removal.

The Record of Decision's groundwater remedy is achieving cleanup standards for the known groundwater contaminants addressed within the Record of Decision.

Vapor Intrusion studies and mitigation methods have helped minimize exposure.

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

The annual groundwater monitoring reports indicate successful groundwater contaminant removal. The Upper Aquifer Unit includes a persistent contaminant area, but the extent has decreased over time.

A separate, unique contaminant mass is reported in groundwater in the southwestern study area region. Some monitoring reports indicate a potential unique source associated with the contaminant mass location.

Vapor Intrusion mitigation methods have helped minimize exposure. A shallow source for soil vapor appears to exist near Area 7. Current Vapor Intrusion mitigation methods appear to minimize exposure.

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

The annual groundwater monitoring reports indicate successful groundwater contaminant removal. The groundwater plume has migrated in some locations. Groundwater contaminant migration models have been updated and groundwater extraction has been modified to continue capture. Concentrations of organic compound vapors exist in select subsurface locations, specifically at Area 7. The shallow extent has not been completely defined.

4. Are new measures/actions being used in the past five years for containment?

Groundwater contaminant migration models have been updated and groundwater extraction has been modified in attempts to continue capture.

Vapor Intrusion potential continues to be studied near Area 7.

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

The groundwater remedial systems include continuous Operations and Maintenance. Staff and electronic systems provide continuous groundwater remediation system monitoring. U.S. EPA and retained subject matter experts provide annual groundwater remediation system inspections and reviews.

Soil vapor intrusion mitigation systems have been installed at select Area 7 locations.

6. 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.

The groundwater remedy retains protectiveness. Maintenance continues as needed and as scheduled. The Operations and Maintenance evolves as needed, but essentially continues a successful process from previous years. However, the groundwater remediation infrastructure is aging. Limited water releases have occurred. Some equipment has worn out and required replacement. Well maintenance has indicated some issues due to decades of subsurface exposure.

Vapor Intrusion mitigation is generally self-supporting.

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

The groundwater remediation infrastructure is aging. Limited water releases have occurred. Some equipment has worn out and required replacement. Well maintenance has indicated some issues due to decades of subsurface exposure.

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

Some optimizations have occurred. Optimization opportunities have been, and are continuing to be, explored. However, there appear to be some water withdrawal constraints and assured water supply concerns that may impact some optimization alternatives. A water withdrawal impact example may be associated with City of Scottsdale's recently opened reverse osmosis treatment system (Thomas Groundwater Treatment Facility). Groundwater degraded by high dissolved solid concentrations is reported to be impinging upon certain municipal water supply locations. The TGTF output blends with water with "high" dissolved solids (hard water) to achieve a better finished water quality.

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

State of Arizona continues legislating groundwater withdrawal limits and assured water supply conditions. These laws and regulations may impact select groundwater pumping and groundwater use options.

10. Are there changes to the remedy that you would like to see acted on?

The groundwater remedy could be optimized or aggressively implemented to complete aquifer restoration. The remedy as is successful. But the Upper Aquifer Unit includes a persistent contaminant area. The Middle Alluvial Unit and Lower Alluvial Unit plume outline exists in 2021 essentially as in 2001. The concentration has decreased, and portions of the plume have shifted laterally, and shifted

northward (in the lower alluvial unit), but the overlying outline remains similar. The infrastructure could be overhauled.

11. Do you have any comments, suggestions, or recommendations regarding the project effectiveness?

The project is effective. There are some items which could be further assessed: The Upper Aquifer Unit includes a persistent contaminant area. A separate, unique contaminant mass is reported in groundwater in the southwestern study area region. Some monitoring reports indicate a potential unique source associated with the contaminant mass location. The groundwater remediation infrastructure is aging. Limited water releases have occurred. Some equipment has worn out and required replacement. Well maintenance has indicated some issues due to decades of subsurface exposure.

A shallow source for soil vapor appears to exist near Area 7.

The interface with the public has been spotty at times. Specifically, Administrative Record and website information lacks in some aspects. Primarily associated with real estate due diligence assessments and real estate disclosure laws. Some customers have concerns that CERCLA does not define "site". There is confusion about if a property has to disclose if within the Superfund Study Area or only when directly above a groundwater plume. Additionally, official regulatory agency documents "closing", or removing properties from vapor intrusion action is not as apparent as maybe should be. The lack of an official "No Further Action" document is more of lacking a historical artifact than a recent five-year item.

SOUTH INDIAN BEND WASH

Respondent Name: Wayne Miller
Title: Project Manager
Organization: Arizona Department of Environmental Quality (ADEQ)
Telephone number: 602.771.4121
Email address: miller.wayne@azdeq.gov

Questions:

12. What is your overall impression of the project success towards meeting cleanup standards?

Overall impression is favorable. The Record of Decision's groundwater remedy (as amended) successfully achieved cleanup standards for the known groundwater contaminants addressed within the Record of Decision.

Vapor Intrusion studies and vapor intrusion mitigation actions, since the project started, appear to have minimized exposure uncertainty and exposure potential.

The 2019 annual Monitored Natural Attenuation report appears to be the final MNA report as groundwater sampling ceased by 2020. In 2020, the regulatory agencies received a final version of a Remedial Action Completion Report. The RACR addresses the known contaminants (per the Record of Decision).

The "recent" Federal and state attention to per- and polyfluoroalkyl substances (PFAS) may impact the Superfund Study Area. PFAS chemicals have been detected in select, sampled water. Federal legislative action may result in a new remedial investigation within the Superfund Study Area.

13. Is the remedy functioning as expected? How well is the remedy performing?

The groundwater remedy mostly functioned as expected. The Record of Decision remedy was amended to include In-Situ Chemical Oxidation. Supplemental groundwater remedial action was applied at select areas, and with time, the contaminant cleanup goals were achieved.

Vapor intrusion studies and mitigation actions, since the project started, appear to have minimized exposure uncertainty and exposure potential.

14. What does the monitoring data show? Is contaminant containment occurring?

Monitoring data shows groundwater contaminant concentrations decreased to regulatory concentrations, and groundwater contaminants contained within a reasonable region.

Vapor intrusion studies and mitigation actions, since the project started, appear to have minimized exposure uncertainty and exposure potential.

15. Are new measures/actions being used in the past five years for containment?

No new groundwater remedial measures have been used since the In-Situ Chemical Oxidation (permanganate injections) were applied at select areas.

No recent soil vapor intrusion actions have been required.

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

Periodic, planned groundwater monitoring was completed during the last five-year period. The Monitored Natural Attenuation groundwater remedy did not require on-site continuous staff and did not require active Operation and Maintenance programs.

17. 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.

No significant sampling changes were required, with respect to the known groundwater contaminants' Monitored Natural Attenuation remedy, for the balance of the preceding five-year period.

The 2019 annual Monitored Natural Attenuation report is the final MNA report as groundwater sampling ceased by 2020. In 2020, the regulatory agencies received a final version of a Remedial Action Completion Report. The RACR addresses the known contaminants (per the Record of Decision).

The Superfund Study Area is now in a flux condition. The "recent" Federal and state attention to per- and polyfluoroalkyl substances (PFAS) may impact the Superfund Study Area. PFAS chemicals have been detected in select, sampled water. Federal legislative action may result in a new remedial investigation within the Superfund Study Area.

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

Not really applicable for this site, in the context applied. There is no active Operation and Maintenance program for the Monitored Natural Attenuation program. No difficulties have occurred with respect to the known groundwater contaminants' MNA remedy.

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

No new groundwater remedial measures have been used since the In-Situ Chemical Oxidation (permanganate injections) were applied at select areas. The ISCO was used to accelerate contaminant degradation. Monitored Natural Attenuation remains the general remedy for the site balance. Unneeded wells were abandoned as the site monitoring evolved.

No recent soil vapor intrusion actions have been required.

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

No law and regulation changes that will impact the contaminants addressed under the existing Record of Decision. However, the "recent" Federal and state attention to per- and polyfluoroalkyl substances (PFAS) may impact the Superfund Study Area. PFAS chemicals have been detected in select, sampled water.

21. Are there changes to the remedy that you would like to see acted on?

ADEQ does not desire to see changes to the existing Record of Decision remedy.

22. Do you have any comments, suggestions, or recommendations regarding the project effectiveness?

This project remedy does not require supplemental recommendations.

However, the interface with the public has been spotty at times. Specifically, Administrative Record and website information lacks in some respects. Primarily associated with real estate due diligence assessments and real estate disclosure laws. Some customers have concerns that CERCLA does not define "site". There is confusion about if a property has to disclose if it is within the Superfund Study Area or only when directly above a groundwater plume. Additionally, official regulatory agency documents "closing", or removing properties from vapor intrusion action is not as apparent as maybe should be. The lack of an official "No Further Action" document is more of lacking a historical artifact than a recent five-year item.

2021 Five Year Review Survey for Indian Bend Wash Superfund Site

Respondents Information				
Name	**Organization**	**Title**	**Telephone**	**Email**
Leslie Katz	Montgomery& Associates	Project Coordinator	(520) 881-4912	lkatz@elmontgomery.com
James Lutton	Consultant to NIBW PCs	Project Engineer	(480) 442-9234	james.lutton@jalpe.net
Terry Lockwood	Motorola Solutions	Program Manager	(602) 760-4763	terry.lockwood@motorolasolutions.com
Alyssa Kirk	Montgomery& Associates	Ground-water Hydrologist	(520) 881-4912	akirk@elmontgomery.com

What is your overall impression of the project success towards meeting cleanup standards?

- There is consistent and meaningful progress toward achievement of remedial action objectives(see responses #2 and #3).
- The Participating Companies (PCs) have committed a team to the project with a long-term historyat the site. The technical and management team has significant institutional memory and depth of understanding of both the hydrogeologic system and site-specific challenges/opportunities.
- The PCs have taken a proactive approach toward the remedy, addressing issues before they are brought up by the agencies, conducting voluntary testing programs, collecting supplemental data,developing improved evaluation tools, and taking steps to evaluate actions that would improve remedy performance. These steps have resulted in short-term cost increases but have provided long-term benefits to the remedy.
- A hallmark at the NIBW site is the effective communication and positive working relationships thathave been developed between stakeholders, including the PCs team, water providers, and agency personnel. Discussions are respectful and productive.
- The remedy was designed around and continues to be operated and optimized to tie the extraction and treatment program into beneficial end-use (municipal, irrigation, injection). In a community where water resources are carefully managed, there is an enhanced focus on havingreliable systems in place to ensure protection of human health and the environment.
- The PCs work with end-users in an on-going manner to successfully balance their evolving needsand issues, such as naturally occurring inorganic water quality, with the critical objectives of volatile organic compound (VOC) plume containment and clean-up. In 2020, this process led to re-evaluation of pumping priorities and evaluation of actions that would

enhance the VOC remedywhile managing inorganic mass loading to the treatment facilities.

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

- The remedy is meeting all remedial action objectives and is performing reliably and effectively.Trichloroethylene (TCE) is the principal Constituent of Concern (COC) for the site.
- With receipt of the final Certification Letter for Area 7 in March 2016, vadose zone remediation programs have now been completed in all previously identified source areas to meet the objectiveof removing the on-going threat to groundwater.
- With a 98% reduction in TCE mass, a 92% reduction in plume area, and only one well thatexceeds the TCE clean-up standard, Upper Alluvium Unit (UAU) groundwater is almost completely restored.
- Water level data and model projections show that the Middle Alluvium Unit (MAU) and LowerAlluvium Unit (LAU) plumes continue to be contained, ensuring the protection of peripheral production wells.
- The two MAU source control programs (Area 7 and Area 12) are effectively capturing and treatinghigher-concentration areas in accordance with their approved design goals and the site performance standards, reducing the amount of mass that migrates from the MAU into the LAU along the western margin.
- The groundwater monitoring program is comprehensive and produces a robust water level andwater quality dataset to support on-going remedy effectiveness evaluations.
- Significant progress has been made toward the removal and restoration of groundwater to drinking water quality with respect to the site COCs. From the inception of the NIBW groundwaterremedy in 1994, about 135 billion gallons of groundwater have been extracted to remove an estimated 96,300 pounds of TCE.

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

- Sampling data show decreasing concentrations in the UAU and in many parts of the MAU and theLAU.
    - TCE concentrations at only one well remain above the drinking water maximum contaminant level (MCL) of 5 micrograms per liter (µg/L) in the UAU as of October 2020.
    - In the MAU and LAU, Mann-Kendall trend analysis indicates TCE concentrations are generally decreasing or have no statistically significant trends over the past 10-year period. Some increasing trends are observed along flow paths toward extraction wells ordue to shifts in pumping, as anticipated.
- Water level data and groundwater modeling demonstrate plume containment.
    - The general groundwater flow direction in each of the aquifer units continues to supportthe remedy design that includes movement of groundwater containing site COCs from the UAU and the MAU outside of source control containment systems to the western margin to be captured in underlying portions of the aquifer at MAU and LAU extraction wells.
    - The MAU source control program extraction wells at Area 7 continue to exceed the design objective of capturing the relatively higher TCE concentration area

above 1,000µg/L.

- The MAU source control program extraction wells at Area 12 continue to exceed the design objective of capturing the relatively higher TCE concentration area above 100µg/L.
- MAU/LAU and LAU extraction wells continue to capture VOC mass outside of source control capture and protect peripheral production wells.
- Extraction wells in the Northern LAU create a regional cone of depression that serves to control plume migration. Extraction wells are projected to capture the entire LAU TCE plume, as well as a substantial area outside of the plume where groundwater is below the cleanup standards.

- Supplemental sampling was conducted in 2020 at Arcadia Water Company (AWC) and other wells located outside of the TCE plume boundary. The AWC wells, which pump for irrigation end use, are not part of the site monitoring program but were sampled in 2020 after the PCs helped negotiate access with the well owner. Peripheral and lower MAU monitor wells that had been removed from the regular monitoring program with EPA concurrence several years ago were sampled to the extent feasible in 2020. In both cases, TCE concentrations indicated that the plume continues to be contained.

4. Are new measures/actions being used in the past five years for containment?

- Since the last five-year review, PCs have worked collaboratively with EPA and the Technical Committee on the following efforts which have helped to confirm on-going plume containment.
  - Conducted a comprehensive groundwater flow model update, including migrating the model to a more robust code, expanding the model domain to encompass critical regional features and stresses, developing a more representative characterization of the western margin, and conducting particle tracking to evaluate plume capture and containment.
  - Created a 3D Geologic Model for visualizing site features and conditions, including wells, lithologic layers, interpolated lithology to evaluate preferential pathways, and interpolated TCE plumes and hydraulic heads for current and historical time periods to understand the distribution of TCE and driving forces for its lateral and vertical migration.
  - Comprehensively evaluated the monitoring network in relation to compliance with the Groundwater Monitoring and Evaluation Program (GM&EP) requirements in 2020, resulting in a finding that the network was complete. Associated recommendations for supplemental data collection tasks to enhance the understanding of the nature and extent of VOCs were completed in 2020.
  - Collected supplemental water quality data from wells that had previously been removed from the monitoring program with EPA concurrence to demonstrate plume containment and protection of peripheral production wells.
  - Prepared a Conceptual Site Model (CSM) update that summarized and evaluated the significant data collected since the CSM presented in the 1999 FSA (2000-2019). A draft was delivered to EPA, Arizona Department of Environmental Quality (ADEQ), and other members of the Technical Committee for review on February 1, 2021. Once finalized, the CSM Update will become an agreed upon basis for evaluating new data and making sound technical decisions regarding the remedy.
  - Worked to optimized groundwater pumping for the VOC remedy within constraints of water providers, including conducting testing programs to evaluate a potential approach to enhance capture of both the Area 7 MAU plume and Northern LAU plume while providing the City of Scottsdale (COS) with water that meets their quantity and inorganic water quality needs.

- Planned additional testing programs (PCX-1, MEX-1MA, COS-71A, and PG-40LA) that will be conducted in 2021 and 2022. These programs will provide further information on the vertical distribution of TCE at the site that can be factored into the CSM and on-goingefforts to optimize the remedy.

5. Is there a continuous O&M presence? If so, describe the staff and activities occurring. If there is not a continuous on-site presence, describe staff and frequency ofsite inspections and activities.

- All of the extraction and treatment systems, as well as the monitoring system, are operated andmanaged by well qualified personnel.
- Operator tasks include, but are not limited to, extraction well and system process sampling, localand automatic data collection and tabulation, chemical and media servicing, mechanical maintenance, and housekeeping.
- Each treatment system is physically monitored on-site at least once per week by an operator. The facilities associated with drinking water end-use are visited by the operators at least once perday. The operators spend several hours at each of these facilities. All groundwater extraction and treatment systems are monitored continuously by electronic control and data collection systems.
- Electronic system controls are used to shut down the groundwater extraction and treatment systems in the event monitored operating parameters, such as flow rates and/or pressures, driftoutside predetermined ranges or set points.

6. 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 protectivenessof the remedy? Please describe changes and impacts

- A fourth treatment train was installed at NGTF on October 12, 2016. This allows the NGTF facilityto continue operations during GAC service events and has minimized downtime for routine maintenance since 2016.
- On October 10, 2017, contingency actions were initiated for well M-2MA when TCE was detectedat concentrations above GMEP metrics associated with monitoring containment of the MAU plume. As a result of investigations into the pumping regime at the time of the detection, the NIBW PCs committed to a program to pump both of the Area 12 extraction wells during time periods when COT-6 is pumping, when possible, to aid in capture.
- One UAU monitor well (PG-3UA) was abandoned in 2018. The well was in an area of planned construction and the landowner had requested that the well be removed. EPA concurred with thePCs that it was no longer needed as part of the UAU monitoring network, and approved abandonment on October 17, 2017. This change has not reduced the quality of the data set available to evaluate performance of the remedial actions.
- One MAU water level monitoring well (PG-57MA) is no longer included in compliance monitoring as of 2018; this well was approved by EPA for abandonment but ownership was transferred to theSalt River Pima Maricopa Indian Community instead at their request.
- One extraction well (7EX-5MA) associated with Area 7 groundwater extraction and treatment system (GWETS) was abandoned in August 2016. Prior to abandonment, the well became unusable. In 2015, a new extraction well (7EX-6MA) was sited and installed at a location that would better affect extraction and treatment of the highest concentrations of VOCs at Area 7. Well 7EX-6MA was designed and constructed in a manner to minimize future issues with installation and removal of the submersible pump. Additionally, hydraulic capture for well

7EX- 6MA was projected to be equivalent to the combined capture associated with existing Area 7 extraction wells 7EX-4MA and 7EX-5MA. Well 7EX-6MA was designed, installed, and operated toreplace well 7EX-4MA which is currently offline due to poor performance, as described under Question #7, and the PCs abandoned extraction well 7EX-5MA.

- Based on ambient air monitoring results in the vicinity of the Area 12 GWETS, new upgraded GAC contactors were installed on the Area 12 air system discharge in April 2018. Subsequent ambient air monitoring confirmed that operations at the Area 12 GWETS are protective of humanhealth and the environment.

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

- Area 7 GWETS well 7EX-4MA was rehabilitated in 2012, when the water level in the well had decreased to a point that the pump began to stall. The pump had already been lowered to near the bottom of the well prior to that time. There was limited improvement in capacity of the well during the 2012 rehabilitation, and well 7EX-4MA was taken off line in October 2016 due to poorperformance. Well rehabilitation activities commenced again in late 2019 and continued into 2020. The PCs have no plans at present to return well 7EX-4MA to service. As described underquestion #6, well 7EX-6MA serves as a replacement well for both 7EX-4MA and 7EX-5MA.

- An accidental release of untreated groundwater associated with the Central Groundwater Treatment Facility occurred on June 18, 2016. During start-up of the facility, the raw water transmission line from well COS-72 ruptured, resulting in the release of approximately 1.2 million gallons (MGs) of water to the ground within the Indian Bend Wash. Water sampling showed levels of TCE between <0.5 – 63 µg/L at the site of the break. Soil sampling at the leak site did not indicate the presence of TCE. Standing water in the vicinity of the release was removed and discharged to the City's wastewater collection system. COS reported this event to EPA on June 18, 2016. On June 24, 2016, COS submitted to EPA the final report summarizing actions taken in response to this incident. EPA and ADEQreviewed the incident and corrective actions report and had no questions or comments.

- An incidental release of untreated groundwater from well COS-75A occurred on January 20, 2018. While conducting routine monthly inspections of air relief valves on the raw water pipelines, Air Relief Valve (ARV) #16 was found to be dripping a small amount of water. Testing was not performed due to insufficient sample volume and a rain event that occurred immediatelyfollowed the leak.

- An incidental release of untreated groundwater from well COS-75A occurred on January 30, 2019when ARV #16 was found to be leaking. Testing of the soil was performed in the vicinity of the leak, and all results were non-detect for TCE. Water sampling was not possible due to the limited volume of water available. Based on recent inspection of the site, the leak had developed within the previous 48 hours, with a total release of less than 500 gallons. A summary report was prepared by the City and submitted to the EPA and other parties on February 6, 2019.

- On May 25, 2019, a release of untreated groundwater occurred when a momentary power outagecaused a communication failure and shutdown the Area 7 GWETS. The remote well 7EX-6MA continued to pump to the Area 7 GWETS until the treatment system overflowed. The released water flowed through the alley south of Area 7 until it collected in a closed storm water system.

    - Upon investigation, up to approximately 29,250 gallons of untreated groundwater wasreleased during the event. No untreated groundwater was discharged to the injection wells.

- In response to the groundwater release at Area 7, several modifications were made to the system and controls to minimize the potential for this situation to occur in the future.The primary modifications included the following:
    - Set all pump drives to STOP upon loss of communication or FAULT with theprogrammable logic controller (PLC).
    - Install new uninterruptible power supply (UPS) with status indicators for auxiliarypower to the main system controller.
    - Install fail-closed control valves on the incoming groundwater pipelines to the GWETS to prevent water from entering the treatment system if the equipment isshut down.
    - Install new alarm call-out features on the control system to alert the operatorimmediately if an alarm condition occurs.
    - Replace the 24-volt direct current (DC) power supply and voltage regulator forthe PLC.
- A report describing the details of the release and response efforts was submitted to EPAand ADEQ on May 31, 2019. The system modifications were made and tested during June and July 2019. After inspection by the NIBW PCs and EPA, the system was restarted on July 16, 2019.

- An accidental release of untreated groundwater from the extraction well PCX-1 pipeline occurredon March 12, 2019. Upon inspection, the release location was identified in a buried section underneath the Arizona Canal.
    - Approximately 55,500 gallons of untreated groundwater leaked from the PCX-1 pipelineinto the Arizona Canal.
    - The NGTF and well PCX-1 were offline from March 12 to July 11, 2019, while pipelinerepairs were completed. Repairs involved installation of a new pipeline bridge over thecanal to bypass the compromised pipeline beneath the canal. The root cause analysisand corrective actions for the compromised segment of the PCX-1 pipeline cannot be completed until the next canal dry-up, which is currently scheduled for 2029.
    - A summary report was prepared by SRP and submitted to the EPA and other parties onMarch 19, 2019.
- Well rehabilitation activities were performed on the Area 12 wells in 2019 and 2020. The activitiesincluded:
    - Well rehabilitation at well MEX-1MA during February and March 2019.
    - Well rehabilitation, modification, testing, and re-equipping at the Granite Reef well duringFebruary through September 2020.
        - The Granite Reef well was removed from service in mid-November 2019 andremained offline until September 2020. SRP installed a 16-inch diameter highstrength, low alloy (HSLA) liner to total depth and installed new electric submersible pumping equipment in the well in 2020.
- In 2020, pump failure and repairs caused two MRTF extraction wells to be down for

prolongedperiods:

- EPCOR well PV-14 was unavailable for pumping from early November 2020 to April 2021when the pump was out of service for conversion from a vertical turbine to line-shaft pump.
- NGTF well PCX-1 was unavailable for pumping after September 16, 2020 when the pump failed and remained unavailable for the remainder of 2020. The pump was replaced in early January 2020 and failed again shortly thereafter. The pump has sincebeen replaced in early February 2021 and has been online since replacement.

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

- Since 2010, optimization of the pumping regimen used at the Paradise Valley wells has had a beneficial impact on the LAU remedy. The PCs have worked successfully with EPCOR, the water provider who owns and operates the Paradise Valley wells and the MRTF, to implement a south to north pumping strategy that focuses pumping on the two Paradise Valley wells that are tied into treatment (PV-15 and PV-14). Pumping from the other Paradise Valley wells is added ina south to north order in response to demand. This approach has been shown through monitoringand modeling to optimize LAU plume containment.

- EPA previously approved the use of HydraSleeve® sampling when aging dedicated pumps fail atmonitor wells. Between 2016 and 2020, 23 wells have been shifted to long-term use of the HydraSleeve sampling protocol after their pumps failed. Twelve additional wells were shifted to HydraSleeve sampling until the pump in the well could be replaced within that period. HydraSleeve was used for six samples that were part of a voluntary supplemental samplingprogram to verify plume boundaries (not compliance samples), and to sample Area 7 GWETS well 7EX-4MA in 2020. This gradual shift away from traditional purge to an in-situ sampling approach reduces risks and costs associated with handling and disposal of investigation derivedwastes. Use of HydraSleeve has allowed quarterly annual, and special monitoring programs toproceed on schedule since implementation in 2015.

- Recognizing the significant power needs of a project of this magnitude, the NIBW PCs have sought to shift an increasing amount of the power to green sources. In the past 5 years (2016-2020), the PCs have incorporated use of about 10.8 million kilowatt hours of green power intoremedy implementation. While this shift came at an additional cost of $130,000 to the PCs, it reduces the project's carbon footprint and helps stimulate industrial markets for green power.

- As described above, in late 2020 the motor on the pump at well PCX-1 failed and the pumping equipment was replaced. The new pump and motor produce several hundred gallons per minute(gpm) less than the previous 2,600 gpm pump. SRP, COS, and the PCs worked together to set the production at well PCX-1 to approximately 2,100 gpm upon restart. This flow rate allows for operation of only two treatment trains at NGTF instead of three. Subsequent monitoring has indicated that the lower flow rate reduces the amount of clean water captured by well PCX-1 while still maintaining complete capture of the Northern LAU plume.

9. Are you aware of any changes in Federal/State/County/Local laws and regulationsthat may impact the protectiveness of the remedy?

- Changes to human health risk levels for TCE related to inhalation exposure resulted in thedetermination by EPA to defer protectiveness in the 2016 Five Year Review.

- To evaluate the potential risk of vapor intrusion from shallow soil gas, the PCs initiated efforts during the last quarter of 2016 to compile soil gas data for the historical source areas, evaluate these data relative to EPA soil vapor intrusion screening levels, and propose locations for installing shallow soil gas sampling (SGS) points. Based on this review, a total of about 50 shallow SGS points were installed at seven of the historical source areas (Area 3, Area 5C, Area7, Area 8, Area 9, Area 11, and Area 12) in 2017.

- With the exception of a few SGS points at Area 7, TCE soil gas concentrations were all below land-use-specific EPA screening levels. Results were reviewed with EPA as they were received and following approval by EPA, all SGS points at Area 3, Area 5C, Area 8, Area 9, Area 11, and Area 12 were abandoned in 2017. At Area 7, 16 of the 21 SGS points installed were abandoned in 2018. A report summarizing SGS point sampling, installation methods, procedures, results, andabandonment status was submitted to EPA on September 27, 2018.

- In addition to shallow soil gas sampling, indoor air was sampled at Area 7 to further evaluate thepotential for vapor intrusion. A report summarizing results from the indoor air sampling was submitted to EPA on June 8, 2018. Follow-up actions, including collection of additional shallow soil gas and indoor air samples, were conducted in 2018 and 2019 and results were shared withthe Technical Committee.
- Additional sampling of indoor air along with annual monitoring of the subslab vapor mitigation system, which was proactively installed below three of the apartment units in a complex locatedsoutheast of Area 7, was conducted by the PCs in 2019.

- The PCs conducted a Human Health Risk Assessment and submitted the associated report to EPA on December 19, 2019. The assessment confirmed that all calculated risks at Area 7 wereless than the noncarcinogenic threshold and less than the most conservative end of EPA's acceptable range for carcinogenic risks under conservative exposure scenarios. The Human Health Risk Assessment indicated there were no current vapor intrusion risks at Area 7 that exceed EPA thresholds.

- The PCs participated in meetings with EPA and other members of the Technical Committee during 2019 and 2020 to discuss vapor intrusion risks at Area 7 and evaluate the potential need for additional mitigation and/or remedial measures. The potential need for remedial actions to address remaining VOC mass in the vadose zone at Area 7 was suggested by EPA. Relying on results of the Human Health Risk Assessment, the PCs continue to believe that current exposurelevels are low and do not pose an unacceptable risk, and that future risks can be managed through engineering controls and monitoring. The PCs further noted that EPA would need to establish remedial action objectives to guide the evaluation of any potential remedial actions. EPA is in the process of reviewing information and assessing regulatory drivers for further actionat Area 7, in consultation with ADEQ.

- In addition to inhalation risk from vapor intrusion, the PCs conducted multiple rounds of ambient air sampling and conducted ambient air modeling to evaluate potential ambient air concentrationsfrom treatment system emissions. Results from sampling and modeling indicate that there is no current risk from treatment systems emissions.

10. Are there changes to the remedy that you would like to see acted on?

- The NIBW PCs have worked closely with COS and SRP to evaluate approaches to support remedy operations which take into consideration water provider concerns regarding increasing concentrations of inorganic constituents – specifically arsenic and nitrate. These inorganic constituents impact the ability of water providers to effectively integrate the water treated for VOCs as part of the remedy into their potable water supplies, resulting in reduced pumping of keyextraction wells. Remedy enhancements being considered focus on areas of the Site where benefits would be most tangible. These include: 1) increasing capture of MAU

mass down- gradient from Area 7 that would otherwise be captured in the LAU, and 2) providing redundancy in Northern LAU containment to increase protection of peripheral production wells.

- Due to inorganics concerns, COS' capacity to pump groundwater from remedy extraction wells has decreased. COS currently follows a regimen to prioritize pumping at well COS-75A and makes well COS-71A, which has less favorable inorganic water quality, available for the remedy only as a last priority during contingency conditions. Extraction wells COS-71A and COS-75A areboth critical extraction wells to the remedy, and therefore additional measures are needed. COS is adding a new reverse osmosis (RO) system in 2021 to address these inorganics at the Central Groundwater Treatment Facility. The RO system will only have a treatment capacity of about 2,000 gpm, or roughly the equivalent of extraction from one Central Groundwater Treatment Facility well.
- The PCs compiled and shared data with COS and then worked on collaborative enhancementsolutions. The enhancement being considered for implementation is modifying COS-71A to extract only from the MAU and balancing pumping between the most critical Central Groundwater Treatment Facility wells. The PCs plan to conduct supplemental vertical fluid movement investigations in 2021 at COS-71A todetermine the feasibility of this enhancement.

- Extraction well PCX-1 is responsible for 90% or more of the historical TCE mass captured in the Northern LAU and is critical to Northern LAU plume containment. Increasing arsenic and nitrate concentrations at PCX-1 have become a concern. The enhancement being considered for implementation is testing and potentially equipping and tying monitoring well PG-41MA/LA, located north of PCX-1, into treatment at the NGTF. In May 2021, the PCs conducted testing at PG-41MA/LA to determine the feasibility of this enhancement. The PCs plan to conduct fluidmovement investigations at PCX-1 to support the understanding of Northern LAU containment in2021.

- If they are deemed feasible and beneficial by all parties, the PCs would like to see remedy enhancements, discussed above, which focus on capture of mass from the MAU downgradient ofArea 7 at Central Groundwater Treatment Facility wells and redundancy in Northern LAU extraction from PG-41MA/LA.

11. Do you have any comments, suggestions, or recommendations regarding the projecteffectiveness?

Comments:

- The NIBW Site is a unique success story, where good working relationships between the PCs,agencies, and water providers have resulted in efficient and effective remedy implementation, along with protection and beneficial end-use of a water resource that is valuable to the community.

- The technical and engineering leadership team on the Site continues to be focused on opportunities to optimize the remedy that increase reliability, decrease clean-up time, reduceenergy consumption, incorporate green power sources, and minimize community risks and impacts.

Recommendations:

- Actions are being evaluated to enhance the remedy in two critical areas – the MAU down- gradient from Area 7 and the northern LAU - while improving the ability of COS to integrate treated remedy water into their system with respect to inorganic water quality. These actionsshould be implemented if deemed feasible and beneficial by all

parties.

- For the last several years, the PCs have been engaged with the NIBW Technical Committee regarding possible updates to the GMEP. In some cases, parties agree that the current performance metrics are no longer appropriate or useful, as they are not focused on the most critical aspects of the remedy. The PCs are committed to continuing to work with EPA, where applicable, to develop more meaningful performance measures for evaluating the effectiveness ofvarious remedy components.

- In addition to the GMEP, other Site documents, such as the Sampling & Analysis Plan and Health& Safety Plan, should be updated. The PCs are committed to moving forward with this task in 2022.

ARIZONA DEPARTMENT
OF
ENVIRONMENTAL QUALITY

Douglas A. Ducey
Governor

Misael Cabrera
Director

via e-mail

September 15,
2021 FPU22-
046

Ms. Carolyn d'Almeida

Remedial Project Manager

Federal Facilities Branch (SFD 8-1)

US EPA Region 9 Laboratory

1337 South 46th Street, Building 201

Richmond, CA 94804

RE: NIBW & SIBW – ADEQ Comments on [Draft] *Third Five-Year Review Report for Indian Bend Wash*
Superfund Site; prepared by U.S. Army Corps of Engineers; Prepared for U.S. Environmental Protection Agency, Region 9; received from U.S. EPA via email August 16, 2021

Dear Ms. d'Almeida:

The Arizona Department of Environmental Quality (ADEQ) Federal Projects Unit (FPU) has reviewed the document referenced above. This letter provides ADEQ's comments on the referenced document.

9. Comments

(1) For North Indian Bend Wash, the groundwater remediation technology and beneficial uses have been protective and minimized human exposure over the preceding five-year time period.

(2) For North Indian Bend Wash, ADEQ is concerned that the groundwater remedial systems' operation and maintenance may not be protective through the future review periods. The aging infrastructure, mechanical capture systems, and mechanical remedial processes have shown vulnerabilities and failure occurrences.

(3) For North Indian Bend Wash, human exposure to the targeted volatile organic compound contaminants' impacted soil appears to have been protective and minimized human exposure over the preceding fiveyear time period.

(4) For North Indian Bend Wash, ADEQ is concerned that human exposure to the targeted volatile organic compound contaminants could be increased if certain subsurface development and excavation projects are undertaken.

(5) For North Indian Bend Wash, ADEQ defers vapor intrusion protectiveness determination to U.S. EPA.

(6) For South Indian Bend Wash, the groundwater remedy for the targeted volatile organic compounds has been protective and minimized human exposure over the preceding five-year time period.

(7) For South Indian Bend Wash, ADEQ is concerned that protectiveness has not been achieved for emerging contaminants found in groundwater. Protectiveness determination is deferred to U.S. EPA

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pending assessments, investigations, and establishment of enforceable groundwater contaminant concentrations.

(8) For South Indian Bend Wash, human exposure to the targeted volatile organic compound contaminants' impacted soil appears to be minimized and protective.

(9) For South Indian Bend Wash, ADEQ defers vapor intrusion protectiveness determination to U.S. EPA.

10. Closure

ADEQ may add and amend comments, evaluations, and concurrence if evidence to the contrary of our understanding is discovered; if received information is determined to be inaccurate; if any condition was unknown to ADEQ at the time this document was delivered; if other parties bring valid concerns to our attention; or site conditions are deemed not protective of human health and the environment within the scope of this Department.

Thank you for the opportunity to comment. Should you have any questions regarding this correspondence, please contact me by phone at (602) 771-4121 or e-mail miller.wayne@azdeq.gov.

Sincerely,

Wayne Miller

ADEQ Project Manager, Federal Projects Unit

Remedial Projects Section, Waste Programs Division

recipients:

Carolyn d'Almeida, U.S. EPA dalmeida.carolyn@epa.gov

ADEQ Reading and Project File