FOURTH FIVE-YEAR REVIEW REPORT FOR BROWN AND BRYANT SUPERFUND SITE ARVIN, KERN COUNTY, CALIFORNIA

PREPARED BY

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FOR

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Region IX

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Executive Summary

This is the fourth Five-Year Review of the Brown and Bryant Superfund site (Site) located in Arvin, California. 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.

The Site is located at 600 South Derby Road in Arvin, Kern County, California approximately 18 miles southeast of the city of Bakersfield. The Brown and Bryant Arvin Pesticide Reformulation Facility operated as an agricultural distributor facility for historic pesticides and other agricultural chemicals from 1960 to 1989. Over the course of operation at the Site, these chemicals were released into the soil and groundwater beneath the facility. Contaminants of Concern (COCs) for the Site are: chloroform, 1,2-dibromo-3-chloropropane (DBCP), 1,2-dichloropropane (1,2-DCP), 1,3-dichloropropane (1,3-DCP), dinoseb, ethylene dibromide (EDB), and 1,2,3-TCP (1,2,3-TCP).

Currently, there are residential properties to the west of the Site, industrial properties to the north and south, and agricultural lands to the east. The property covers approximately 5 acres and is topographically flat with a slightly decreasing grade towards the south.

Structures currently present on-Site include groundwater monitoring wells, a warehouse that houses a small, unoccupied office area and the A-zone groundwater extraction system. An engineered-pavement cap covers the entire property. The cap is designed as a Resource Conservation and Recovery Act (RCRA) regulated cap in the property's southeastern portion and as a non-RCRA regulated cap in the property's northern portion. The Site is fenced completely with an additional fence between the RCRA cap and basic cap areas.

The Record of Decision (ROD) for Operable Unit (OU)-1 was signed in 1993 and the ROD for OU-2 was signed in 2007.

The 1993 ROD addressed the surface soil, the subsurface soil, and the shallowest groundwater unit (the A-zone groundwater). The function of this OU was to address the principal threat at the Site, the A-zone groundwater, and to address the surface soil exposure threat.

The major components of the OU-1 selected remedy include:

- Extraction, treatment, and reinjection of groundwater from the shallowest unit;
- Consolidating contaminated surface soil on a 1.2 acre portion of the Site and capping the consolidated soils cap in accordance with RCRA Subtitle C standards for cover systems; and
- Capping the remaining portion of the Site with a basic cap.

Additional investigation was necessary for adequate design and implementation of the A-zone groundwater remediation component. Therefore, the A-zone groundwater extraction and treatment component of OU-1 selected remedy was not installed prior to the issuance of the 2007 ROD, and was carried over to the OU-2 to be addressed in conjunction with actions for the B-zone groundwater remedy selected in the 2007 ROD.

The 2007 ROD (OU-2) addresses the A-zone groundwater, subsurface soil from the base of the A-zone groundwater to the second water-bearing unit (B-zone groundwater), and the B-zone groundwater. The OU-2 ROD is the final ROD for groundwater. The actions selected in the OU-2 ROD are the final actions for groundwater remediation.

The major components for the OU-2 selected remedy include:

- Relocation of the Arvin City Well CW-1: Properly abandon the existing Arvin well CW-1 and locate a replacement well a suitable distance from the known OU-2 plume. Extraction system: Install an extraction system in the shallow A-zone aquifer with above ground ultraviolet (UV) oxidation water treatment and disposal of the treated water to the Arvin City sewer. The ROD also allowed for temporarily storage of the extracted water and periodically transport off-site for treatment and disposal.
- Monitored Natural Attenuation (MNA): Conduct groundwater monitoring of the B-zone to evaluate: 1) the effectiveness of the remedy; 2) the location of the plume; and 3) whether remediation goals have been met by natural attenuation in the B-zone. This component will include an MNA performance plan during implementation of the remedy, which will include details of the groundwater monitoring and natural attenuation progress evaluation for the B-zone groundwater. Actual performance of the natural attenuation remedy will be carefully monitored in accordance with the MNA Performance Plan. If monitoring data indicate that the COC levels do not continue to decline, as estimated in the fate and transport model, EPA and DTSC will reconsider the remedy decision.
- Place institutional controls on the Site and nearby properties to limit use of B-zone groundwater.

In late 1998 and early 1999, contaminated soil and asphalt were consolidated in an area that is now beneath the RCRA-cap. On behalf of EPA, the U.S. Army Corps of Engineers (USACE) imported clean soil materials, performed grading and fencing, and constructed the RCRA- and basic caps over the property.

In April 2013, installation of the OU-2 A-zone groundwater extraction system was initiated with installation of three extraction wells. The extraction system became operational in October 2015. EPA decided initially to store on-site and dispose off-site during the initial phase of operation to determine actual volumes and costs. Extracted groundwater is pumped to two 4,000-gallon storage tanks located on-site where it is stored until transported off-site to an appropriate Class I hazardous waste disposal facility. As of February 2016, approximately 48,000 gallons of A-zone groundwater has been extracted and disposed of.

The remedy at OU-1 is functioning as intended. The RCRA- and non-RCRA-caps are preventing infiltration of precipitation to the A-zone groundwater. Institutional Controls have not been implemented.

Soil vapor sampling was performed in 2006 to evaluate whether there were complete exposure pathways on- and off-site. While there were detections of COCs in on-site and off-site samples, all

detected constituents in the soil vapor samples were below the California Human Health Screening Levels (CHHSLs). As part of this FYR the April 2015 A-zone groundwater concentrations nearest the warehouse were compared to EPA's Vapor Intrusion Screening Level. Results indicate that there is no risk of vapor intrusion at the B&B Site outside of acceptable risk range.

The remedy at OU-1 currently protects human health and the environment because the RCRA cap and the basic cap are preventing exposure to contaminated surface soils. In order for the remedy to be protective in the long-term, the institutional controls must be implemented.

The OU-2 remedy appears not to be progressing towards the remedial action objectives used at the time of the remedy selection because: 1) there have been spikes in concentrations for B-zone wells downgradient of the cap which indicate contamination is migrating from the A-zone to the B-zone; and 2) the furthest downgradient B-zone wells are showing increasing trends which indicate that MNA may not be working. The City of Arvin drinking water supply well CW-1, is located 1,500 feet southwest of the Site and draws from the C-zone (as do all city wells). These wells may include gravel pack intervals that include the B-zone. The well CW-1 completion of screen/gravel pack intervals within both the B-zone and C-zone represents a potential mechanism for vertical mixing of groundwater between these otherwise isolated units. Proper abandonment of well CW-1 will remove the threat of cross contamination from the A-zone and the B-zone to the C-zone, as this well has potential to be a conduit.

Recent sampling of well CW-1 in May 2016 did not indicate that migration had occurred; concentrations of COCs were non-detect with the exception of 1,2,3-TCP, which is attributable to the regional distribution of 1,2,3- TCP in the Arvin area's C-zone aquifer. 1,2,3-TCP has also been detected in upgradient B-zone wells at concentrations above the clean-up level of 0.5 µg/L.

The remedy at OU-2 currently protects human health and the environment because the there is no exposure to the contaminated groundwater. However, to be protective in the long-term the following actions need to be taken:

- Proper abandonment of Arvin City well CW-1,
- Implement Institutional Controls,
- Evaluate the effectiveness of MNA,
- Conduct an investigation to determine if 1,2,3-TCP cleanup levels can be achieved below current background concentrations,
- Investigate the source of the increase COC concentrations in the B-zone well, WB2-1, and complete full characterization of the B-zone contamination.

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List of Abbreviations

1,23-TCP	1,2,3-trichloropropane
1,2-DCP	1,2-dichloropropane
1,3-DCP	1,3-dichloropropane
ARAR	applicable or relevant and appropriate requirements
bgs	below ground surface
CDHS	California Department of Health Services
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
COC	contaminant of concern
DTSC	California Department of Toxic Substances Control
DBCP	1,2-dibromo-3-chloropropane
EDB	ethylene dibromide
EDMS	electronic database management system
EPA	Environmental Protection Agency
FYR	five-year review
MAROS	Monitoring and Remediation Optimization System
MCL	maximum contaminant level
µg/L	microgram per liter
MNA	monitored natural attenuation
NCP	National Contingency Plan
NPL	National Priority List
OU	operable unit
RCRA	Resource Conservation and Recovery Act
ROD	record of decision
TBC	to-be-considered
USACE	United States Army Corps of Engineers
UU/UE	unlimited use and unrestricted exposure

1. Introduction

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

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

This is the fourth FYR for the Brown and Bryant Superfund Site (the B&B Site or the Site). The triggering action for this statutory review is completion of the third FYR report on September 22, 2011. This FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the Site at levels above those that would allow for unlimited use and unrestricted exposure (UU/UE).

The B&B Site consists of two operable units (OUs), and both will be addressed in this FYR. OU-1 addresses surface soil, subsurface soil and initially addressed the shallowest groundwater unit, A-zone groundwater in the 1993 Record of Decision (ROD). OU-2 addresses the next-deeper groundwater unit, B-zone groundwater, and also the A-zone groundwater that was initially addressed in OU-1in the 1993 ROD, and carried over to OU-2 in the 2007 ROD.

The Site FYR was led by Brunilda Dávila of EPA Region 9. Participants included Cynthia Wetmore, EPA Region 9 FYR Coordinator; Karah Haskins, U.S. Army Corps of Engineers (USACE) Technical Lead; and Richard Garrison, USACE Geologist. The review began on 10/22/2015. Documents reviewed are listed in Appendix A. Table 1 summarizes the status of the Site and this FYR.

Table 1. Five-Year Review Summary

SITE IDENTIFICATION		
Site Name: Brown and Bryant (Arvin Plant) Superfund Site		
EPA ID: **CAD052384021**		
Region: 9	**State:** CA	**City/County:** Arvin/ Kern
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Brunilda Dávila		
Author affiliation: EPA Region 9		
Review period: 10/22/2015 - 9/22/2016		
Date of site inspection: 1/29/2016		
Type of review: Statutory		
Review number: 4		
Triggering action date: 9/22/2011		
Due date *(five years after triggering action date)*: 9/22/2016		

1.1. Background

The Brown and Bryant Arvin Pesticide Reformulation Facility operated as an agricultural distributor facility from 1960 to 1989. This facility stored and distributed agricultural chemicals including dinoseb and dibromochloropropane. In 1981, the facility was licensed under Resource Conservation and Recovery Act (RCRA) as a hazardous waste transporter. Operations ceased in 1989 and the Site was added to the National Priorities List (NPL) that same year. Currently, structures currently present on- Site include groundwater monitoring wells, and a warehouse that houses a small unoccupied office area and the A-zone groundwater extraction system. An engineered-pavement cap covers the entire property. The Site is vacant.

Facility operations at the Site resulted in the discharge of contaminants to the surface and subsurface soils, and certain contaminants have penetrated into the groundwater in the A-Zone and the unsaturated soils below the A-Zone. A deeper, regional aquifer has also been impacted. Contamination of soil and groundwater resulted from inadequate procedural controls and chemical spills during operations and leaks from a surface water pond and sumps. Several volatile organic compounds, semi-volatile organic compounds, herbicides, and pesticides were detected in soil samples.

From 1983 through 1988, Brown and Bryant, the owner/operator of the Site, conducted several soil and groundwater investigations and remedial actions under California Department of Health Services (CDHS) supervision (including disposal of contaminated soil). The most significant work included the installation of 10 monitoring wells and the removal, in 1987, of some heavily contaminated soil beneath the two sumps and waste pond. The lined waste pond in the southeast corner of the property was excavated in August 1987 by Brown and Bryant. The pond liner and approximately 640 cubic yards of soil that showed visible signs of contamination were removed. The depths of this excavation ranged from approximately 1.5 feet on the sides to 5 feet near the center.

1.2. Physical Characteristics

The B&B Site is located at 600 South Derby Road in Arvin, Kern County, California, approximately 18 miles southeast of the city of Bakersfield (see Figure 1). There are residential properties to the west of the Site, industrial properties to the north and south, and agricultural lands to the east. The property covers approximately 5 acres and is topographically flat with a slightly decreasing grade toward the south.

The property is currently vacant and secured by a chain link fence. The structures currently present within the fenced area are groundwater monitoring wells and a vacant warehouse that houses a small office area and the A-zone groundwater extraction system. An engineered pavement cap covers the entire property. The cap is designed as a RCRA cap in the property's southeastern portion and as a non-RCRA, basic cap in the property's northern portion (see Figure 2).

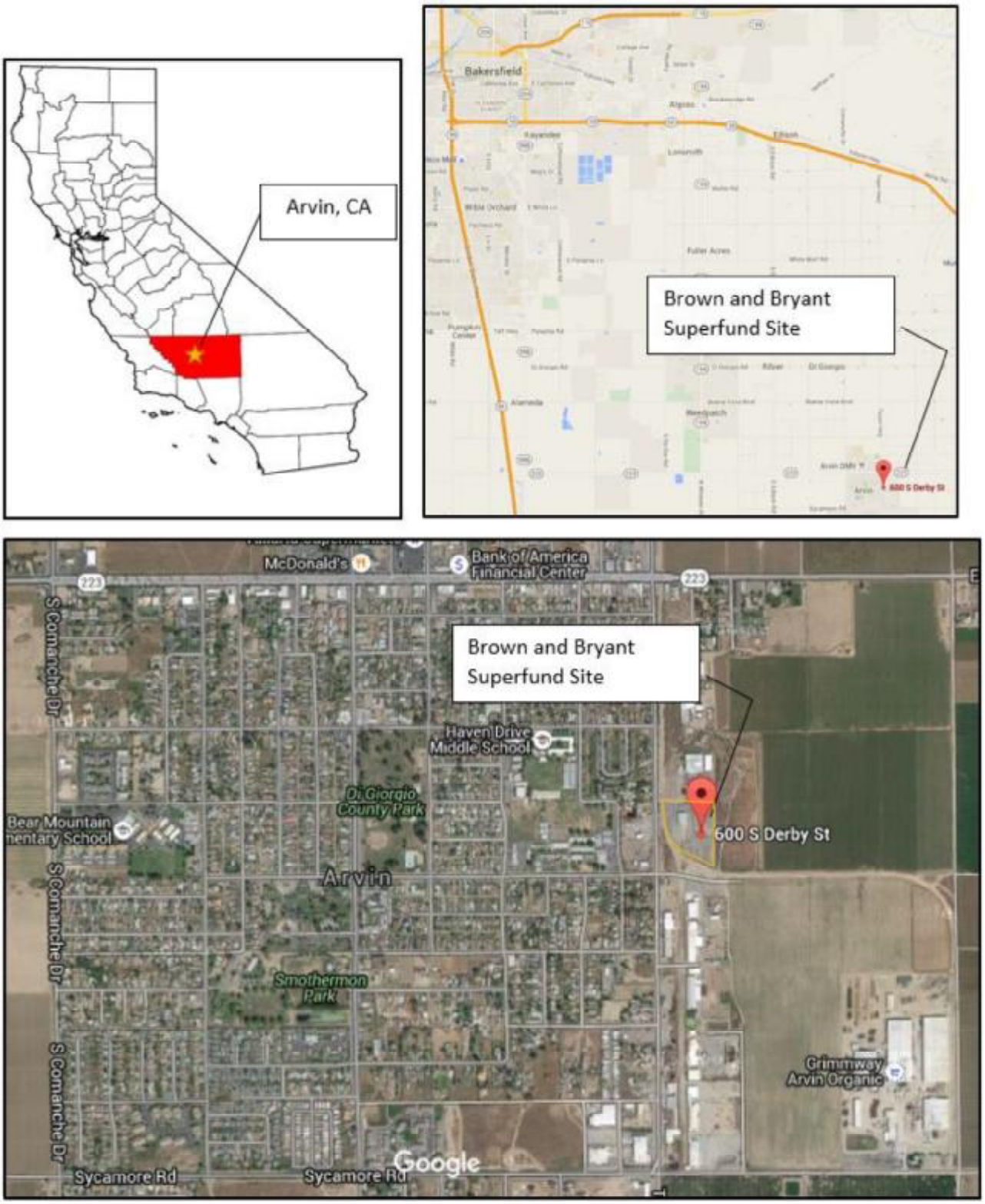

Figure 1. Location Map for the Brown and Bryant Superfund Site

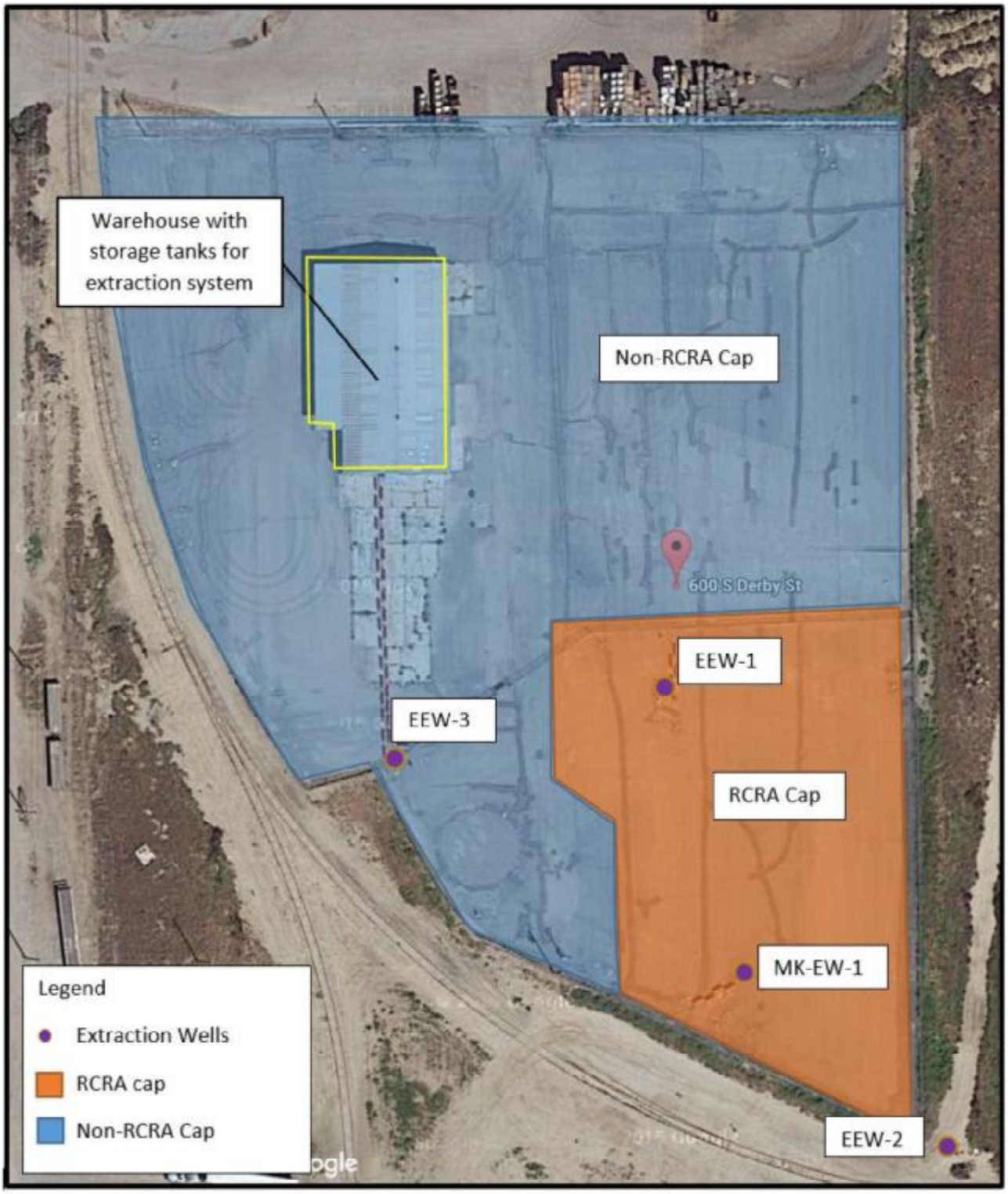

Figure 2. Detailed Map of the Brown and Bryant Superfund Site

1.3. Hydrology

The B&B Site is underlain by an alluvial deposit of alternating layers and mixtures of unconsolidated sands, silts, and clay. Soil underlying the Site to a depth of 80 feet generally consists of silty fine sand to fine sandy silt. Clean, well-graded sand lenses and seams of silty clay occur locally within this upper deposit.

The Site hydrogeology has three zones: the A-zone, the B-zone, and the C-zone. The A-zone includes unsaturated soil at 65 to 75 feet below ground surface (bgs) and includes the first water-bearing unit, the A-zone groundwater. The depth to the saturated zone varies from 70 to 89 feet bgs in recent groundwater depth measurements. The base of the A-zone is a thin sandy clay layer between 75 and 85 feet bgs. The clay layer and the A-zone groundwater perched above it occur beneath the entire Site, but disappear within 640 feet south of the Site, 560 feet east of the Site, and 500 feet west of the Site. Groundwater in the A-zone flows in a generally southwesterly direction. Periodic and localized changes in flow directions occur beneath the Site. Several groundwater depressions exist south of the Site toward which groundwater flow occurs. These groundwater depressions are suspected of providing pathways for vertical flow of groundwater from the A-zone into the B-zone.

The B-zone includes unsaturated soil beneath the A-zone, which includes a water-bearing unit first encountered between roughly 130 and 154 feet bgs. The B-zone extends to at least 250 feet bgs with intermediate layers of mixed coarse and fine-grain material present within the overall unit. The lower boundary is a clay layer that confines the drinking water aquifer beneath it. The top of the clay layer varies in elevation and is found at depth as great as 300 feet bgs. The clay layer is reported to be between 20 and 40 feet thick. The general direction of flow in the B-zone is to the south-southwest, and the gradient is relatively flat (0.0004 feet per foot). The hydraulic conductivity in the B-zone is much higher than that for the A-zone.

The C-zone begins at the top of the clay aquitard and is reportedly several hundred feet to over 1,000 feet thick. The C-zone is a productive aquifer and is used locally for municipal water supply. The City of Arvin drinking water supply well CW-1, is located 1,500 feet southwest of the Site and draws from the C-zone (as do all city wells). These wells may include gravel pack intervals that include the B-zone. The CW-1 completion of screen/gravel pack intervals within both the B-zone and C-zone represents a potential mechanism for vertical mixing of groundwater between these otherwise isolated units.

2. Remedial Actions Summary

2.1. Basis for Taking Action

The primary chemicals of concern (COCs) found at the Site are:

- Chloroform;
- 1,2-Dibromo-3-chloropropane (DBCP);
- 1,2-Dichloropropane (1,2-DCP);
- 1,3-Dichloropropane (1,3-DCP);

- Dinoseb;
- Ethylene dibromide (EDB); and
- 1,2,3-Trichloropropane (1,2,3-TCP).

The presence of contamination in soil, contamination in groundwater at levels that exceed drinking water standards, evidence that contamination will continue to migrate into groundwater areas that are presently clean or less contaminated, and the future potential use of groundwater in and around the B&B Site as a source of drinking and irrigation water are the basis for taking action.

2.2. Remedy Selection

The Record of Decision (ROD) for OU-1 was signed in 1993 and the ROD for OU-2 was signed in 2007.

The 1993 ROD addressed the surface soil, the subsurface soil, and the shallowest groundwater unit (the A-zone groundwater). The function of this OU was to address the principal threat at the Site, the A-zone groundwater, and to address the surface soil exposure threat.

The major components of the OU-1 selected remedy include:

- Extraction, treatment and reinjection of groundwater from the shallowest unit;
- Consolidating contaminated surface soil on a 1.2 acre portion of the Site and constructing a cap over it that is constructed in accordance with RCRA Subtitle C standards;
- Capping the remaining portion of the Site with a basic cap; and
- Implementing institutional controls which will consist of deed restrictions precluding residential use of the Site and assuring that the RCRA cap area is maintained.

Additional investigation was necessary for adequate design and implementation of A-zone groundwater remediation component. Therefore, the A-zone groundwater extraction and treatment component of the OU-1 selected remedy was not installed prior to the issuance of the 2007 ROD, and therefore was carried over to OU-2 to be addressed in conjunction with actions for the B-zone groundwater remedy selected in the 2007 ROD.

The 2007 ROD addresses the A-zone groundwater, subsurface soil from the base of the A-zone groundwater to the second water-bearing unit (B-zone groundwater), and the B-zone groundwater. The actions selected in the OU-2 ROD are the final actions for groundwater remediation.

The major components for the OU-2 selected remedy include:

- Relocation of the Arvin City Well CW-1: Properly abandon the existing Arvin CW-1 well and locate a replacement well a suitable distance from the known OU-2 plume. Relocating this well will remove the threat of cross contamination from the A-zone and the B-zone to the C-zone, as this well has potential to be a conduit.
- Groundwater extraction system: Installation of an extraction system in the shallow A-zone aquifer with above ground ultraviolet (UV)/oxidation water treatment and disposal of the treated water to the City of Arvin sewer system.

- Monitored Natural Attenuation (MNA): Conduct groundwater monitoring of the B-zone to evaluate: 1) the effectiveness of the remedy; 2) the location of the plume; and 3) whether remediation goals have been met by natural attenuation in the B-zone. This component will include a MNA performance plan during implementation of the remedy, which will include details of the groundwater monitoring and natural attenuation progress evaluation for the B-zone groundwater. Actual performance of the natural attenuation remedy will be carefully monitored in accordance with the MNA Performance Plan. If monitoring data indicate that the COC levels do not continue to decline, as estimated in the fate and transport model, EPA and the Department of Toxic Substances Control (DTSC) will reconsider the remedy decision.
- Place institutional controls on the Site and nearby properties to limit use of B-zone groundwater.

2.2.1. Remedial Action Objectives

As described in the 1993 ROD, the primary remedial action objective for the surface soils is to prevent human and ecological exposure to the contaminated soil.

As described in the 2007 ROD, the specific remedial action objectives for the B&B Site groundwater are to:

- remove or control COCs in the A-zone groundwater such that it is no longer a source of contamination to B-zone and C-zone groundwater,
- restore the B-zone groundwater to its potential beneficial use as drinking water aquifer, and
- prevent potential exposure to contaminated groundwater.

2.2.2. Cleanup Levels

The remediation levels for the surface soil are based on health calculations considering the human ingestion pathway. Dinoseb was the only chemical found in the upper 7 feet above health based levels. Since dinoseb is a systemic toxicant, the cleanup level was developed based on the most sensitive subgroup, young children. The cleanup level for dinoseb, 80 milligrams per kilogram, was developed assuming a child ingests 0.2 mg/day of soil over a five-year period using calculations for RCRA no further action.

A-zone groundwater is a source of contamination to the B-zone groundwater. The goal for the A-zone groundwater cleanup is to control the migration of contaminants by controlling the groundwater flow or reducing the concentrations of COCs in the A-zone to the extent that it is no longer a threat to the B-zone groundwater. Based on movement of COCs though the A-zone groundwater to the B-zone groundwater, as estimated by modeling conducted for use in developing the 1993 ROD, cleanup goals for the A-zone groundwater were set at a range of 10 to 100 times the respective maximum contaminant levels (MCLs) at that time. The 1993 ROD further specified that after the A-zone groundwater extraction system is in operation, the final A-zone groundwater cleanup goals will be established within the stated cleanup range based on costs and effectiveness for reducing and maintaining COC concentrations at or below MCLs in the B-zone groundwater. Table 2 shows the cleanup range for the A-zone groundwater.

Table 2. 2007 ROD Cleanup Range for A-zone Groundwater

Contaminant of Concern	A-zone Groundwater Cleanup Range (µg/L)[1]
Chloroform	800-8,000
1,2-Dibromo-3-chloropropane (DBCP)	2-20
1,2-Dichloropropane (1,2-DCP)	50-500
1,3-Dichloropropane (1,3-DCP)	5-50
Dinoseb	70-700
Ethylene Dibromide (EDB)	0.5-5.0
1,2,3-Trichloropropane	5-50

NOTE: Table adapted from 2007 ROD
1. Micrograms per liter

Although the B-zone aquifer is not currently used as a drinking water source, it is classified by the Central Valley Regional Water Quality Control Board (CVRWQCB) as a potential drinking water source. Therefore, groundwater cleanup levels are based on groundwater chemical-specific applicable or relevant and appropriate requirements (ARARs), which are based on protection of human health. The basis for the final cleanup levels for the B-zone aquifer were the Federal drinking water MCLs unless State drinking water MCLs were more stringent. Since there was no MCL for 1,2,3-TCP, the cleanup level for this contaminant was based on California Department of Health Services (CDHS) Drinking Water Notification Levels and Response Levels[1], which is a to-be-considered (TBC) criteria. Table 3 presents the B-zone groundwater cleanup levels.

Table 3. 2007 ROD Cleanup Levels for B-zone Groundwater

Contaminant of Concern	Cleanup Level (µg/L)[1]	Source
Chloroform	80[2]	Federal National Primary Drinking Water Standards *(40 CFR Part 141)*
1,2-Dibromo-3-chloropropane (DBCP)	0.2	Federal National Primary Drinking Water Standards *(40 CFR Part 141)*
1,2-Dichloropropane (1,2-DCP)	5	Federal National Primary Drinking Water Standards *(40 CFR Part 141)*
1,3-Dichloropropane (1,3-DCP)	0.5	California Safe Drinking Water Act *(CCR Title 22, Sec 6444)*
Dinoseb	7	Federal National Primary Drinking Water Standards *(40 CFR Part 141)*
Ethylene Dibromide (EDB)	0.05	Federal National Primary Drinking Water Standards *(40 CFR Part 141)*
1,2,3-Trichloropropane (1,2,3-TCP)	0.5	Response Level, Drinking Water Program, California Department of Health Services, 1999; and available analytical practical quantification limit for 1,2,3-TCP.

NOTE: Table adapted from 2007 ROD.
1. Micrograms per liter
2. Total Trihalomethanes (sum of bromodichloromethane, dibromochloromethane, bromoform, and chloroform), EPA MCL effective 01/01/04

[1] . The notification level and response level are now issued from the California State Water Resources Control Board.

2.3. Remedy Implementation

In late 1998 and early 1999, approximately 6400 cubic yards of contaminated soil and asphalt were consolidated in one area that is now beneath the RCRA cap in accordance with the selected remedy. The remaining work including grading and fencing, construction of the RCRA cap in the southeast corner of the Site, and construction of basic cap over the remaining property was also completed.

In 2012, an MNA evaluation was performed for the B-zone groundwater, which concluded that all COCs appear to be naturally attenuating. Attenuation was expected to take another 10-30 years, depending upon the flow path. However, this evaluation was completed prior to installation and operation of the A-zone extraction system and prior to the recent increases in concentration in the B-zone; therefore, the evaluation may no longer represent current Site conditions.

In April 2013, installation of the OU-2 A-zone groundwater extraction system was initiated with installation of three extraction wells. The system consists of three 36-inch long auto-reclaimer pneumatic pumps, an air compressor, discharge hoses, and two holding tanks. The A-zone extraction system began operating on January 22, 2014, drawing from extraction wells EEW-1, EEW-3, and MK-EW-1. (Extraction well EEW-2 is not active because there was not sufficient yield and was replaced by MK-EW-1 installed in 1990). Extracted groundwater is pumped to two 4,000-gallon storage tanks located within the warehouse where it is stored. Since the waste is sent off-site for disposal, a hazardous waste determination is required. Based on the analytical data and waste determination screening criteria, the extracted wastewater and purged groundwater accumulated at the site is classified as P-listed RCRA hazardous waste, thus it is required to be sent to a RCRA Subtitle C facility, or in the State of California, a Class I hazardous waste disposal facility.

Once becoming operational through October 2015, the extraction system operated in batch mode with periods of pumping and periods of system shutdown due to storage tank capacity. Since October 2015 the extraction system has been running continuously. As of February 2016, approximately 48,000 gallons of A-zone groundwater has been extracted and disposed of.

The remaining components of the OU-2 selected remedy have not yet been implemented: relocation of the Arvin City Well CW-1, full implementation of the MNA performance plan, and institutional controls. In addition, the current A-zone extraction system may require additional extraction wells to be installed. The full list of institutional controls for OU-1 and OU-2 still to be implemented is described in Table 4. During the last FYR, DTSC required additional input from EPA to implement land use controls. In addition, DTSC indicated that off-property land use controls would likely require a city ordinance due to the large number of properties affected.

Table 4. Summary of Planned ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed?	ICs Called for in the Decision Documents?	Impacted Parcel(s)	IC Objective
RCRA Cap	Yes	Yes	The Site	To protect the integrity of the RCRA cap and ensure that it is maintained
B-zone Groundwater	Yes	Yes	The Site and properties surrounding the Site	To limit exposure to contaminated B-zone groundwater via wells

2.4. Operation and Maintenance (O&M)

Maintenance of the RCRA and basic caps and other ancillary features is necessary for maintaining long-term protectiveness of the OU-1 remedy. The caps are currently maintained by DTSC. Annual Site inspections are performed by DTSC and occasional maintenance to the both caps is necessary to ensure there is no infiltration of surface water to the A-zone groundwater. Removal of contaminants from the A-zone groundwater would be impacted by cracks allowing surface water into the A-zone groundwater which could potentially mobilize contaminants further down-gradient. According to the annual OU-1 O&M reports, inspections performed by DTSC include a visual examination of the caps, security fencing, signs, and warehouse exterior.

During the Site visit, it was noted that EPA has updated several Site documents, such as the conceptual site model, and operation, performance and maintenance plan since Site management changed in May 2015. Maintenance of the tanks, warehouse and other equipment needed for operating the system, and sampling of the extraction wells is performed monthly. Extraction rate optimization opportunities are being evaluated to determine whether there is an optimum rate for increasing source removal.

Currently, EPA is conducting, at least, annual sampling for monitoring wells in the A-zone and B-zone groundwater. In addition, the Arvin City well CW-1 and other city wells have been routinely sampled by EPA since 2011 to monitor for COCs associated with the Site, although this monitoring is not required by either ROD. EPA sampled Arvin City well CW-1 in May 2016 and the only detection was 1,2,3-TCP at 0.015 µg/L. 1,2,3-TCP is commonly detected in the groundwater in the Arvin area at levels greater than 0.012 µg/L.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

Following is the protectiveness statement from the third FYR for the B&B Site:

> *The remedy at OU-1 currently protects human health and the environment, because the RCRA Subtitle C containment cap and non-RCRA asphalt cap prevent exposure to contaminated soil, limit infiltration, reducing impacts to the A-zone groundwater. In order for the remedy to be protective in the long-term, institutional controls required by the OU-1 ROD need to be implemented.*

The third FYR included one issue that affects protectiveness and a corresponding recommendation. This recommendation and its current status are provided in Table 5.

Table 5. Status of Recommendation from the 2011 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description
1	Institutional controls required by the OU-1 ROD, in the form of land use covenants prohibiting residential use and ensuring the integrity of the remedy, have not yet been implemented	Implement institutional controls as specified in OU-1 ROD	Under Discussion	Institutional controls have not been implemented at the Site.

The third FYR also included issues that do not affect protectiveness:

- The information repository at the Kern County library in Arvin, for the B&B Site, is not up-to-date. Efforts should be made to include relevant project reports, especially recent groundwater monitoring reports and the OU-2 ROD.
- Although attempts have been made to file the Survey Plat of the RCRA Subtitle C cap with city and county local authorities (consistent with 40 CFR 264.116 and 264.119), neither of these entities wanted to file this information. This matter should be further researched, to determine other options for complying with this regulation.
- Annual surveys of the RCRA Subtitle C cap have not always been completed.

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

In August 2012, three background wells were installed in the B-zone up-gradient of the B&B Site to investigate background concentrations of Site COCs. The background wells were sampled for all B&B Site COCs, however the most commonly detected COCs were 1,2-DCP and 1,2,3-TCP. Chloroform was also detected in one of the wells. Although chloroform is a COC for B-zone groundwater, it is typically not found at levels that exceed the MCL for trihalomethanes (80 micrograms per liter [µg/L]).

EPA's contractor conducted six B-zone background sampling events from August 2012 through December 2013 [Eco and Associates, Inc. (2013)]. Based on the results from these events, EPA calculated the 95 percent upper confidence level (UCL) background concentration with 90 percent coverage for 1,2-DCP as 1.111 µg/L (which is below the 5 µg/L cleanup level), and for 1,2,3-TCP as 1.3 µg/L (which is above the 0.5 µg/L cleanup level). Because background levels for 1,2,3-TCP are above its cleanup level of 0.5 µg/L, the remedy may not be able to achieve the remedial action objectives for 1,2,3 TCP.

In January 2014, EPA started operating the groundwater extraction system, as described in Section 2.3. EPA is currently evaluating the potential implementation of enhancements to optimize source mass removal in the A-zone. EPA has identified three potential enhancements that could be applied to the Site: 1) Vacuum-Enhanced Groundwater Recovery/Soil Vapor Extraction (SVE), as known as multi-phase extraction (MPE), 2) SVE with Hot Air Injection, 3) In-Situ Bioremediation using Gaseous Phase Amendments (for both the vadose zone and below the A zone). Since August 2012, EPA has set aside funds for the replacement of well CW-1 and has been working with the Arvin Community Services District (ACSD) to execute a cooperative agreement.

4. Five-Year Review Process

4.1. Community Notification and Involvement

On Friday, January 29, 2016 EPA had a meeting with the Committee for a Better Arvin (CBA), to provide a Site update on the ongoing activities at the Site and the FYR process. CBA is a community group that works on environmental issues in Arvin, CA.

In 2014, The Technical Assistance Services for Communities (TASC) program replaced the Technical Assistance Grant (TAG) which had offered independent technical assistance services for CBA.

4.2. Data Review

Data collected since the previous FYR were evaluated to assess changes in aquifer conditions, COC concentrations, and plume migration (See Attachment A of Appendix B). Data sources for this analysis include:

- Groundwater Sampling Reports for
  - April 2011, Spring 2012, October 2012 by Eco & Associates
  - June 2014 and Spring 2015 by CBI Federal Services
- Groundwater Sampling and Analysis Report for City Wells prepared by Eco & Associates, September 2012
- Monitored Natural Attenuation Report for the Brown & Bryan Superfund Site, prepared by Eco & Associates, August 2012

For this report, on behalf of EPA, USACE performed a trend analysis using the Mann-Kendall test for trend as implemented in the Monitoring and Remediation Optimization System (MAROS) software.

MAROS also calculates the total mass, the location of the center of mass, and mass spread in what is termed a "moment analysis." A detailed discussion of the trend analysis is provided in Appendix B, and is summarized in the sections below.

A-Zone Groundwater Levels

Groundwater levels in the A-zone have fallen since the last FYR, but flow direction continues to be both from the north and from the south of the Site toward a pair of aquifer lows, located immediately south of the Site (See Figure B-2). Between thirteen and fifteen wells could not be measured during each sampling event in the last five years, because the water levels fell too low or recharge was too slow to meet appropriate sampling protocol. It is not clear whether the decreasing groundwater levels are the result of the cap, the extraction pumping, the drought conditions, or a combination of these three.

A-Zone Concentration Trends

In the A-zone, most wells showed stable to decreasing concentrations of the five compounds assessed. However, one atypical, high concentration, which was for dinoseb at PWA-2, was detected in April 2015. This result of 24,000 µg/L was significantly higher than previous results which ranged from 2,600 to 9,100 µg/L in the previous 5 years. Because this is the first time, and the only well and constituent, showing a spike in concentration, it is unclear what may have caused it, however it is possible that pumping may have changed flow paths, or contamination may have migrated vertically. The Mann-Kendall trends and MAROS analysis show that the contaminant plumes are shrinking in volume and not migrating, however there are still concentrations of COCs that exceed the A-zone cleanup goal range in monitoring wells EPAS-3, PWA-2, and WA-3. EPAS-3 and PWA-2 which are 100 feet south (downgradient) of the RCRA cap and 150 feet from the closest extraction well, respectively. Evaluation of extraction well placement and flow pathways indicate that the extraction system may not be capturing contaminated groundwater in the vicinity of EPAS-3 and PWA-2 (See Table B-3).

B-Zone Groundwater Levels

B-zone groundwater levels have followed a different set of trends than those seen in the A-zone. B-zone wells had their lowest elevations in 1995 and elevations had steadily increased to peak in 2012, but have declined 2 to 3 feet since 2012. Groundwater flow in the B-zone is generally to the south, albeit with some complexity (See Figure B-3). There is some uncertainty regarding the B-zone potentiometric surface due to the limited number of wells completed in this zone, and due to varying vertical well screen placement within the relatively thick and heterogeneous aquifer.

B-Zone Concentration Trends

Although concentration trends in the majority of B-zone monitoring wells were stable or declining from 2009 to 2015, there were notable increasing trends in a few wells (see Table B-4 of Appendix B). Increasing concentration trends were observed in monitoring wells located in the downgradient portion of the plume, particularly PWB-13A, PWB-15, and PWB-16, which are all located south of the Site. Well PWB-16 is the furthermost downgradient well. This indicates contaminant plume has been spreading.

In well WB2-1, a spike in concentrations for many of the COCs, including a jump of almost 3 orders of magnitude in 1,2-DCP, occurred in 2014 after several years of very low to non-detect concentrations. Monitoring well WB2-1 is near the south boundary of the Site and the presumed location of the connection between the A-zone and B-zone. Recent modeling shows that there is vertical movement of groundwater between the A-zone and B-zone just north of WB2-1. From October 2011 to April 2015, dramatic changes in concentrations in well WB2-1 for three of the five COCs, 1,2-DCP (0.67 to 950 µg/L), 1,2,3-TCP (1.5 to 88 µg/L), and dinoseb (<0.2 to 18 µg/L), indicate that contamination from the A-zone has migrated to the B-zone. This substantial increase would represent a difficult challenge for natural attenuation alone to address.

4.3. Site Inspection

The inspection of the Site was conducted on 1/29/2016. In attendance were Brunilda Dávila, EPA Region 9; Karah Haskins, USACE; James Horna, CB&I Federal Services; and Ken Kitchens, CB&I Federal Services. The purpose of the inspection was to assess the protectiveness of the remedy.

The Site inspection began with the groundwater extraction system. The EPA contractor, CB&I, described how the system upgrades optimized the time that the system was running. The system is now remotely operable and provides emergency notifications with a description of the incident to the operator. Other aspects of the extraction system include storage containers and a secondary containment system. Extraction wells were also observed to be in good condition. The piping from the extraction wells to the containers is protected by "Jersey barriers."

The fence line was walked to observe the integrity of the fence. The integrity of the fence was in good condition. Maintenance of the brush along the outside of the fence had not been conducted. There are two gates that are locked when no one is on-Site.

The RCRA cap was observed next. There were some minor cracks and extensions of cracks that were previously repaired. The most notable crack was on the east side near the fence. The crack extends the length of the cap and may indicate that there is some sloughing of the east side of the cap.

The asphalt basic cap at the Site continues to show evidence of cracking in spots, particularly on the northern and western edges, and there has been cracking along the southern and eastern edge of the RCRA capped area. According to EPA's contractor, CB&I, cracks have been shown to enlarge over time and attempts to seal these cracks have limited success. Vegetation has taken root in some cracks.

Ponding is still evident on the west side of the warehouse on the basic cap; however, EPA implemented a temporary system to drain the ponding as part of El Niño Planning Activities. The other ponding issue located on the east side of the property was resolved by clearing out the drain of the shallow channel. The drainage of this channel seems to be causing some erosion at the edge of the cap.

5. Technical Assessment

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

Yes and No. Yes, the remedy is functioning as intended for OU-1. No, the remedy is not functioning as intended for OU-2. The extraction wells have been removing significant contaminant mass, however, there have been recent spikes in detections in B-zone wells that indicate contamination is migrating from the A-zone to the B-zone. Furthermore, MNA may not be sufficient to reduce the current B-zone contamination to levels below drinking water standards evidenced by the recent spike in contamination in the well WB2-1.

For OU-1, the remedial action continues to operate and function as intended. There are some minor cracks in both caps. Overall, the integrity of the caps is preventing surface water from infiltrating the A-zone groundwater.

The 1993 ROD states that "Institutional controls will be implemented which will consist of deed restrictions precluding residential use of the Site and assuring that the RCRA cap area is maintained." As of this FYR, site access controls are in place, including security fencing around the perimeter of the property, with locked gates at entrances. Signs are posted in English and Spanish stating that this is a hazardous area and entrance is prohibited. Combined with the physical barrier represented by the RCRA cap, these controls currently ensure that exposure to contaminated soil beneath the cap is prevented. However, deed restrictions are needed to ensure that the integrity of the cap is ensured should the property be transferred to new owners.

For OU-2, the remedy is not operating as intended. One of the objectives of the OU2 remedy is to remove or control COCs in the A-zone groundwater such that it is no longer a source of contamination to B-zone and C-zone groundwater. Concentrations of COCs in well WB2-1, which is screened deep in the B-zone, have increased, suggesting an increasing transport of contaminants from the A-zone downward into the deeper aquifer zones. This increase did not have any precursors in other A-zone wells, which suggests that additional monitoring within the A-zone peripheral to WB2-1 may be a necessary part of any active remediation, because the connection between the A-zone and B-zone is not well understood. In addition, the trend analysis indicates that the furthest downgradient B-zone wells (PWB-13A, PWB-15, and PWB-16) have contaminant concentrations that are increasing indicating that MNA may not be sufficient to clean B-zone concentrations to below drinking water standards.

The extraction system in the A-zone, designed to control the source to the B-zone, was installed in early 2014. The extraction system extracts contaminated groundwater from the A-zone at approximately 83-gal/day. This new continuous extraction of the A-zone groundwater may change sampling concentrations in other monitoring wells by removing the source of contamination to the B-zone. Further remedial actions may be necessary to completely remove the source area in the A-zone.

The OU-2 ROD also selects institutional controls as part of the remedy. The objective of the institutional controls is to restrict well drilling and groundwater pumping within at least half a mile from the Site to ensure that pumping influences do not spread contamination or reduce the effectiveness of the remedy. As

of this FYR, there are currently no institutional controls in place preventing drinking water wells from being installed. The OU-2 ROD selects relocation of the Arvin City Well CW-1 as part of the remedy. As of this FYR, the Arvin City Well CW-1 has not been relocated. In June 2016 ACSD submitted an application for funding and EPA is currently reviewing the application. There are no agriculture or City Wells near the extent of the B-zone plume (See Figure 3).

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

For OU1 the exposure assumptions, toxicity data, cleanup levels, and RAOs are still valid. The RCRA and basic caps are preventing infiltration to the A-zone groundwater.

For OU2, the exposure assumptions and risk assessment methods used at the time of remedy selection are still valid; however, there is some evidence that shows the remedy is not progressing towards the RAOs and may not achieve cleanup levels. Further discussion is provided below.

Changes in Standards and TBCs

There have been no changes in the ARARs or "to-be-considered" (TBCs) that would affect the protectiveness of the remedy. An ARARs review is documented in Appendix C.

Changes in Toxicity and Other Contaminant Characteristics

To evaluate the protectiveness of the cleanup levels for B-zone groundwater, the cleanup levels were compared to EPA's current Regional Screening Levels (RSLs), as shown in detail in Appendix D. The RSLs are chemical-specific concentrations for individual contaminants that correspond to an excess cancer risk level of $1x10^{-6}$ (or a Hazard Quotient of 1 for non-carcinogens), and they have been developed for a variety of exposure scenarios. RSLs are not de facto cleanup standards for a Superfund site, but they do provide a good indication of whether actions may be needed. The comparison concluded that the selected cleanup levels for chloroform, 1,2-dibromo-3-chloropropane, and 1,2,3-TCP were outside their respective cancer risk range. However, MCLs are considered protective and no cleanup levels are above the current MCL (as shown in Appendix C). Background concentrations for 1,2,3-TCP were also identified above the B-zone cleanup level, and the EPA. Concentrations of 1,2,3-TCP in the City of Arvin well CW-1 are similar to measured background concentrations. The results from recent sampling indicate there is no detectable chloroform and 1,2-dibromo-3-chloropropane in the City of Arvin drinking water wells. There is also no current exposure to contaminated water in the B-zone groundwater; however, the institutional controls for preventing exposure to B-zone groundwater have not yet been implemented.

Changes in Risk Assessment Methods

There have been changes in risk assessment methods that would affect protectiveness of the remedy.

Vapor intrusion was evaluated in the 2004 OU-2 RI/FS, and soil vapor sampling was performed in 2006 to evaluate whether there were complete exposure pathways on- and off-site. While there were detections of COCs in on-site and off-site samples, all detected constituents in the soil vapor samples were below the California Human Health Screening Levels (CHHSLs).

As part of this FYR the April 2015 A-zone groundwater concentrations nearest the warehouse (well WA-5) were compared to target groundwater concentrations for a cancer risk of $1x10^{-6}$ using EPAs Vapor Intrusion Screening Level (VISL) Calculator. Results indicate that there is no risk of vapor intrusion at the B&B Site outside of acceptable risk range.

Changes in Exposure Pathways

There have been no changes to exposure assumptions that could affect the protectiveness of the remedy.

A biological constraints analysis was performed in 2002 at the B&B Site. There are no significant ecological risks associated with OU-1 and OU-2; however, the caps and fence surroundings should continue to be inspected for possible animal burrows.

Additional details regarding exposure assumptions, toxicity data, and cleanup levels can be found in Appendix D.

Expected Progress Towards Meeting RAOs

For OU-1, the RAO to prevent human and ecological exposure to contaminated soil was attained with installation of the RCRA cap. Institutional Controls, as identified in the OU-1 ROD for the selected remedy, must be implemented to ensure that the response action remains protective of human health and the environment over the long term.

For OU-2, there is not sufficient data to determine if the remedy is progressing towards RAOs. The extraction system has been operating continuously since October 2015. The concentrations in the extraction wells show significant contaminant mass being removed; however, there have been spikes in contaminant concentrations for B-zone wells downgradient of the cap which indicate contamination is migrating from the A-zone to the B-zone. The furthest downgradient B-zone wells are also showing increasing trends which indicate that MNA may not be working as expected.

Background levels of 1,2,3- TCP are above its cleanup level of 0.5 µg/L; and therefore, the remedy may not be able to achieve the remedial action objectives for 1,2,3-TCP.

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

No, there is no other information that calls into question the protectiveness of the remedy. There have been no earthquakes or other natural disasters to impact the protectiveness of the remedy.

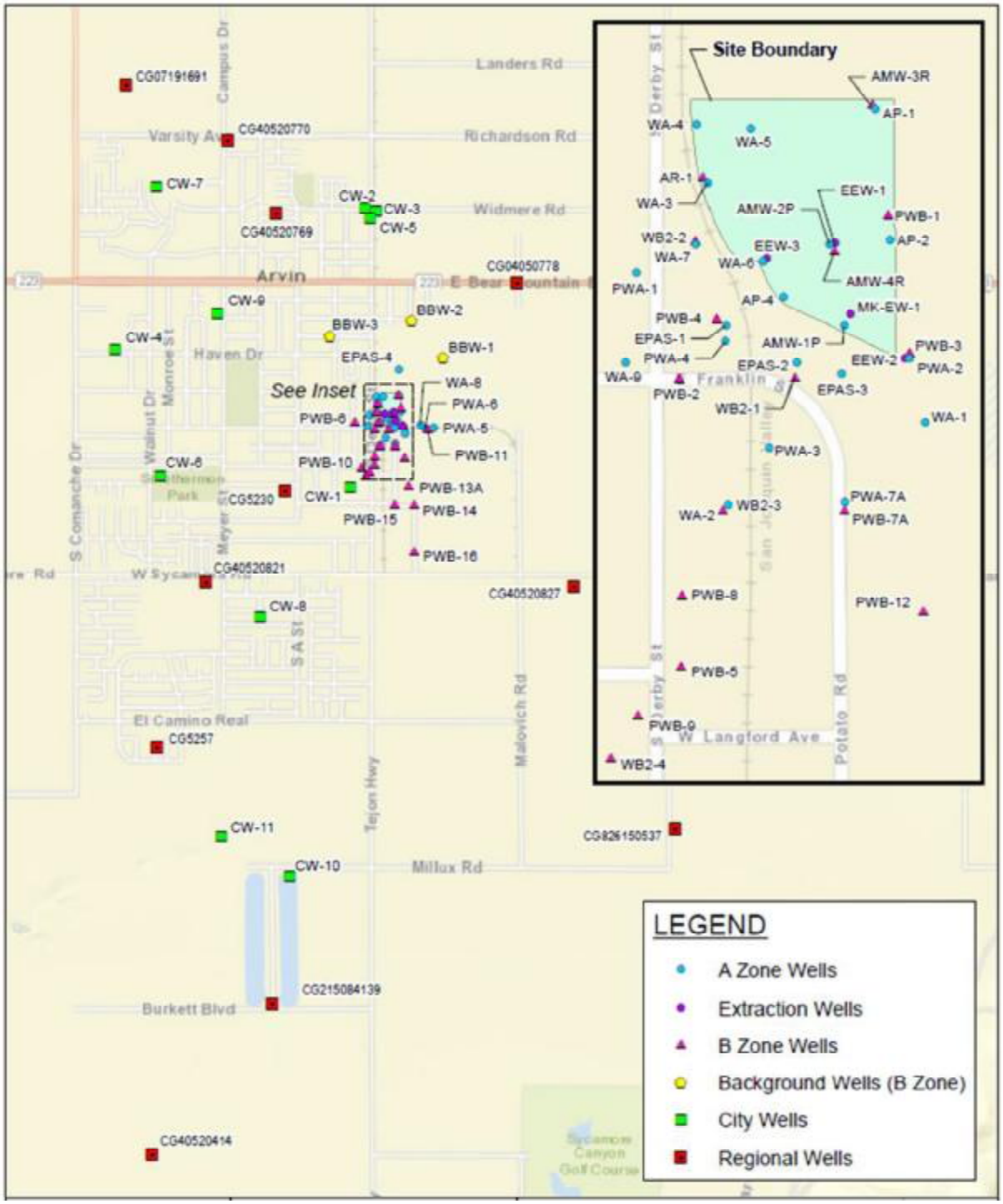

Figure from June 2014 Groundwater Sampling Report (CBI, 2015), and the Spring 2015 Groundwater Sampling Report (CBI, 2016).

Figure 3 Site Plan and Well Locations

6. Issues/Recommendations

Table 6. Issues and Recommendations Identified in this Five-Year Review

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 1	Issue Category: Institutional Controls			
	Issue: Institutional controls required by the OU-1 ROD, in the form of land use covenants prohibiting residential use and ensuring the integrity of the remedy, have not yet been implemented.			
	Recommendations: Implement institutional controls as specified in OU-1 ROD.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	DTSC/EPA	EPA	6/1/2021
OU(s): 2	Issue Category: Other			
	Issue: Abandonment of the Arvin City Well CW-1 required by the OU-2 ROD, has not yet been implemented. Properly abandoning this well will remove the threat of cross contamination from the A-zone and the B-zone to the C-zone, as this well has potential to be a conduit.			
	Recommendations: Work with Arvin Community Services District to relocate CW-1 and properly abandon the well in its current location.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	12/31/2016
OU(s): 2	**Issue Category: Institutional Controls**			
	Issue: Institutional controls required by the OU-2 ROD, in the form of land use controls on the Site and nearby properties to limit use of B-zone groundwater.			
	Recommendations: Implement institutional controls as specified in OU-2 ROD.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	6/1/2021
OU(s): 2	**Issue Category: Remedy Performance**			
	Issue: Downgradient B-zone wells show increasing trends which indicated MNA may not be sufficient to reduce concentrations in the B-zone to below drinking water standards.			
	Recommendations: Evaluate MNA and if needed, evaluate potential remedy alternatives for B-zone groundwater.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	6/1/2020
OU(s): 2	**Issue Category: Remedy Performance**			
	Issue: Background B-zone groundwater concentrations for 1,2,3-trichloropropane are above the selected cleanup levels.			
	Recommendations: Conduct an investigation to assess the impact of background concentrations on the ability for the remedy to be completed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	6/1/2020

OU(s): 2	Issue Category: Remedy Performance			
	Issue: Recent spike in 1,2-DCP concentrations in WB2-1 and trends in downgradient B-zone wells (e.g. PWB-13A, PWB-15 and PWB-16) have recently indicated increasing COC concentrations.			
	Recommendations: Investigate the increased concentrations of COCs to determine the source and whether MNA will be able to achieve the remedial action objectives with increased concentrations.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	6/1/2020

Recommendations that do not affect protectiveness of the Site include:

- Conduct more frequent monitoring of both the RCRA cap and basic cap to ensure that cracks are repaired in a timely manner;
- Clear the brush along the fence on a quarterly basis to ensure the integrity of the fence is visible; and
- Evaluate the causes of low yield in EEW-2. If possible, return EEW-2 into use to capture contamination near PWA-2.

7. Protectiveness Statement

Table 7. Protectiveness Statement

Protectiveness Statement(s)		
Operable Unit: OU-1-Soil	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: *The remedy at OU-1 currently protects human health and the environment because the RCRA cap and the basic cap are preventing exposure to contaminated surface soils. However, in order for the remedy to be protective in the long-term, the institutional controls must be implemented.*		
Operable Unit: OU-2-Groundwater	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* Click here to enter a date

Protectiveness Statement:
The remedy at OU-2 currently protects human health and the environment because the there is no exposure to the contaminated groundwater. However, to be protective in the long-term the following actions need to be taken:

- *Properly Abandon Arvin City well CW-1,*
- *Implement Institutional Controls,*
- *Evaluate the effectiveness of MNA,*
- *Conduct an investigation to determine if 1,2,3-TCP cleanup levels can be achieved below current background concentrations, and*
- *Investigate the source of the increase COC concentrations in the B-zone well, WB2-1.*

8. Next Review

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

Appendix A: List of Documents Reviewed

List of Documents Reviewed

CB&I (CB&I Federal Services). 2015. *Final June 2014 Groundwater Sampling Report Brown and Bryant Superfund Site*. November 2015.

CB&I. 2016. *Draft Spring 2015 Groundwater Sampling Brown and Bryant Superfund Site*. January 2016.

Eco & Associates, Inc. 2012a. *Site-Specific Work Plan Monitored Natural Attenuation*. January 2012.

Eco & Associates, Inc. 2012b. *Monitored Natural Attenuation Evaluation Report.* August 9, 2012.

Eco & Associates, Inc. 2013. *Draft Final Background Concentrations of B-zone Groundwater Chemicals of Concern Brown and Bryant Superfund Site*. December 2013.

Eco & Associates, Inc. 2014. *Memorandum: Reinstallation of BarCad Pumps and Surveying Activities*. December 2014.

Eco & Associates, Inc. 2015. *Extraction Wells and Extraction System Installation Report*. February 2015.

EPA (Environmental Protection Agency). 1993. *Superfund Record of Decision Brown and Bryant, Inc. EPA/ROD/R09-94/108*. November 1993.

EPA. 2007. *Record of Decision Brown and Bryant Operable Unit No. 2 Superfund Site*. September 2007.

GSI Environmental Inc. 2006. *Monitoring and Remediation Optimization System (MAROS), Version 2.2*. Software available at: http://www.gsi-net.com/en/software/free-software/monitoring-and-remediation-optimization-systems-maros-version-3-0.html.

Panacea, Inc. 2004. *Baseline Human Health Risk Assessment Final Brown and Bryant Superfund Site*. June 2004.

URS. 2012a. *Brown & Bryant, Arvin Site, Revised O & M Manual-Final*. January 2012.

URS. 2012b. *Operations and Maintenance Summary Report Brown and Bryant, Arvin Facility Superfund Site, First Operable Unit Remedial Action*. May 2012.

URS. 2014. *Cap Repair Summary Report Brown and Bryant Superfund Site*. September 2014.

URS. 2015. *Cap Repair Summary Report Brown and Bryant Superfund Site*. October 2015.

USACE (U.S. Army Corps of Engineers). 2011. U.S. Army Corps of Engineers. *Final Remedial Action Completion Report Operable Unit No. 1 Brown and Bryant Superfund Site*. September 2011.

USACE. 2011. *Third Five Year Review Report for Brown and Bryant Superfund Site*. September 2011.

Appendix B: Data Review

Data Review Appendix

This appendix focuses on an assessment of the effectiveness of the RCRA cap in preventing infiltration of precipitation and protecting shallow groundwater from further degradation, as determined by an evaluation of trends in the groundwater concentrations of several of the contaminants of concern. Data from 2011 to 2015 were used in this analysis as presented in the following reports:

- Groundwater Sampling Reports for:
  - April 2011, spring 2012, October 2012 by Eco & Associates,
  - June 2014 and spring 2015 by CBI Federal Services.
- Groundwater Sampling and Analysis Report for City Wells prepared by Eco & Associates, September 2012;
- Monitored Natural Attenuation Report for the Brown & Bryan Superfund Site, prepared by Eco & Associates, August 2012.

An assessment of data trends was also performed using the Mann-Kendall test for trend as implemented in the Monitoring and Remediation Optimization System (MAROS) software. MAROS also calculates the total mass, the location of the center of mass, and mass spread in what is termed a "moment analysis." A detailed discussion of the moment analysis is provided. This analysis is also compared to the trend analysis performed for the period of 2002 to 2009 that was presented in the previous Five Year Review (FYR).

1. Background

The Brown & Bryant Arvin facility is located at 600 South Derby Street in Arvin, California, about 18 miles southeast of the City of Bakersfield. Pesticides and other agricultural chemicals were stored and produced here between 1960 and 1989. Over the course of the operation at the site, these chemicals were released into the soil and groundwater beneath the facility. Operations ceased in 1989 and the site was added to the National Priority List that same year. Currently, the site is vacant with the exception of a groundwater extraction system.

The primary chemicals of concern (COCs) found at the Brown and Bryant Superfund Site (B&B Site or the Site) are:

- Chloroform;
- 1,2-Dibromo-3-chloropropane (DBCP);
- 1,2-Dichloropropane (1,2-DCP);
- 1,3-Dichloropropane (1,3-DCP);
- 1,2,3-Trichloropropane (1,2,3-TCP);
- Ethylene dibromide (EDB); and
- Dinoseb.

Groundwater at the Site is divided into three zones: The A-zone consists of the unsaturated soil and lenses of perched water, and it has limited lateral extent. The next-deeper B-zone ends at the top of a thick clay layer; B-zone groundwater flows in a south-southwesterly direction toward the City of

Arvin drinking water supply well CW-1 (which draws from the C-zone as do all city wells). The C-zone consists of all soil and groundwater beneath the thick clay layer; City of Arvin water supply wells draw from the C-zone.

The specific remedial action objective for the B&B Site groundwater is to:

- remove or control COCs in the A-zone groundwater such that it is no longer a source of contamination to B-zone and C-zone groundwater,
- restore the B-zone groundwater to its potential beneficial use as drinking water aquifer, and
- prevent potential exposure to contaminated groundwater.

A-zone groundwater is a source of contamination to the B-zone groundwater. The goal for the A-zone groundwater is to control the migration of contaminants by controlling the groundwater flow or reducing the concentrations of COCs in the A-zone to the extent that it is no longer a threat to the B-zone groundwater. Table B-1 shows the cleanup ranges for the A-zone groundwater and the cleanup levels for the B-zone groundwater.

Table B-1. Contaminants of Concern and Cleanup Levels

Contaminant of Concern	A-zone Groundwater Cleanup Range (µg/L)[1]	B-zone Groundwater Cleanup Levels (µg/L)
1,2-Dichloropropane (1,2-DCP)	50-500	5
1,3-Dichloropropane (1,3-DCP)	5-50	0.5
1,2,3-Trichloropropane (TCP)	5-50	0.5
Chloroform	800-8,000	80
Dinoseb	70-700	7
1,2-Dibromo-3-chloropropane (DBCP)	2-20	0.2
Ethylene Dibromide (EDB)	0.5-5.0	0.05

Notes: Table adapted from the 2007 ROD
[1]micrograms per liter

Although the B-zone aquifer is not currently used as a drinking water source, it is classified as a potential drinking water source.

The components of the selected remedy for the groundwater operable unit (OU) are presented below.

- Properly abandon the existing Arvin well CW-1 and locate a replacement well a suitable distance from the B&B Site.
- An extraction system in the shallow A-zone aquifer.
- MNA of the B-zone. If monitoring data indicate that the COC levels do not continue to decline, as estimated in the fate and transport model, EPA and the California Department of Toxic Substances Control (DTSC) will reconsider the remedy decision.

- Place institutional controls on the Site and nearby properties to limit use of B-zone groundwater.

The A-zone groundwater extraction system was installed at the Site and became operational in January 2014. Groundwater is currently being pumped from three extraction wells (EEW-1, MK-EW-1, and EEW-3; see Figure B-1) and stored in two 4,000-gallon tanks located within the warehouse awaiting off-site transportation to an appropriate Class I hazardous waste disposal facility.

Impacted groundwater beneath the Site is found in the A-zone and the B-zone. The A-zone includes unsaturated soil from 65 to 75 feet below ground surface (bgs). The depth to the saturated zone varies between 65 and 88 feet bgs. The water is perched on a thin sandy clay layer between 75 and 85 feet bgs. The clay that forms the perching layer is laterally discontinuous and pinches out south, east and west of the Site. The saturated thickness of the A-zone groundwater ranges from 0 to 10 feet. The groundwater velocity in the A-zone has been estimated at 53 feet per year. Slug test results suggest that a yield of less than 100 gallons per day can be expected for wells in the A-zone. Aquifer testing of three of the on-Site extraction wells showed a groundwater yield of approximately 0.25 gallon per minute (gpm). Operational data for the extraction wells indicated the sustainable flow rates are lower than those observed during testing.

The B-zone aquifer comprises a series of water-bearing units. Wells in the B-zone were installed in the water-bearing units located at approximately 145 feet bgs and 170 feet bgs. The direction of flow in the water-bearing unit at 170 feet bgs is not consistent, though generally to the south, and the gradient is flat (0.0004). The B-zone may have differentiated layering of sandy zones and the flow in this zone may vary amongst its sub-zones. Permeabilities are much higher than for the A-zone groundwater. Past pump tests for the water-bearing unit at 170 feet bgs indicated that wells could be pumped at 7 gpm for an extended period.

Groundwater Levels

Groundwater levels in the A-zone perched aquifer have fallen since the last FYR, but flow direction continues to be from the north and from the south of the Site toward a pair of aquifer lows, located immediately south of the Site (see Figure B-2). The low levels of precipitation recorded in California, including Kern County, since approximately 2011 appears to be reflected in the groundwater elevations recorded in the A-zone wells. Groundwater in most measured wells decreased by 0 to 3 feet. Wells with groundwater elevation decreasing more than 4 feet include PWA-2 and PWA-6 east of the Site, and WA-2 south of the Site. Between thirteen to fifteen wells could not be measured at any given sampling event in the last five years, because the water levels fell below the depths of BarCad units (groundwater sampling devices installed in selected wells) or recharge was too slow to meet appropriate sampling protocol. Six of the thirteen fell below the device depths since the last FYR analysis in 2011. The well experiencing the least severe decline (only 1.84 feet) within the A-zone is well EPAS-1, which is also located south of the Site. The potentiometric surface in the A-zone shows a low point at EPAS-1 (344.96 feet, mean sea level). The lack of significant decline in this location may be due to the presence of fine-grain impermeable strata limiting vertical flow. Further

evaluation of the lithology in the area should be undertaken before further remedial activities are taken, to better understand any aquifer connectivity.

B-zone groundwater levels have followed a different set of trends than those seen in the A-zone. B-zone wells had their lowest elevations in 1995, then steadily increased to peak in 2012, and then have declined 2 to 3 feet since 2012. Groundwater flow in the B-zone is generally to the south, albeit with some complexity (Figure B-3). There is some uncertainty regarding the B-zone potentiometric surface due to the limited number of wells in this zone and due to well screen placement within the isolated heterogeneous zones.

2. Groundwater Quality Monitoring

A-zone

Table B-3 presents the analytical results for the COCs reported in groundwater samples collected from the A-zone from April 2009 through April 2015. The Site plan and location of A-zone wells are shown in Figure B-2. Isoconcentration maps (contours) were plotted for COCs with sufficient data: 1,2-DCP, 1,2,3-TCP, and dinoseb (Figures B-4, B-5, and B-6, respectively). Because the goal of the extraction system is to dewater the A-zone, several monitoring wells surrounding the extraction wells have no measureable levels of groundwater and cannot be sampled. In order to supplement these data gaps, the April 2015 extraction well results were included in the generation of the A-zone isoconcentration maps to better represent the likely extent of the plume.

Overall, COC concentrations in the A-zone are decreasing. The Mann-Kendall trends and moment analysis show that the contaminant plumes are shrinking in volume and not migrating, suggesting that a) the extraction wells that have been in continuous operation since January 2014 are extracting at a pumping rate that exceeds the recharge rate for this aquifer, b) the asphalt cap is limiting recharge into the A-zone and, in turn, the A-zone is becoming a reduced source of contamination to the B-zone. The possibility of the plumes extending beyond the Site needs to be considered following each sampling event. There are still concentrations of COCs that exceed the A-zone cleanup goal range in monitoring wells EPAS-3, PWA-2, and WA-3. EPAS-3 and PWA-2 are 100 feet south (downgradient) of the RCRA cap and 150 feet from the closest extraction well.

The area of perched water in the A-zone is shrinking as indicated by the falling water levels. It is not clear if this is a result of the cap, the extraction pumping, or the drought. Additional data can be collected with the modified pilot testing of the enhancements, at least in critical locations (that is, near the former sump location).

B-zone

Table B-4 presents the analytical results for the COCs reported in groundwater samples collected from the B-zone from April 2009 through April 2015. The Site plan and location of B-zone wells are shown in Figure B-3. Isoconcentration maps (contours) were plotted for COCs with sufficient data: 1,2-DCP; 1,2,3-TCP; DBCP; and dinoseb (Figures B-7 through B-10, respectively).

Contaminant concentrations in the B-zone were generally consistent over the last five years; however results from monitoring wells PWB-13A, PWB-15, and PWB-16 indicate that contamination may be migrating downgradient. In conjunction with the recent increased COC concentrations in monitoring well WB2-1, MNA may not be sufficient to reach cleanup levels. Although MNA was evaluated in 2012 (Eco & Associates, 2012b), Site conditions have changed and additional sampling and an MNA analysis should be conducted. In addition, 1,2,3-TCP background concentrations were evaluated in 2013 and results indicate that background concentrations are higher than selected cleanup levels for B-zone.

Monitoring well WB2-1 is near the south boundary of the Site and the presumed location of the connection between the A-zone and B-zone. Recent modeling shows that there is vertical movement of groundwater between the A-zone and B-zone just north of WB2-1. Dramatically increased concentrations of three of the five COCs (1,2-DCB; 1,2,3-TCP; and dinoseb) beginning in 2014 indicate that contamination from the A-zone has migrated to the B-zone. The well was re-sampled three months after the initial discovery of the increased results confirming the high concentrations. The extraction wells came on-line in 2014, but there is no other information or discovery that might explain the sudden increase in contaminant concentrations in well WB2-1. Additional sampling may be needed to determine if MNA will be sufficient for the recent increase in contamination in the B-zone considering there is no alternative remedial action selected for if MNA is unsuccessful.

Downgradient of the, wells PWB-13A, PWB-15, and PWB-16 showed increases in concentrations for several COCs during the last five years. The Mann-Kendall trends and moment analysis show that the areas of the contaminant plumes are spreading as shown in Attachment A-6 of Appendix B. However, the concentrations within the plumes are generally stable or decreasing. The increased area of spreading may be the results of variations the plume margins.

MNA of the B-zone was evaluated in 2012 (Eco & Associates, Inc., 2012b). The evaluation shows that all COCs appear to be naturally attenuating. Along the flow path to the south, the attenuation is expected to take another 30 years or more. There is less contamination along the flow path to the southwest and this will likely attenuate over the next 10 to 15 years. Based on the trend analysis presented in this report, the natural attenuation processes appear to be contributing to the degradation of COCs in B-zone aquifer. The concentrations of COCs in most of the groundwater monitoring wells show a statistically significant negative trend for most of the COCs (Eco & Associates, Inc., 2012b). In review of the data since 2012, COC concentrations in the downgradient B-zone wells suggest that the predominant natural attenuation mechanisms appear to be dispersion/natural flushing as opposed to biodegradation. The decreasing trends in the A-zone wells, plus the dry wells with previously significant contaminant concentrations, may reflect decreasing mass flux to the B-zone; however concentrations in WB2-1 may suggest otherwise.

Since the background wells were installed in 2012, they have been reported to contain COCs, which suggests that contaminants may have migrated onto the Site from up-gradient sources. During the April 2015 sampling, 1,2,3-TCP was reported in groundwater samples collected from each of the background wells BBW-1 (1.4 µg/L), BBW 2 (0.044 µg/L), and BBW 3 (0.0075 µg/L). The detections

reported from these well are much lower than the concentrations of 1,2,3-TCP found in on-Site wells, however are still above the selected cleanup level of 0.5 µg/L. Chloroform was also detected in background well BBW-3 at 0.39 µg/L, (below the B-zone cleanup level). Chloroform detections are frequent across the area and do not represent a definable plume. The presence of chloroform may be related to leakage of chlorinated drinking water or similar sources. Chloroform may need to be reconsidered and perhaps eliminated as an MNA indicator.

City Well CW-1

The municipal water and irrigation supply, including CW-1, uses the C-zone aquifer. These wells, although not screened in the B-zone, may include gravel pack intervals that include the B-zone. The completion of screen/gravel pack intervals within both the B-zone and C-zone represents a potential mechanism for vertical mixing of groundwater between otherwise isolated units.

The Arvin Water District operates 11 water supply wells (CW-1 through CW-11) in the Arvin, California area. Seven of the 11 wells (CW-1, CW-5, CW-6, CW-8, CW-9, CW-10, and CW-11) were sampled monthly until March 2013, and since then have been sampled coincident with the sampling of Site monitoring wells. Well CW-1 is the only water supply well potentially located in the path of the groundwater contaminants from the B&B Site (see Figures B-5 through B-10).

The results show that 1,2,3-TCP, in well CW-1, is the only COC reported in concentrations above its drinking water Notification Level of 0.005 µg/L; however, the concentrations are below the cleanup level of 0.5 µg/L.

A-Zone Groundwater Extraction System Performance

As of February 2016, approximately 48,000 gallons of A-zone groundwater had been extracted, temporarily stored, and transported off-site for disposal. The extraction wells are successfully removing contamination from the A-zone. All extraction wells continue to have COC concentrations above the MCL, except for EDB in EEW-1 and EEW-3. Results from the April 2015 sampling event are presented in Table B-2. Extracted COC concentrations have been generally decreasing since March 2014. This could be a result of the extraction system reducing the mass of contamination.

Table B-2. A-Zone Extraction Well Results for April 2015

Analyte	MCL (µg/L)	Concentration (µg/L)		
		EEW-1	EEW-3	MK-EW-1
1,2-DCP	5	40,000	17,000	1,400
1,3-DCP	0.5	75	6.1	2
1,2,3-TCP	0.5	2,400	940	200
Chloroform	80	22	24	6.5
DBCP	0.2	77	50	24
Dinoseb	7	43	200	5,600
EDB	0.05	ND	ND	57

A key component of the OU-2 remedy is groundwater extraction to prevent further vertical migration from the "hot" A-zone into the B-zone where downgradient groundwater migration occurs. Because of the major drop in the water table over recent years the pumping rates from the A-zone extraction wells are very low (around 0.25 gpm on average). It is uncertain what degree of influence operating these extraction wells have on A-zone groundwater levels and vertical migration control (e.g., radius of capture, level of dewatering). An analysis needs to be performed by the project team during this next FYR period to address these uncertainties.

Table B-3. Analytical Results for Chemicals of Concern in A-Zone Wells

Well No.	Chemical	Apr 09	Apr 11	Oct 11	Apr 12	Oct 12	Apr 13	Dec 13	Jun 14	15-Apr	A-zone Clean- up Goal (µg/L)
EPAS-1	1,2-DCP	**2,400**						34.0	13.0	19.0	50-500
	1,3-DCP	1.40						<0.2	<0.2	<0.05	5-50
	1,2,3-TCP	**250**						**97.0**	**90.4**	**70.0**	5-50
	Chloroform	15.0						0.79	1.60	7.50	800-8k
	DBCP	6.70						3.00	2.60	1.80	2-20
	Dinoseb	20.0						18.0	14.0	12.0	70-700
	EDB	<0.02						<0.02	<0.02	<0.05	0.5-5
EPAS-2	1,2-DCP	**520**	**51.0**	28.0	32.0	29.0	27.0	32.0	34.0	42.0	50-500
	1,3-DCP	1.80	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.05	5-50
	1,2,3-TCP	31.0	5.40	3.80	4.10	5.60	5.00	4.10	4.80	4.8	5-50
	Chloroform	1.30	1.90	3.50	2.70	2.80	3.70	3.50	3.20	3.10	800-8k
	DBCP	4.30	1.30	0.98	0.91	0.89	0.98	0.64	0.81	1.00	2-20
	Dinoseb	32.0	7.10	5.30	5.80	7.70	5.30	5.10	5.60	5.7	70-700
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	0.5-5
EPAS-3	1,2-DCP	**9,200**	**7,200**	**5,700**	**600**	**4,500**	**4,200**	**3,600**	**3,500**	**3,000**	50-500
	1,3-DCP	15.0	9.40	8.80	6.80	5.60	5.10	4.70	3.40	4.1	5-50
	1,2,3-TCP	**940**	**770**	**760**	**570**	**660**	**620**	**68.0**	**570**	**510.0**	5-50
	Chloroform	9.10	6.20	5.10	5.10	4.40	3.90	4.30	3.30	3.20	800-8k
	DBCP	**530**	**370**	**380**	**260**	**240**	**240**	**<0.02**	**240**	**260.00**	2-20
	Dinoseb	**2,300**	**700**	**1,100**	**1,100**	**1,400**	**1,100**	**840**	**1,500**	**730**	70-700
	EDB	**6.60**	4.00	4.20	2.90	3.00	<0.02	2.20	2.10	1.7	0.5-5
WA-1	1,2-DCP	<0.2	0.96	0.97	<0.2	0.21	<0.2	0.23	<0.2	<1	50-500
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	5-50
	1,2,3-TCP	0.55	1.50	1.10	0.42	1.50	0.67	1.10	0.88	1.00	5-50
	Chloroform	6.60	4.80	3.30	3.30	3.70	4.50	4.50	3.10	4.60	800-8k
	DBCP	0.016	0.068	0.076	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	2-20
	Dinoseb	0.060	0.44	0.50	<0.2	0.35	<0.2	<0.2	<0.2	<0.4	70-700
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	0.5-5
WA-3	1,2-DCP	2.50		1.70	1.80	2.30	1.40	1.00	0.98	0.21J	50-500
	1,3-DCP	<0.2		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	5-50
	1,2,3-TCP	**100.0**		**87.0**	**78.0**	**140**	**86.0**	**68.0**	**65.0**	**52.0**	5-50
	Chloroform	<0.2		0.40	0.52	0.50	0.47	0.37	0.38	<1	800-8k
	DBCP	**2.80**		1.20	0.99	1.10	0.80	0.54	0.46	0.26	2-20
	Dinoseb	**69.0**		36.0	38.0	41.0	35.0	22.0	31.0	6.7	70-700
	EDB	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	0.5-5

Table B-3. Analytical Results for Chemicals of Concern in A-Zone Wells Continued

Well No.	Chemical	Apr 09	Apr 11	Oct 11	Apr 12	Oct 12	Apr 13	Dec 13	Jun 14	15-Apr	A-zone Cleanup Goal (µg/L)
WA-5	1,2-DCP	3.30	5.60	4.90	5.10	5.10	5.50	6.40	6.50	5.30	50-500
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	5-50
	1,2,3-TCP	0.18	0.23	0.22	0.26	0.39	0.42	0.85	0.49	0.50	5-50
	Chloroform	<0.2	0.33	2.30	0.37	0.39	0.46	0.55	0.59	0.56	800-8k
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	2-20
	Dinoseb	0.010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	70-700
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	0.5-5
PWA-2	1,2-DCP	5,200	8,000	7,700	860	6,600	6,000	2,600	2,000	2,400	50-500
	1,3-DCP	9.10	13.0	12.0	9.60	8.90	9.10	3.40	2.70	3.40	5-50
	1,2,3-TCP	710	1,200	1,100	960	1,100	1,100	360	350	430	5-50
	Chloroform	8.50	11.0	10.00	8.50	9.70	9.00	4.20	3.30	3.70	800-8k
	DBCP	250	340	390	300	310	480	140	140	180	2-20
	Dinoseb	8,300	6,700	6,200	7,800	9,100	7,500	2,600	4,700	24,000	70-700
	EDB	140	99.0	110	64.0	81.0	100.0	54.0	37.0	37.0	0.5-5
PWA-3	1,2-DCP	<0.2	0.67	0.42	0.30	0.33	0.32	0.26	0.32	0.26	50-500
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	5-50
	1,2,3-TCP	<0.0025	<0.0025	0.094	0.085	0.11	0.088	0.065	0.076	0.073	5-50
	Chloroform	1.40	3.50	4.40	5.20	5.90	8.80	12.0	12.0	11.0	800-8k
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	2-20
	Dinoseb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	70-700
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	0.5-5
PWA-7A	1,2-DCP		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	50-500
	1,3-DCP		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	5-50
	1,2,3-TCP		0.51	0.48	0.47	0.67	0.51	0.46	0.44	0.52	5-50
	Chloroform		<0.2	<0.2	<0.2	<0.2	<0.2	0.24	0.20	0.28	800-8k
	DBCP		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	2-20
	Dinoseb		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	70-700
	EDB		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	0.5-5

Notes:
- Blank cell means the sample was not collected because the well was not installed, was dry, or was no longer present.
- Reported results highlighted yellow are in excess of the Cleanup Goal for that compound.
- Reported results highlighted grey are results reported as qualified by the laboratory.
- All results are reported in micrograms per liter.

µg/L = micrograms per liter;
"<" = non-detect analytes reported as less than the level of detection (LOD).

Source: CBI Federal Services. *Draft Spring 2015 Groundwater Sampling Brown and Bryant Superfund Site*. January 2016.

Table B-4. Analytical Results for Chemicals of Concern in B-Zone Wells

Well No.	Chemical	Apr 09	Apr 11	Oct 11	Apr 12	Oct 12	Apr 13	Dec 13	Jun 14	Sep 14	Apr 15	B-zone Cleanup Level (µg/L)
AR-1	1,2-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.80	<0.2		<1	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.18	0.11	0.13	0.15	0.14	0.054	0.65	0.063		0.068	0.5
	Chloroform	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
AMW-3R	1,2-DCP	<0.2	0.31	0.22	0.31	0.32	0.25	0.37	0.32		0.51J	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.23	0.21	0.20	0.30	0.21	0.19	0.22	0.23		0.24	0.5
	Chloroform	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	0.042	<0.02	<0.02	<0.02	<0.02	<0.02	0.28	<0.02		<0.05	0.2
	Dinoseb	0.010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
AMW-4R	1,2-DCP	2.50	0.68	0.65	0.62	0.47	0.54	0.52	5.50		0.37	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.41	0.34	0.36	0.38	0.55	0.38	0.45	0.33		0.23	0.5
	Chloroform	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	0.035	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	0.13	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
WB2-1 *	1,2-DCP	1.90	1.00	0.67	0.56	0.60	0.55	0.49	800	1700	950	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	0.5
	1,2,3-TCP	4.30	1.70	1.50	1.20	1.10	1.10	0.84	190	170	88	0.5
	Chloroform	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	22	27	17	80
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.044	0.03	0.023J	0.2
	Dinoseb	0.62	0.28	<0.2	<0.2	<0.2	<0.2	<0.2	26	32	18	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	0.05
WB2-2	1,2-DCP	11.0	10.00	1.30	2.40	0.99	0.67	1.00	0.80		0.72	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	40.0	35.0	12.0	11.0	9.30	5.50	3.30	2.80		2.30	0.5
	Chloroform	0.50	0.53	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	3.10	1.50	0.56	0.42	0.30	0.18	0.50	0.089		0.067	0.2
	Dinoseb	12.0	4.30	1.70	1.70	0.90	0.52	0.12	0.28		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05

Table B-4. Analytical Results for Chemicals of Concern in B-Zone Wells Continued

Well No.	Chemical	Apr 09	Apr 11	Oct 11	Apr 12	Oct 12	Apr 13	Dec 13	Jun 14	Sep 14	Apr 15	B-zone Clean up Level (µg/L)
WB2-3	1,2-DCP	0.85	4.80	3.60	2.00	1.10	0.71	0.72	0.49		0.50	5
	1,3-DCP	<0.2	0.22	0.23	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.075	0.72	1.10	0.62	0.50	0.37	0.30	0.19		0.28	0.5
	Chloroform	<0.2	0.22	0.52	0.56	0.52	0.37	0.35	<0.2		<1	80
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	0.080	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
WB2-4	1,2-DCP	1.80	1.70	1.40	1.50	1.60	1.80	1.40	1.60		1.50	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.067	0.079	0.076	0.072	0.10	0.10	0.078	0.072		0.074	0.5
	Chloroform	<0.2	0.24	0.42	0.28	0.32	0.41	0.30	0.42		0.74	80
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	0.020	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02		<0.05	0.05
PWB-1	1,2-DCP	<0.2	0.37	0.27	0.23	0.25	<0.2	0.41	<0.2		<1	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.28	0.17	0.13	0.11	0.15	0.15	0.35	0.15		0.11	0.5
	Chloroform	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-2	1,2-DCP	18.0	21.0	19.0	11.0	6.60	3.60	1.30	1.10		1.10	5
	1,3-DCP	<0.2	2.00	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.22	0.25	2.10	1.30	1.10	0.77	0.20	0.094		0.044	0.5
	Chloroform	5.70	5.00	5.00	3.80	2.10	0.91	0.29	0.39		0.51	80
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	<0.2	<0.2	0.61	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-3	1,2-DCP	0.43	0.34	0.27	0.27	0.25	<0.2	0.27	0.57		0.28	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.27	0.25	0.24	0.085	0.28	0.22	0.23	0.34		0.26	0.5
	Chloroform	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	0.013	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	0.018	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05

Table B-4. Analytical Results for Chemicals of Concern in B-Zone Wells Continued

Well No.	Chemical	Apr 09	Apr 11	Oct 11	Apr 12	Oct 12	Apr 13	Dec 13	Jun 14	Sep 14	Apr 15	B-zone Cleanup Level (µg/L)
PWB-4	1,2-DCP	16.0	4.20	3.40	3.50	3.40	3.00	2.60	2.90		14.0	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	70.0	19.0	12.0	13.0	14.0	13.0	13.0	14.0		48.0	0.5
	Chloroform	1.20	0.35	0.31	0.28	0.30	0.27	0.28	0.35		7.30	80
	DBCP	4.10	0.37	0.25	0.27	0.26	0.21	1.30	0.26		0.30	0.2
	Dinoseb	9.00	2.00	1.10	0.91	0.81	0.68	0.29	0.55		7.50	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-5	1,2-DCP	4.00		3.50	2.80	2.10	2.30	2.40	3.20		1.90	5
	1,3-DCP	<0.2		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	2.50		20.0	15.0	13.0	11.0	9.70	14.0		17.0	0.5
	Chloroform	1.30		0.48	0.37	0.33	0.40	0.53	0.93		0.70	80
	DBCP	0.40		0.68	0.54	0.42	0.33	1.50	0.31		0.45	0.2
	Dinoseb	0.43		7.00	1.90	1.00	0.87	0.37	1.60		1.90	7
	EDB	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-6	1,2-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<1	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.58	<0.0025	0.0047	<0.0025	0.0027	<0.0025	0.0032	<0.0025		0.0053	0.5
	Chloroform	<0.2	<0.2	0.24	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	0.096	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-7A	1,2-DCP	<0.2	7.80	12.0	12.0	17.0	14.0	24.0	2.60		13.0	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	75.0	26.0	32.0	37.0	55.0	38.0	64.0	82.0		50.0	0.5
	Chloroform	<0.2	<0.2	0.36	0.39	0.54	0.55	1.10	<0.2		0.81	80
	DBCP	31.0	1.30	0.89	0.93	1.30	0.74	12.0	0.92		0.83	0.2
	Dinoseb	51.0	<0.2	11.0	23.0	17.0	8.20	1.00	9.70		7.70	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-8	1,2-DCP	1.60	2.20	1.70	2.10	2.70	2.50	2.30	1.70		1.40	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	<0.0025	6.50	7.70	8.40	13.0	11.0	7.30	4.30		3.20	0.5
	Chloroform	0.61	0.48	0.46	0.31	0.39	0.42	0.76	0.59		0.45	80
	DBCP	<0.02	0.72	0.41	0.54	0.51	0.26	0.67	0.16		0.19	0.2
	Dinoseb	0.041	1.00	1.20	1.20	1.10	0.82	0.081	0.36		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05

Table B-4. Analytical Results for Chemicals of Concern in B-Zone Wells Continued

Well No.	Chemical	Apr 09	Apr 11	Oct 11	Apr 12	Oct 12	Apr 13	Dec 13	Jun 14	Sep 14	Apr 15	B-zone Clean up Level (µg/L)
PWB-9	1,2-DCP	<0.2	1.10	1.80	0.46	0.63	1.30	0.81	1.30		1.30	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	<0.0025	3.00	4.70	1.90	3.40	2.50	1.50	1.90		2.80	0.5
	Chloroform	<0.2	<0.2	0.22	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	<0.02	0.030	0.046	0.030	<0.02	0.024	0.62	0.020		0.04	0.2
	Dinoseb	<0.2	1.20	1.40	0.66	0.77	0.46	0.033	0.52		1.20	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-10	1,2-DCP	1.70	0.36	0.37	0.30	0.41	0.39	0.52	0.41		0.40	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	1.60	0.33	0.23	0.32	0.49	0.50	0.41	0.40		0.56	0.5
	Chloroform	<0.2	<0.2	0.22	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	0.18	0.037	0.021	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	0.36	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-11	1,2-DCP	1.10	0.73	0.74	0.68	0.68	0.66	0.56	0.54		0.49	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	4.00	3.30	3.30	3.00	3.70	3.60	2.70	3.90		4.10	0.5
	Chloroform	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.69	<0.02		<0.05	0.2
	Dinoseb	0.97	0.45	0.47	0.38	0.35	0.42	<0.2	0.64		0.77	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-12	1,2-DCP	5.20	4.70	5.40	4.00	4.60	4.40	5.30	5.10		4.40	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	17.0	17.0	18.0	14.0	20.0	22.0	21.0	19.0		19.0	0.5
	Chloroform	0.38	0.64	1.00	0.74	0.78	0.56	0.47	0.56		0.46	80
	DBCP	2.10	2.90	3.10	2.70	2.60	3.30	3.60	3.20		3.20	0.2
	Dinoseb	16.0	25.0	24.0	44.0	27.0	25.0	26.0	25.0		21.0	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-13A	1,2-DCP	23.0	19.0	17.0	13.0	11.0	11.0	11.0	8.40		9.9	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	7.90	8.20	8.00	8.60	15.0	15.0	15.0	11.0		9.4	0.5
	Chloroform	21.0	20.0	20.0	16.0	14.0	14.0	14.0	12.0		16	80
	DBCP	0.13	<0.02	0.45	0.86	1.30	1.20	3.20	1.40		0.81	0.2
	Dinoseb	0.49	1.10	1.20	1.60	4.30	2.80	2.20	1.40		0.69	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05

Table B-4. Analytical Results for Chemicals of Concern in B-Zone Wells Continued

Well No.	Chemical	Apr 09	Apr 11	Oct 11	Apr 12	Oct 12	Apr 13	Dec 13	Jun 14	Sep 14	Apr 15	B-zone Cleanup Level (µg/L)
PWB-14	1,2-DCP	29.0	21.0	20.0	18.0	17.0	16.0	17.0	13.0		14.0	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	5.90	3.30	3.00	2.70	3.90	3.10	2.90	2.50		2.50	0.5
	Chloroform	8.70	9.20	10.00	10.00	10.00	9.90	11.0	9.60		13.00	80
	DBCP	1.10	0.35	0.33	0.27	0.20	0.15	0.30	0.11		0.09	0.2
	Dinoseb	0.75	0.52	0.79	0.33	0.24	<0.2	0.13	0.22		0.24	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-15	1,2-DCP	5.00	5.30	6.20	6.30	7.90	6.50	8.10	6.10		6.70	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	0.45	0.30	0.27	0.53	1.20	1.20	1.20	1.20		1.40	0.5
	Chloroform	19.0	13.0	12.0	9.60	8.70	6.50	8.20	6.70		8.20	80
	DBCP	<0.02	<0.02	<0.02	0.036	0.11	0.11	0.56	0.16		0.16	0.2
	Dinoseb	<0.2	<0.2	<0.2	<0.2	0.36	0.38	0.13	0.51		0.38J	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
PWB-16	1,2-DCP	8.10	10.00	9.70	9.10	8.60	7.40	8.50	7.80		9.10	5
	1,3-DCP	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP	3.00	2.50	2.60	2.60	3.90	2.90	3.50	3.80		3.50	0.5
	Chloroform	1.00	1.10	1.50	1.10	0.93	0.95	0.84	0.72		1.20	80
	DBCP	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb	<0.2	0.72	0.85	0.37	<0.2	<0.2	<0.2	<0.2		0.6	7
	EDB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
BBW-1	1,2-DCP				0.52	0.51	0.37	0.24	0.22		<1	5
	1,3-DCP				<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP				0.49	0.44	0.36	0.32	0.35		1.40	0.5
	Chloroform				<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP				<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb				<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB				<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
BBW-2	1,2-DCP				0.72	0.67	0.99	0.90	1.10		<1	5
	1,3-DCP				<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP				0.93	0.74	0.99	1.10	2.00		0.04	0.5
	Chloroform				<0.2	<0.2	<0.2	<0.2	<0.2		<1	80
	DBCP				<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb				<0.2	<0.2	<0.2	<0.2	<0.2		<0.4	7
	EDB				<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05
BBW-3	1,2-DCP				<0.2	<0.2	<0.2	<0.2	<0.2		<1	5
	1,3-DCP				<0.2	<0.2	<0.2	<0.2	<0.2		<0.5	0.5
	1,2,3-TCP				0.021	0.020	0.016	0.011	0.012		0.008	0.5
	Chloroform				0.33	0.39	0.51	0.50	0.46		0.39	80

	DBCP				<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.2
	Dinoseb				<0.2	<0.2	<0.2	<0.2	<0.2		0.4	7
	EDB				<0.02	<0.02	<0.02	<0.02	<0.02		<0.05	0.05

Notes:

• Blank cell means the sample was not collected because the well was not installed, was dry, or was no longer present.
• Reported results highlighted yellow are in excess of compound Cleanup Level.
• Reported results highlighted grey are results reported as qualified by the laboratory.
* Well WB2- 1 was resampled on 9/2/2014 to confirm a spike in concentrations detected in original June 2014 analytical results.

µg/L = micrograms per liter;
"<" = non-detect analytes reported as less than the level of detection (LOD).

Reference: June 2014 Groundwater Sampling Report, CB&I Federal Services LLC, November 2015

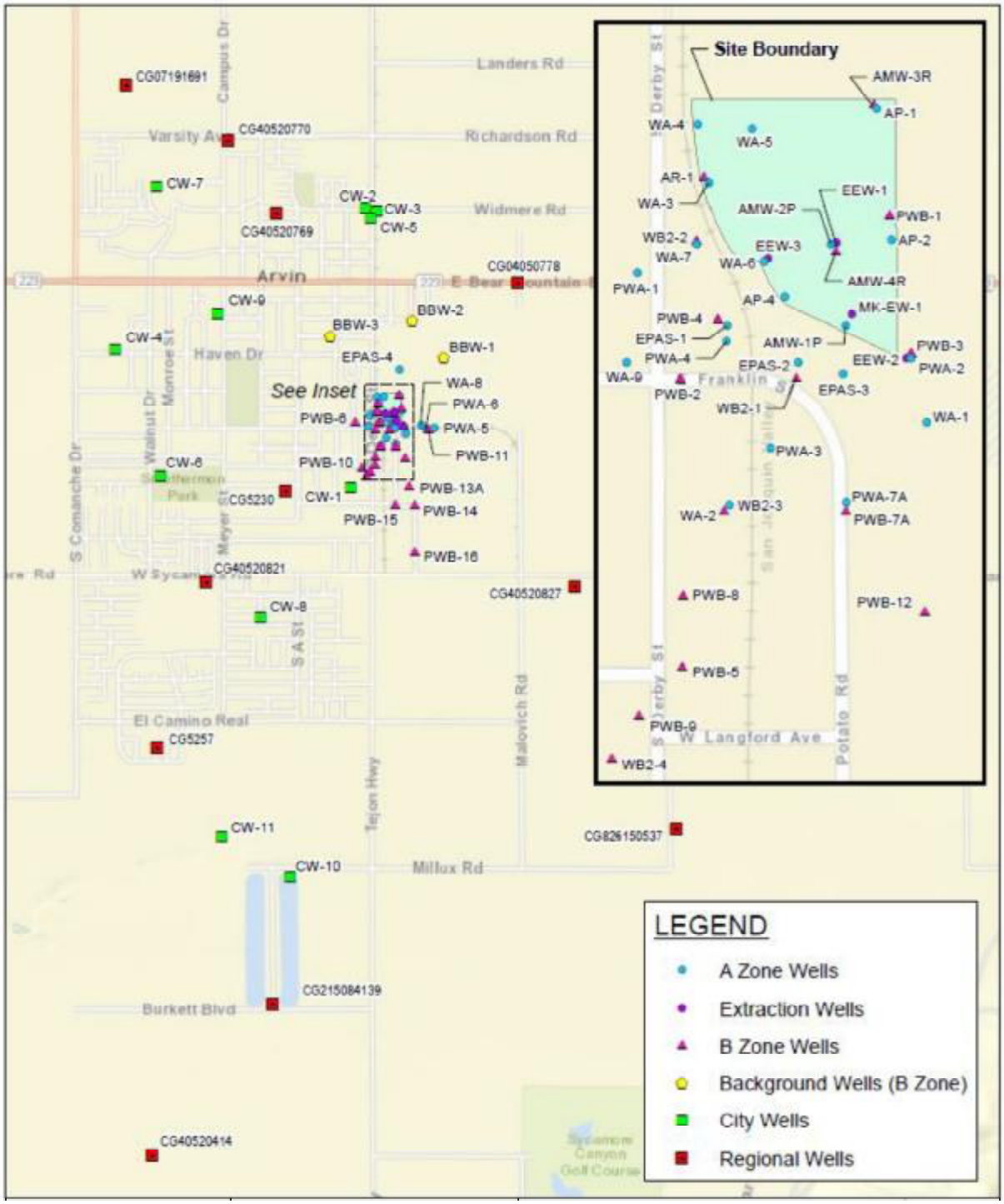

Figure B-1. Site Plan and Well Locations. Figure from June 2014 Groundwater Sampling Report (CBI, 2015), and the Spring 2015 Groundwater Sampling Report (CBI, 2016).

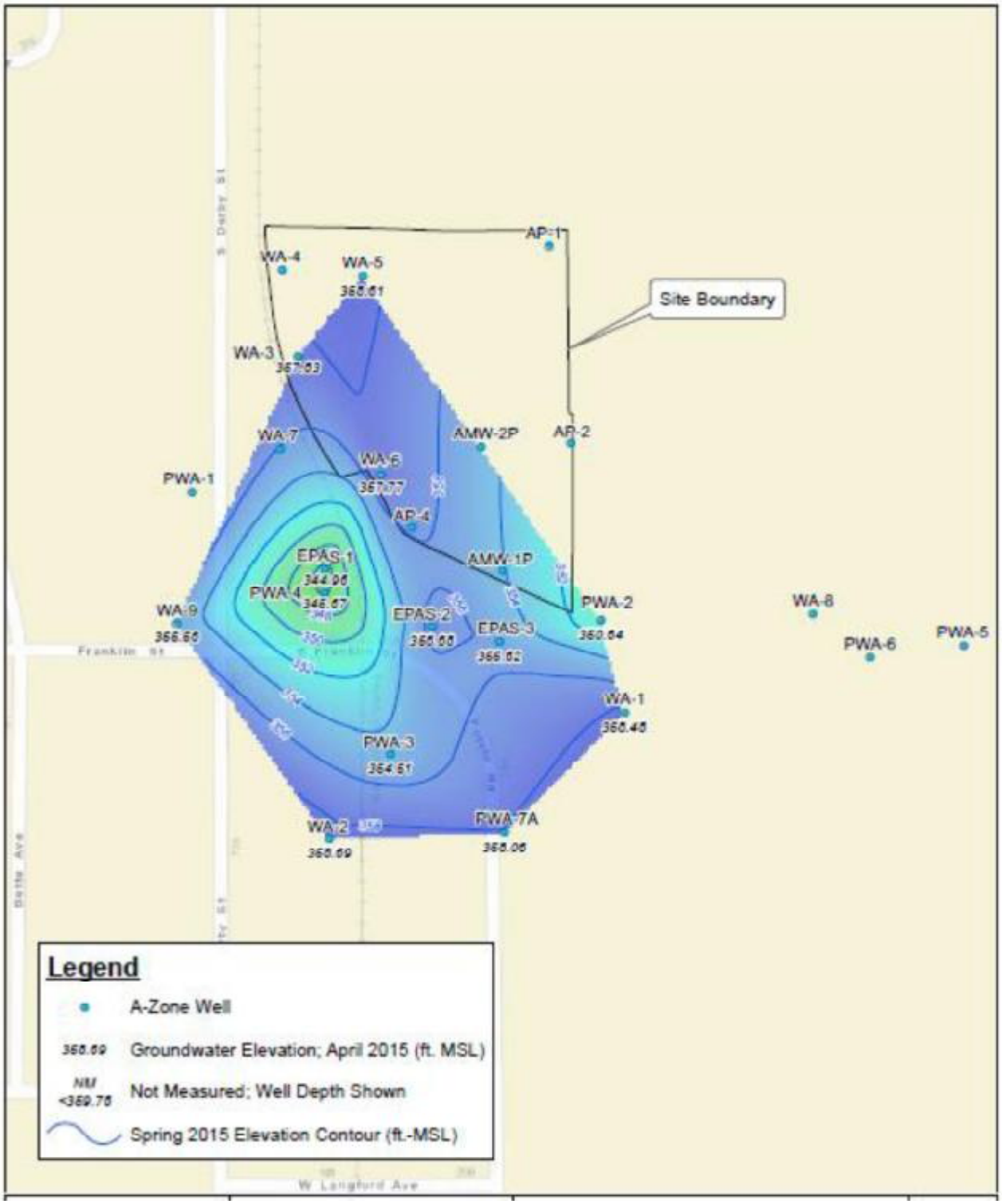

Figure B-2. A-zone groundwater Potentiometric Surface. Figure from Spring 2015 Groundwater Sampling Report (CBI, 2016).

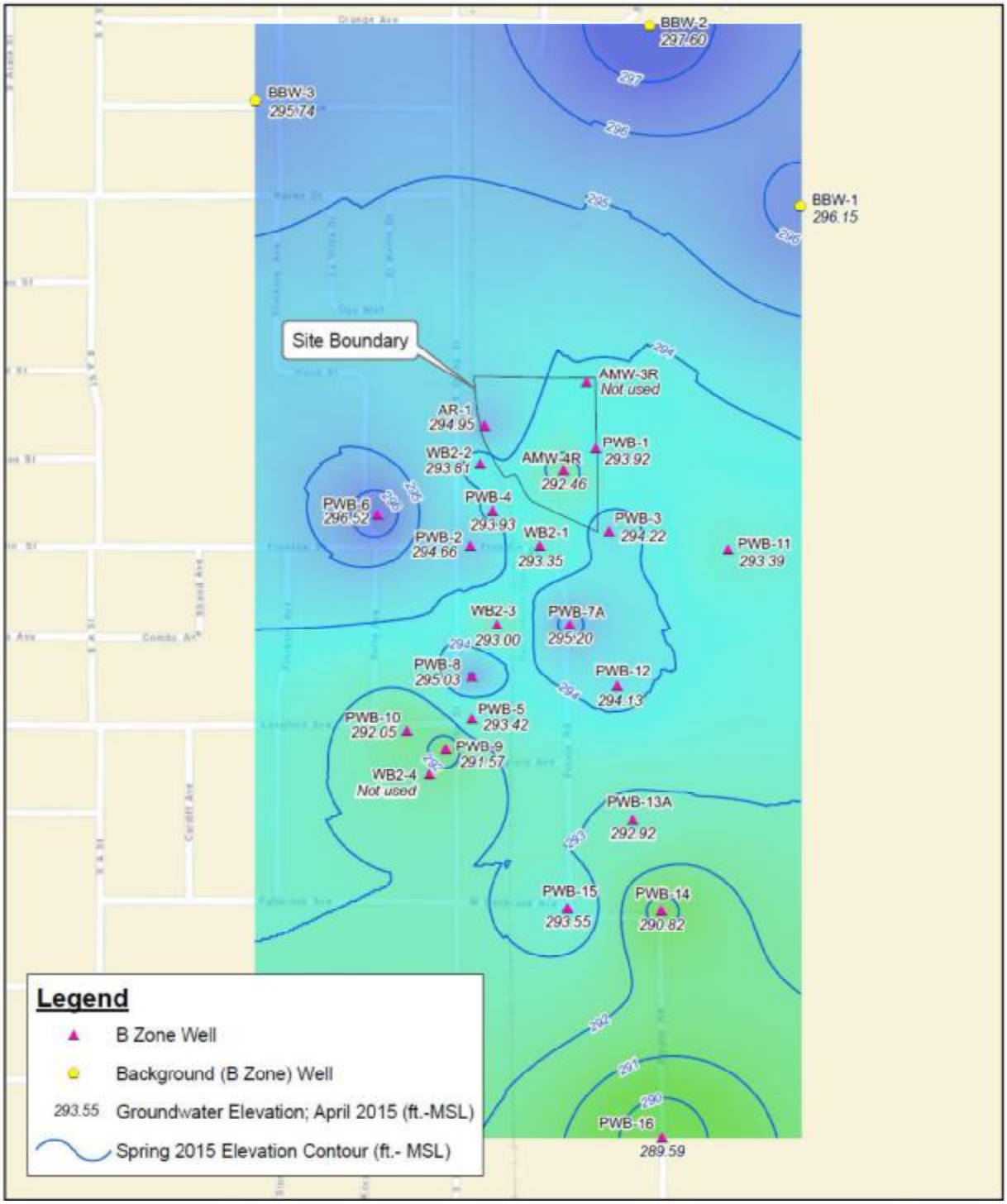

Figure B-3. B-Zone groundwater Potentiometric Surface. Figure from Spring 2015 Groundwater Sampling Report (CBI, 2016).

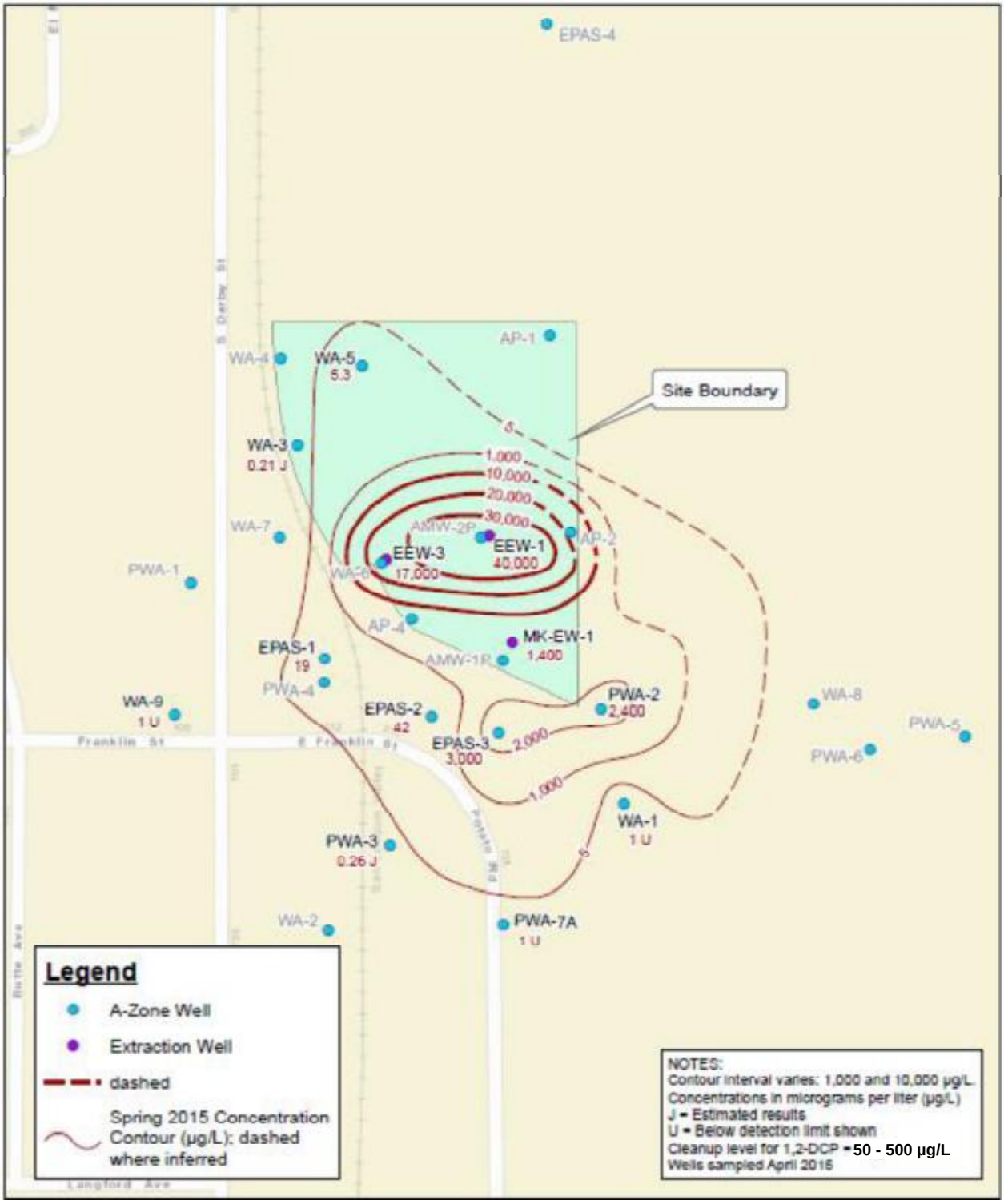

Figure B-4. A-zone 1,2-DCP Isoconcentration Map. Figure from Spring 2015 Groundwater Sampling Report (CBI, 2016).

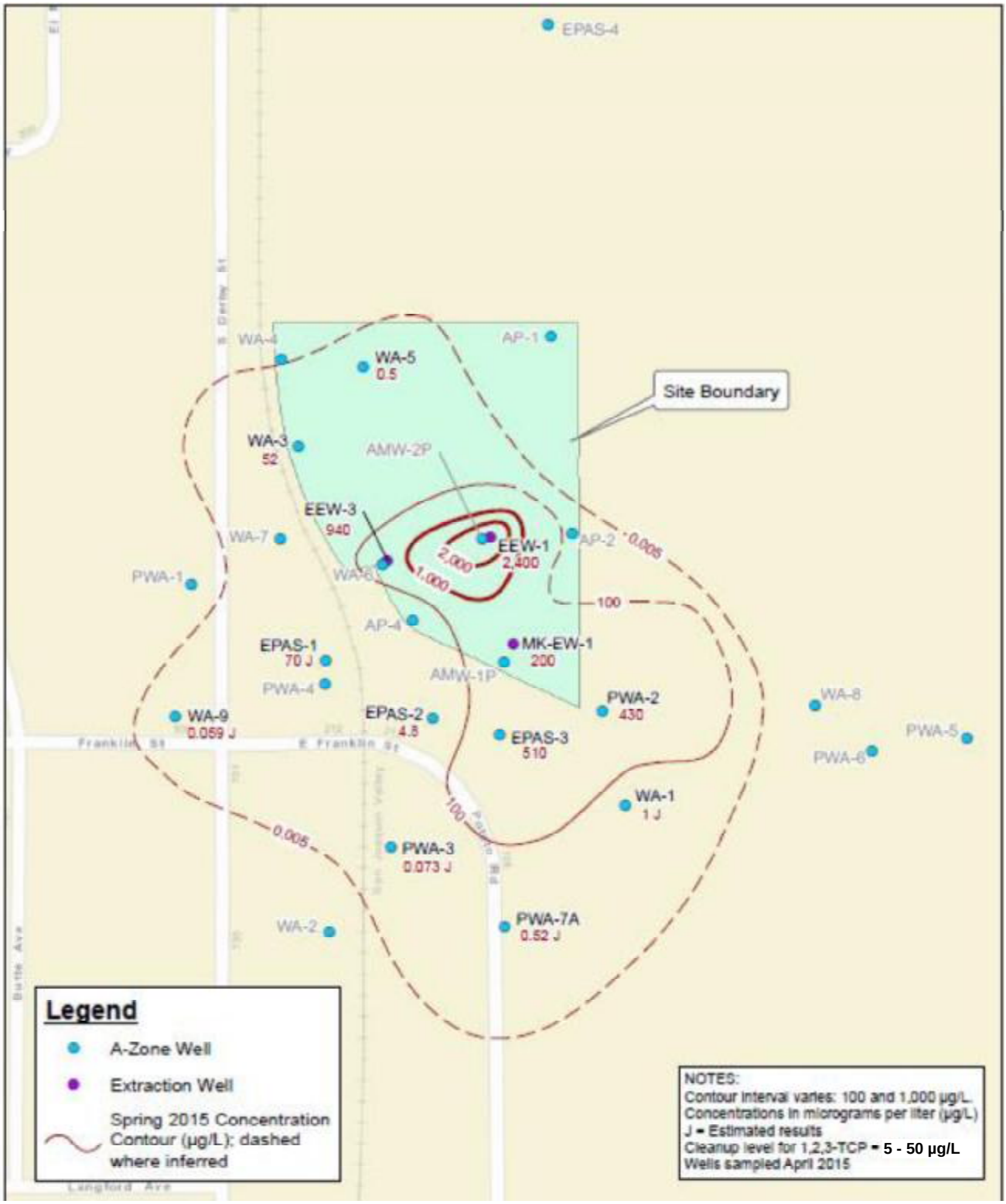

Figure B-5. A-zone 1,2,3-TCP Isoconcentration Map. Figure from Spring 2015 Groundwater Sampling Report (CBI, 2016).

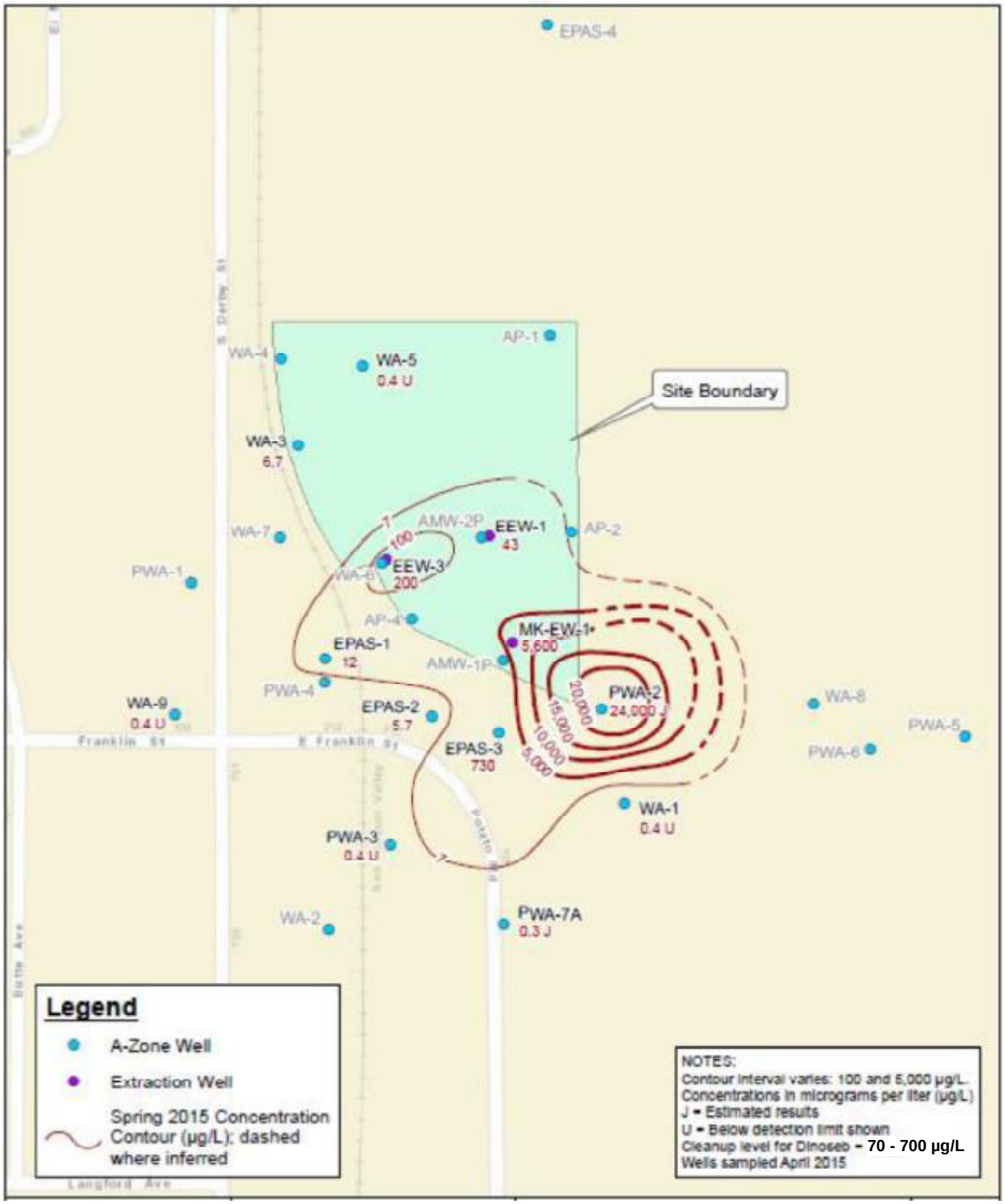

Figure B-6. A-zone Dinoseb Isoconcentration Map. Figure from the Spring 2015 Groundwater Sampling Report (CBI, 2016).

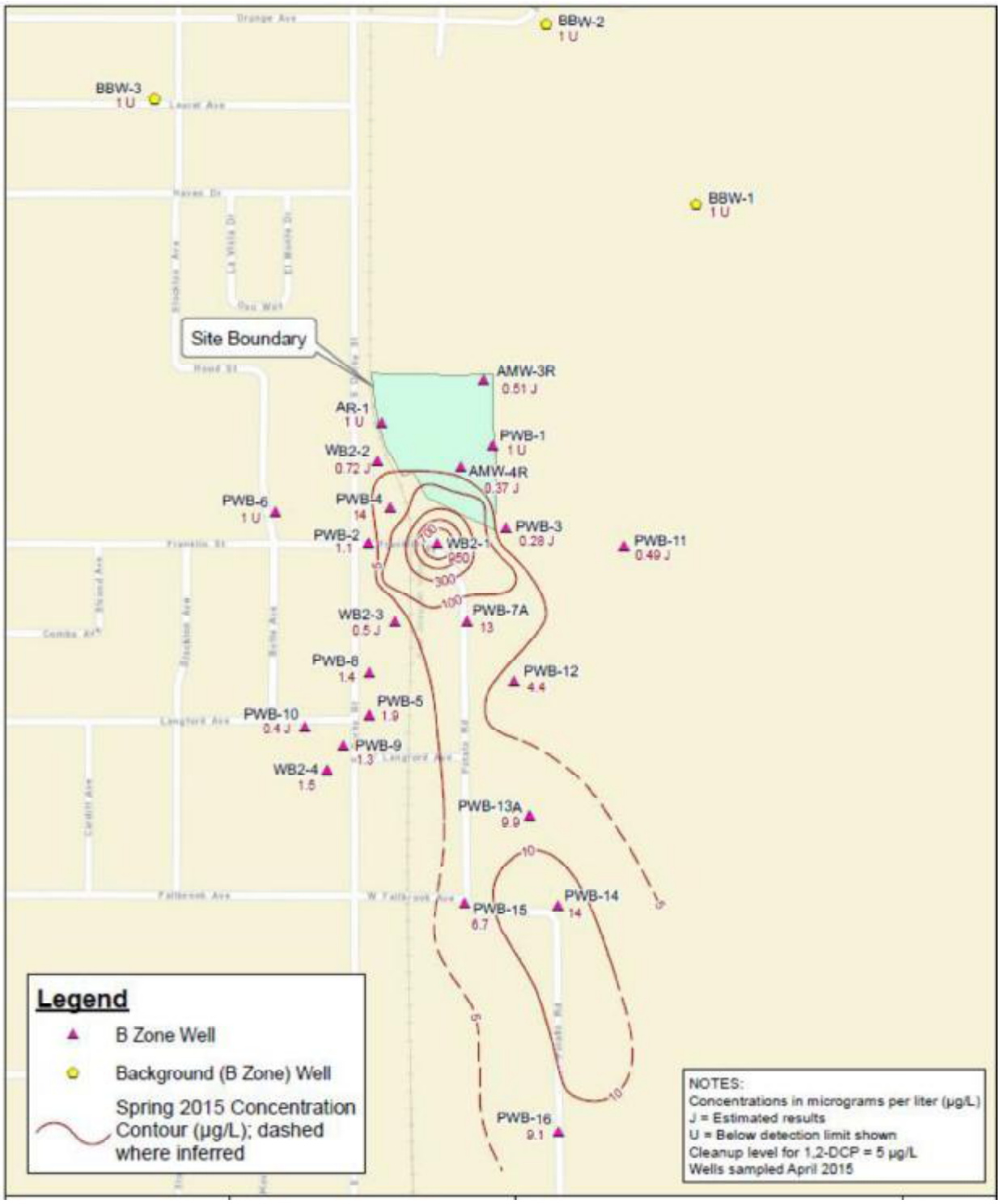

Figure B-7. B-zone 1,2-DCP Isoconcentration Map. Figure from Spring 2015 Groundwater Sampling Report (CB&I, 2016).

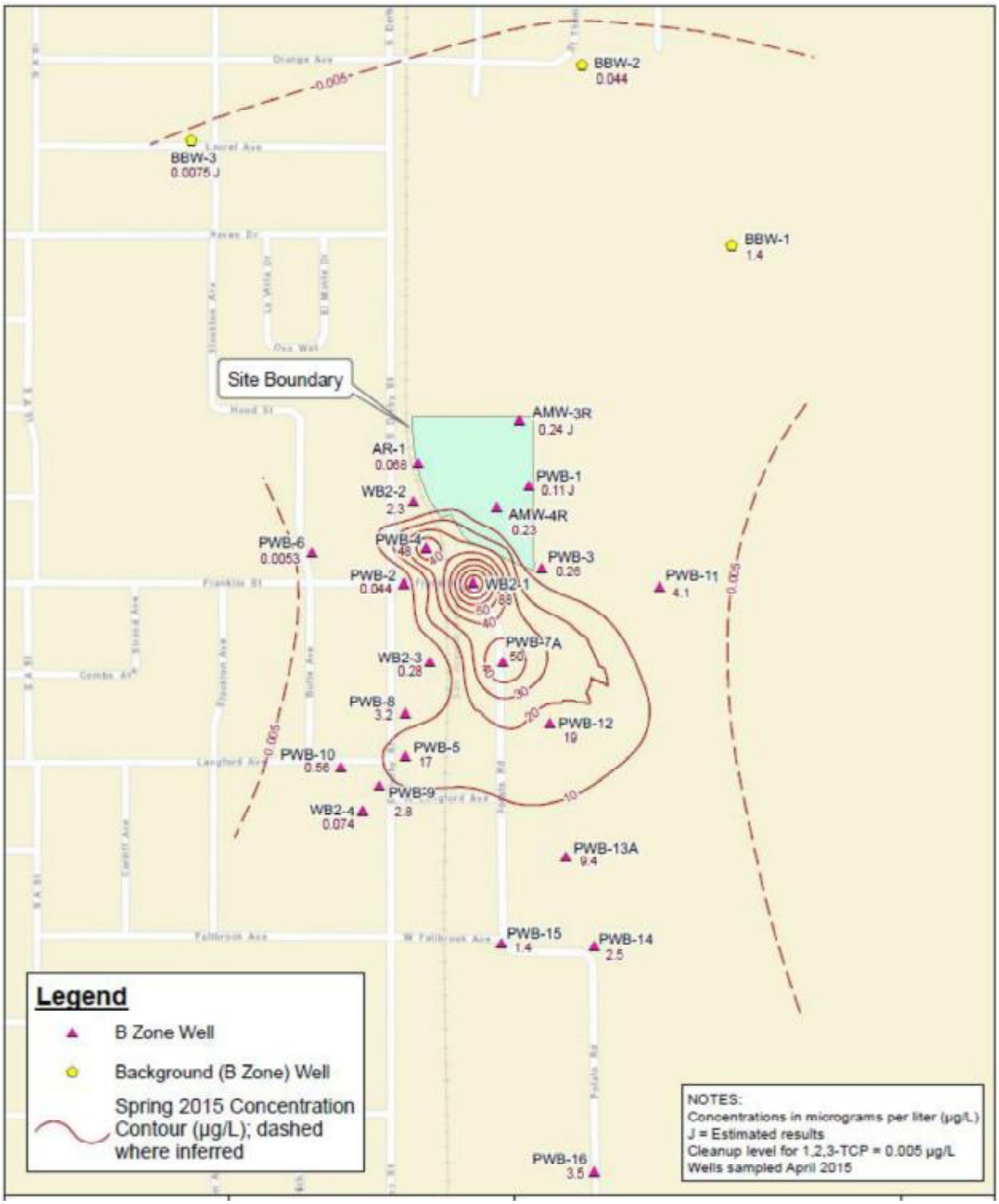

Figure B-8. B-zone 1,2,3-TCP Isoconcentration Map. Figure from Spring 2015 Groundwater Sampling Report (CBI, 2016).

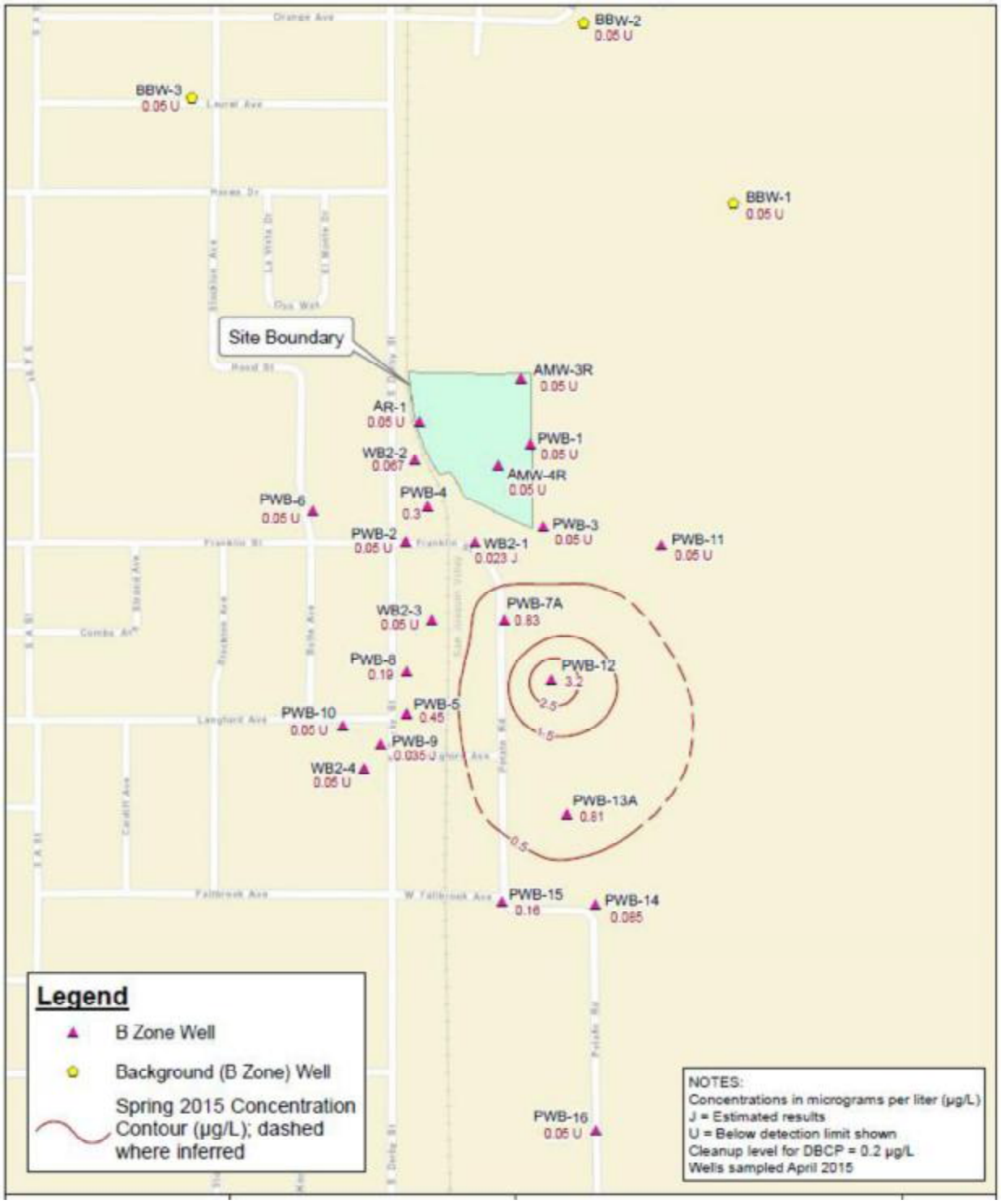

Figure B-9. B-zone DBCP Isoconcentration Map. Figure from Spring 2015 Groundwater Sampling Report (CBI, 2016).

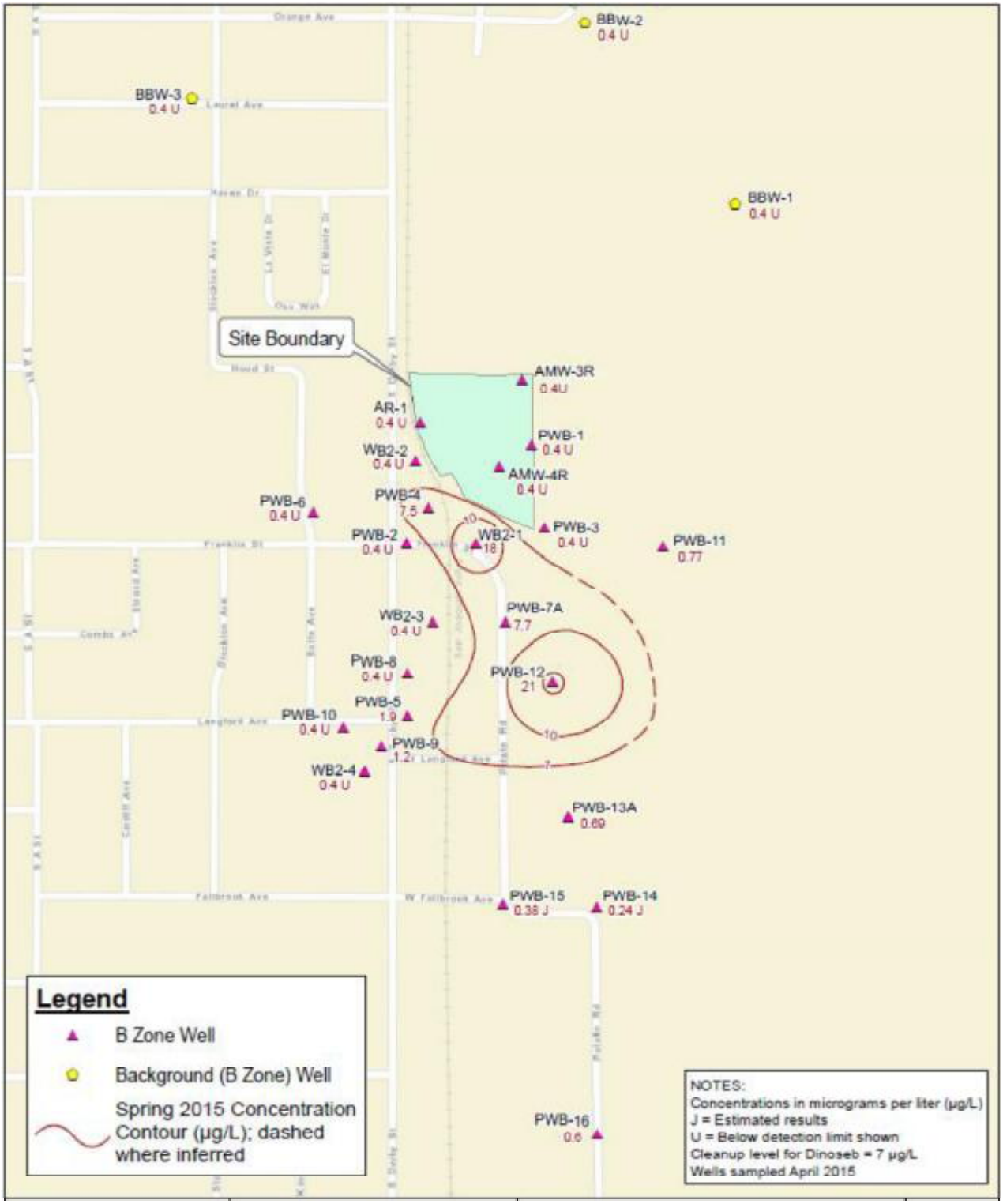

Figure B-10. B-zone Dinoseb Isoconcentration Map. Figure from Spring 2015 Groundwater Sampling Report (CBI, 2016).

Attachment A
Trend Analysis

1. Introduction

This attachment focuses on an assessment of the effectiveness of the RCRA cap in preventing infiltration of precipitation and protecting shallow groundwater from further degradation as determined by an evaluation of trends in the groundwater concentrations of several of the contaminants of concern.

1.1 Tools Used

The assessment of data trends was facilitated by the use of the Monitoring and Remediation Optimization System (MAROS) software, version 2.2 (GSI Environmental Inc., 2006). The MAROS software includes the capability to assess trends in concentrations over time using the non-parametric Mann-Kendall test for trend. In addition, it allows the presentation of concentration versus time plots for individual wells which in turn can be used for qualitative assessment of the trends. As a non-parametric test, the Mann-Kendall analysis is not dependent on having a normal distribution of data, can handle a reasonable number of non-detect results, and can analyze data collected on an irregular basis (as has been the case at the B&B Site).

The MAROS software identifies trends according to the calculated Mann-Kendall statistic (S) and the coefficient of variation (COV, the standard deviation divided by the mean) and indicates if there is an increasing trend (with 95% confidence), a probably increasing trend (90-95% confidence), a stable trend ($S \leq 0$ and a COV of < 1), a probably decreasing trend, a decreasing trend, or no trend ($S > 0$ but confidence less than 90%, or $S < 0$ and $COV > 1$). MAROS also calculates the total mass, the location of the center of mass, and mass spread in what is termed a "moment analysis." The results of the moment analyses were reviewed qualitatively for the A- and B-zones to assess overall plume behavior over time.

1.2 Data Used

Contaminant data for A-zone and B-zone wells were obtained from the project Electronic Database Management System (EDMS), which incorporates sampling events from April 2011 through April 2015. The data were obtained from the Draft Spring 2015 Groundwater Sampling Report (CB&I, 2016) and were manually entered into the MAROS input spreadsheets.

1.2.1 Contaminants of Concern Chosen for the Analysis

MAROS allows the simultaneous analysis of up to five contaminants of concern (and, if desired, will help guide the selection of COCs). Of the seven Site COCs, five compounds were selected for this analysis: 1,2,3-trichloropropane (1,2,3-TCP), 1,2-dibromo-3-chloropropane (DBCP), ethylene dibromide (EDB), 1,2-dichloropropane (1,2-DCP), and dinoseb. These represent the most prevalent compounds and include both mobile (e.g., 1,2-DCP) and relatively less mobile (e.g., dinoseb) compounds at the Site. These compounds also cover the range of risks posed by Site contaminants.

Two Site COCs, 1,3-dichloropropane and chloroform, were not included in the analysis. 1,3-dichloropropane is detected at concentrations orders of magnitude lower than 1,2-DCP, and there is poor risk information available for the compound. Chloroform is a common contaminant at the Site, but may be present in samples due to other causes, such as leaks from water supply pipelines or decontamination water, or may be due to lab contamination. Since other compounds approximate the spatial distribution, mobility, and toxicity of chloroform, its exclusion should not alter the conclusions of the analysis.

1.2.2 Handling of Non-Detectible Concentrations

The Mann-Kendall analysis can accommodate non-detectible concentrations but requires some estimate of either the method detection limit (MDL) or the reporting limit (RL). Because data are quantified at or above the RL (and estimated between the MDL and the RL), the RL was assigned to non-detects. A proxy value based on the RL, such as the RL or fraction of the RL, is then used in the calculation. For purposes of this analysis, the proxy was one-half the RL.

In many cases, specific reporting limits for the Brown and Bryant data were not identified, but could only be estimated based on low concentration, J-flagged, results. Use of variable detection limits in the analysis introduces the possibility of false trends based on non-detectible concentrations. For example, a well with mostly non-detects could appear to have an increasing or decreasing trend based on changes in the RLs for the samples used in the analysis. A qualitative review of the concentration vs. time results was conducted to determine whether non-detects biased trend analysis results.

2. Results

2.1 A-zone

The detailed results of the Mann-Kendall analysis for A-zone wells are provided in Attachments A-1 through A-3 and are discussed here. Trends are summarized in Attachment A-1 and selected time-series graphs with Mann-Kendall statistics for individual contaminants and wells exhibiting increasing or decreasing trends are provided in Attachment A-2. For a spatial understanding of groundwater flow directions and contaminant distribution in the A-zone, refer to Attachment A-3.

Most wells showed stable to decreasing concentrations of the five compounds assessed, where they were detected above the reporting limit. In particular, wells that historically have had the highest concentrations of contaminants (EPAS-3 and PWA-2) are exhibiting no trend or decreasing trends. The no trend outcome for the dinoseb in PWA-2 is notable because the April 2015 concentration of 24,000 µg/L is significantly higher than results that ranged from 2,600 to 9,100 µg/L in the previous 5 years. In addition, groundwater elevations have decreased across the Site since the previous five-year review, to the point that some wells beneath the cap have gone dry, further limiting the potential for migration of contaminants from the source areas.

The table below provides a summary of select A-zone contaminant trends for the period of 2009 to 2015. The wells selected for the comparison shown in this table contained one or more constituents that exceed the cleanup range. See Attachment A-1 for the trend analysis of all A-zone wells analyzed. The table shows that

contaminant trends, for the five COCs in the selected wells, have generally been stable or decreasing during the five-year review period.

Well	1,2,3-TCP	DBCP	EDB	1,2-DCP	Dinoseb
EPAS-1	N/A	N/A	ND	N/A	N/A
EPAS-3	▼	▼	▼	▼	NT
PWA-2	▼	S	▼	▼	NT
WA-3	▼	▼	ND	▼	▼

Blank spaces indicate there was no trend or data was stable

▲ Increasing or probably increasing trend based on Mann-Kendall analysis

▼ Decreasing or probably decreasing trend based on Mann-Kendall analysis

NA - Insufficient data; S - Stable trend; NT - No trend; ND – no detectable concentration

Though the trends in concentrations of the downgradient wells are decreasing or show no trend, the MAROS statistical analysis of the plume mass shown in Attachment A-3 of Appendix B indicates that the plumes for the five constituents are increasing, probably increasing, or show no trend. This may suggest a predominant mechanism of dispersion and or natural flushing in the aquifer.

2.2 B-zone

The detailed results of the Mann-Kendall analysis for B-zone wells are provided in Attachments A-4 through A-6 to this appendix memo and are discussed here. Most wells that are located in the B-zone plumes and have trends, have stable or declining trends as shown in Attachment A-4. Time-series graphs with Mann-Kendall statistics for selected individual contaminants and wells exhibiting trends are provided in Attachment A-5.

The table below provides a summary of select B-zone contaminant trends for the period of 2009 to 2015. The wells selected for the comparison shown in this table contained one or more constituents that exceed the cleanup goals. See Attachment A-4 for the trend analysis of all B-zone wells analyzed.

Well	1,2,3-TCP	DBCP	EDB	1,2-DCP	Dinoseb
PWB-2		ND	ND	▼	NT
PWB-4	NT	NT	ND	S	▼
PWB-5	S	S	ND	S	NT
PWB-7A	▲	NT	ND	NT	ND
PWB-8	S	▼	ND	S	▼
PWB-9	S	NT	ND	NT	S
PWB-11	NT	NT	ND	▼	NT
PWB-12	NT	NT	ND	S	S

PWB-13A	NT	▲	ND	▼	S
PWB-14	S	▼	NT	▼	▼
PWB-15	▲	▲	NT	▲	▲
PWB-16	▲	ND	ND	▼	S
WB2-1	NT	NT	ND	NT	NT
WB2-2	▼	▼	ND	▼	▼

Blank spaces indicate there was no trend or data was stable

▲ Increasing or probably increasing trend based on Mann-Kendall analysis

▼ Decreasing or probably decreasing trend based on Mann-Kendall analysis

NA - Insufficient data; S - Stable trend; NT - No trend; ND – no detectable concentration

In well WB2-1, a spike in concentrations for many of the COCs occurred in 2014 after several years of very low to no detect concentrations. Because of this inconsistency in the data, the statistical analysis for WB2-1 could not assess any trend. Contaminants in other wells generally show stable or decreasing trends from 2009 to 2015, often changing the increasing trends seen during in the previous five-year review period to a stable or decreasing trend. The contaminant EDB has historically been nearly always non-detect.

In the last five years, the trends for 1,2-DCP have generally become stable or decreasing for wells located along the perimeters of the plumes. However, increasing trends occur for constituents exceeding clean up levels in wells located downgradient of the hotspots: PWB-13A (DBCP), PWB-15 (1,2,3-TCP, DBCP, 1,2-DCP, and dinoseb), and PWB-16 (1,2,3-TCP). These wells represent the downgradient edge of the plume. These recent increases to levels above background may indicate that MNA will not be sufficient to reduce B-zone contamination to levels below drinking water standards. Further sampling, now that the A-zone extraction system is in operation, is necessary to determine if MNA will be sufficient.

The previous FYR noted no clear trends regarding the mass of the plume in the B-zone. For this FYR, there is increasing mass of 1,2,3-TCP, but decreasing or no trend for the other constituents (see zeroth moment results in Attachment A-6).

Despite the observation of increasing trends in the downgradient wells near the edge of the plume, the MAROS 2nd moment analysis (indication of plume spread) indicates that the plumes for the five contaminants were generally stable or decreasing (see Attachment A-6 of Appendix B). MAROS results indicate that the plumes for all the contaminants have shown an appreciable change since 2011. Considerable variability is, in fact, seen from one sampling event to another in the MAROS 2nd moment results. Whether these changes reflect real changes in plume dimensions or are the result of subtle variation along the plume margins is not clear.

3. Conclusions

MAROS results are consistent with a conclusion that the plumes are relatively stable in the A- and B-zones and that the cap is limiting dissolution of contaminants in soil beneath the cap.

The main contaminants in wells adjacent to RCRA cap appear to be spreading, but have seen stable or decreasing contaminant concentrations, with the exception of well WB2-1. Over time, this reduction in source contributions to groundwater should be reflected in decreasing contaminant concentrations in groundwater down-gradient of the cap.

Attachment A-1
Mann-Kendall Summary Statistics for the A-Zone

All units are µg/L (not mg/L)

MAROS Statistical Trend Analysis Summary

Project: Brown & Bryant Superfund Site

Location: Arvin

User Name:

State: California

Time Period: 4/25/2011 to 4/21/2015

Consolidation Period: No Time Consolidation

Consolidation Type: Median

Duplicate Consolidation: Average

ND Values: 1/2 Detection Limit

J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Average Conc. (mg/L)	Median Conc. (mg/L)	All Samples "ND" ?	Mann-Kendall Trend	Linear Regression Trend
1,2,3-TRICHLOROPROPANE								
EPAS-1	T	3	3	8.6E+01	9.0E+01	No	N/A	N/A
EPAS-2	T	8	8	4.7E+00	4.8E+00	No	S	NT
EPAS-3	S	8	8	5.7E+02	6.0E+02	No	D	S
PWA-2	S	8	8	8.3E+02	1.0E+03	No	D	D
PWA-3	T	8	7	7.4E-02	8.1E-02	No	S	NT
PWA-7A	T	8	8	5.1E-01	5.0E-01	No	S	S
WA-1	T	8	8	1.0E+00	1.1E+00	No	S	S
WA-2	T	7	7	9.2E-03	8.9E-03	No	PD	D
WA-3	T	7	7	8.2E+01	7.8E+01	No	D	D
WA-5	T	8	8	4.2E-01	4.1E-01	No	I	I
WA-9	T	8	8	2.1E-02	1.5E-02	No	NT	PI
1,2-DIBROMO-3-CHLOROPROPANE								
EPAS-1	T	3	3	2.5E+00	2.6E+00	No	N/A	N/A
EPAS-2	T	8	8	9.4E-01	9.5E-01	No	S	S
EPAS-3	S	8	7	2.5E+02	2.5E+02	No	PD	S
PWA-2	S	8	8	2.9E+02	3.1E+02	No	S	D
PWA-3	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWA-7A	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
WA-1	T	8	2	2.6E-02	1.0E-02	No	NT	D
WA-2	T	7	0	1.0E-02	1.0E-02	Yes	ND	ND
WA-3	T	7	7	7.6E-01	8.0E-01	No	D	D
WA-5	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
WA-9	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMID								
EPAS-1	T	3	0	1.0E-02	1.0E-02	Yes	ND	ND
EPAS-2	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
EPAS-3	S	8	7	2.5E+00	2.5E+00	No	D	S
PWA-2	S	8	8	7.3E+01	7.3E+01	No	D	D
PWA-3	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWA-7A	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
WA-1	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
WA-2	T	7	0	1.0E-02	1.0E-02	Yes	ND	ND
WA-3	T	7	0	1.0E-02	1.0E-02	Yes	ND	ND

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All units are µg/L (not mg/L)

MAROS Statistical Trend Analysis Summary

Well	Source/ Tail	Number of Samples	Number of Detects	Average Conc. (mg/L)	Median Conc. (mg/L)	All Samples "ND" ?	Mann-Kendall Trend	Linear Regression Trend
1,2-DIBROMOETHANE (ETHYLENE DIBROMID								
WA-5	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
WA-9	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
1,2-DICHLOROPROPANE								
EPAS-1	T	3	3	2.2E+01	1.9E+01	No	N/A	N/A
EPAS-2	T	8	8	3.4E+01	3.2E+01	No	NT	I
EPAS-3	S	8	8	4.0E+03	3.9E+03	No	D	S
PWA-2	S	8	8	4.5E+03	4.3E+03	No	D	S
PWA-3	T	8	8	3.6E-01	3.2E-01	No	D	D
PWA-7A	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
WA-1	T	8	4	3.5E-01	1.6E-01	No	PD	D
WA-2	T	7	0	1.0E-01	1.0E-01	Yes	ND	ND
WA-3	T	7	7	1.3E+00	1.4E+00	No	D	D
WA-5	T	8	8	5.5E+00	5.4E+00	No	NT	NT
WA-9	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
DINOSEB								
EPAS-1	T	3	3	1.5E+01	1.4E+01	No	N/A	N/A
EPAS-2	T	8	8	6.0E+00	5.7E+00	No	S	S
EPAS-3	S	8	8	1.1E+03	1.1E+03	No	NT	NT
PWA-2	S	8	8	8.6E+03	7.1E+03	No	NT	NT
PWA-3	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
PWA-7A	T	8	1	1.3E-01	1.0E-01	No	NT	I
WA-1	T	8	3	2.2E-01	1.0E-01	No	PD	D
WA-2	T	7	1	1.2E-01	1.0E-01	No	NT	PI
WA-3	T	7	7	3.0E+01	3.5E+01	No	D	D
WA-5	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
WA-9	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Not Applicable (N/A) - Due to Insufficient Data (< 4 sampling events); No Detectable Concentration (NDC)

The Number of Samples and Number of Detects shown above are post-consolidation values.

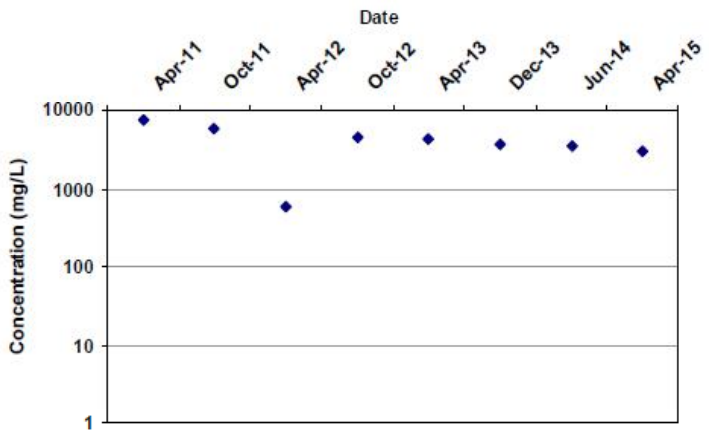
Attachment A-2
Time-Series Charts for
Selected A-Zone Wells

All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: EPAS-3
Well Type: S
COC: 1,2-DICHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -18

Confidence in Trend: 98.4%

Coefficient of Variation: 0.48

Mann Kendall Concentration Trend: (See Note) D

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
EPAS-3	S	4/25/2011	1,2-DICHLOROPROPANE	7.2E+03		1	1
EPAS-3	S	10/15/2011	1,2-DICHLOROPROPANE	5.7E+03		1	1
EPAS-3	S	4/24/2012	1,2-DICHLOROPROPANE	6.0E+02		1	1
EPAS-3	S	10/15/2012	1,2-DICHLOROPROPANE	4.5E+03		1	1
EPAS-3	S	4/13/2013	1,2-DICHLOROPROPANE	4.2E+03		1	1
EPAS-3	S	12/15/2013	1,2-DICHLOROPROPANE	3.6E+03		1	1
EPAS-3	S	6/17/2014	1,2-DICHLOROPROPANE	3.5E+03		1	1
EPAS-3	S	4/21/2015	1,2-DICHLOROPROPANE	3.0E+03		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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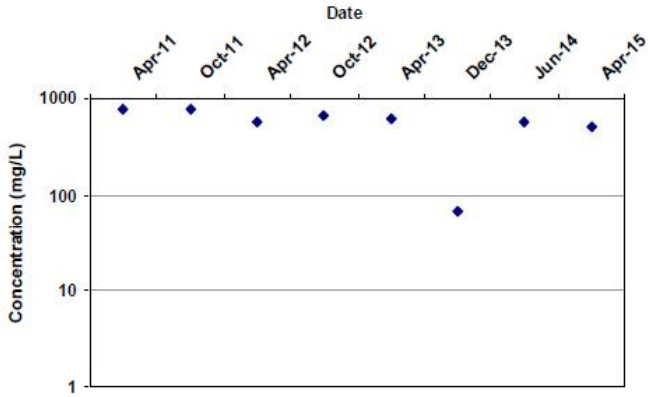
All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: EPAS-3
Well Type: S
COC: 1,2,3-TRICHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -19

Confidence in Trend: 98.9%

Coefficient of Variation: 0.39

Mann Kendall Concentration Trend: (See Note) D

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
EPAS-3	S	4/25/2011	1,2,3-TRICHLOROPROPANE	7.7E+02		1	1
EPAS-3	S	10/15/2011	1,2,3-TRICHLOROPROPANE	7.6E+02		1	1
EPAS-3	S	4/24/2012	1,2,3-TRICHLOROPROPANE	5.7E+02		1	1
EPAS-3	S	10/15/2012	1,2,3-TRICHLOROPROPANE	6.6E+02		1	1
EPAS-3	S	4/13/2013	1,2,3-TRICHLOROPROPANE	6.2E+02		1	1
EPAS-3	S	12/15/2013	1,2,3-TRICHLOROPROPANE	6.8E+01		1	1
EPAS-3	S	6/17/2014	1,2,3-TRICHLOROPROPANE	5.7E+02		1	1
EPAS-3	S	4/21/2015	1,2,3-TRICHLOROPROPANE	5.1E+02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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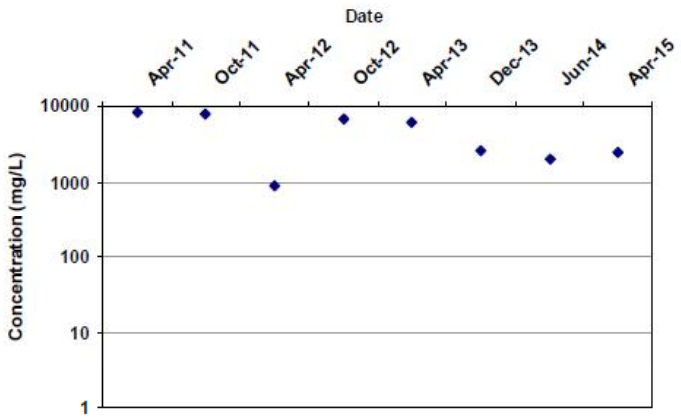
All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: PWA-2
Well Type: S
COC: 1,2-DICHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -16

Confidence in Trend: 96.9%

Coefficient of Variation: 0.63

Mann Kendall Concentration Trend: (See Note) D

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PWA-2	S	4/25/2011	1,2-DICHLOROPROPANE	8.0E+03		1	1
PWA-2	S	10/15/2011	1,2-DICHLOROPROPANE	7.7E+03		1	1
PWA-2	S	4/24/2012	1,2-DICHLOROPROPANE	8.6E+02		1	1
PWA-2	S	10/15/2012	1,2-DICHLOROPROPANE	6.6E+03		1	1
PWA-2	S	4/13/2013	1,2-DICHLOROPROPANE	6.0E+03		1	1
PWA-2	S	12/15/2013	1,2-DICHLOROPROPANE	2.6E+03		1	1
PWA-2	S	6/17/2014	1,2-DICHLOROPROPANE	2.0E+03		1	1
PWA-2	S	4/21/2015	1,2-DICHLOROPROPANE	2.4E+03		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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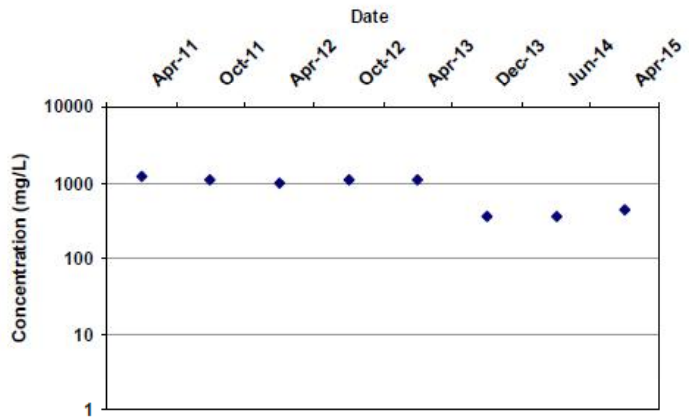
All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: PWA-2
Well Type: S
COC: 1,2,3-TRICHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -17

Confidence in Trend: 97.7%

Coefficient of Variation: 0.45

Mann Kendall Concentration Trend: (See Note) D

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PWA-2	S	4/25/2011	1,2,3-TRICHLOROPROPANE	1.2E+03		1	1
PWA-2	S	10/15/2011	1,2,3-TRICHLOROPROPANE	1.1E+03		1	1
PWA-2	S	4/24/2012	1,2,3-TRICHLOROPROPANE	9.6E+02		1	1
PWA-2	S	10/15/2012	1,2,3-TRICHLOROPROPANE	1.1E+03		1	1
PWA-2	S	4/13/2013	1,2,3-TRICHLOROPROPANE	1.1E+03		1	1
PWA-2	S	12/15/2013	1,2,3-TRICHLOROPROPANE	3.6E+02		1	1
PWA-2	S	6/17/2014	1,2,3-TRICHLOROPROPANE	3.5E+02		1	1
PWA-2	S	4/21/2015	1,2,3-TRICHLOROPROPANE	4.3E+02		1	1

Note. Increasing (I), Probably Increasing (PI), Stable (S), Probably Decreasing (PD), Decreasing (D), No Trend (NT), Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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Attachment A-3
Moment Analysis
for the A-Zone

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	1,2,3-TRICHLOROPROPANE	0.14	-8	80.1%	S
	1,2-DIBROMO-3-CHLOROPROPAN	0.40	-16	96.9%	D
	1,2-DIBROMOETHANE (ETHYLEN	0.26	-18	98.4%	D
	1,2-DICHLOROPROPANE	0.36	-16	96.9%	D
	DINOSEB	0.20	-4	64.0%	S
1st Moment: Distance to Source					
	1,2,3-TRICHLOROPROPANE	0.38	20	99.3%	I
	1,2-DIBROMO-3-CHLOROPROPAN	0.61	10	86.2%	NT
	1,2-DIBROMOETHANE (ETHYLEN	0.31	20	99.3%	I
	1,2-DICHLOROPROPANE	0.14	14	94.6%	PI
	DINOSEB	0.06	10	86.2%	NT
2nd Moment: Sigma XX					
	1,2,3-TRICHLOROPROPANE	0.43	18	98.4%	I
	1,2-DIBROMO-3-CHLOROPROPAN	0.33	14	94.6%	PI
	1,2-DIBROMOETHANE (ETHYLEN	0.09	14	94.6%	PI
	1,2-DICHLOROPROPANE	0.12	2	54.8%	NT
	DINOSEB	0.25	4	64.0%	NT
2nd Moment: Sigma YY					
	1,2,3-TRICHLOROPROPANE	0.22	22	99.8%	I
	1,2-DIBROMO-3-CHLOROPROPAN	0.11	22	99.8%	I
	1,2-DIBROMOETHANE (ETHYLEN	0.06	14	94.6%	PI
	1,2-DICHLOROPROPANE	0.03	0	45.2%	S
	DINOSEB	0.08	12	91.1%	PI

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.25 **Saturated Thickness:** Uniform: 10 ft

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

MAROS Spatial Moment Analysis Summary

Project: Brown & Bryant Superfund Site

Location: Arvin

User Name:

State: California

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	**Estimated Mass (Kg)**	**Xc (ft)**	**Yc (ft)**	**Source Distance (ft)**	**Sigma XX (sq ft)**	**Sigma YY (sq ft)**	**Number of Wells**
1,2,3-TRICHLOROPROPANE							
4/25/2011	2.3E+02	145	-149	68	5,118	8,110	9
10/15/2011	2.2E+02	123	-135	69	10,862	10,978	10
4/24/2012	1.8E+02	106	-117	83	11,105	11,957	10
10/15/2012	2.5E+02	112	-121	80	11,804	12,429	10
4/13/2013	2.2E+02	109	-114	86	10,332	12,323	10
12/15/2013	1.6E+02	13	-41	181	21,318	15,983	11
6/17/2014	1.9E+02	58	-88	120	20,292	16,406	11
4/21/2015	2.0E+02	60	-92	116	21,048	15,439	10
1,2-DIBROMO-3-CHLOROPROPANE							
4/25/2011	4.8E+01	145	-157	62	4,417	5,731	9
10/15/2011	5.0E+01	139	-155	60	7,148	6,466	10
4/24/2012	3.4E+01	119	-139	64	7,416	7,461	10
10/15/2012	3.3E+01	118	-138	65	7,591	7,578	10
4/13/2013	3.9E+01	121	-139	65	6,677	7,326	10
12/15/2013	7.5E+00	6	-22	201	13,353	7,600	11
6/17/2014	2.6E+01	111	-137	64	9,431	8,250	11
4/21/2015	3.0E+01	116	-139	63	7,479	7,603	10
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)							
4/25/2011	3.2E+00	132	-132	76	8,275	10,245	9
10/15/2011	3.3E+00	133	-132	76	8,447	10,380	10
4/24/2012	2.6E+00	126	-127	77	9,294	10,958	10
10/15/2012	2.8E+00	127	-127	78	8,998	10,835	10
4/13/2013	1.4E+00	66	-48	156	8,173	9,724	10
12/15/2013	2.3E+00	121	-123	80	9,841	11,306	11
6/17/2014	2.1E+00	119	-123	79	10,397	11,522	11
4/21/2015	2.0E+00	119	-117	85	9,698	11,092	10
1,2-DICHLOROPROPANE							
4/25/2011	1.6E+03	115	-108	93	4,653	9,059	9
10/15/2011	1.2E+03	117	-109	93	5,096	9,626	10
4/24/2012	4.2E+02	78	-59	143	5,506	9,390	10
10/15/2012	1.1E+03	104	-94	106	4,588	9,566	10
4/13/2013	9.7E+02	100	-89	111	4,121	9,378	10
12/15/2013	8.5E+02	90	-84	117	6,107	9,882	11
6/17/2014	7.6E+02	89	-81	120	5,148	9,524	11
4/21/2015	8.0E+02	89	-81	120	4,808	9,295	10

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Project: Brown & Bryant Superfund Site

Location: Arvin

User Name:

State: California

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	**Estimated Mass (kg)**	**Xc (ft)**	**Yc (ft)**	**Source Distance (ft)**	**Sigma XX (sq ft)**	**Sigma YY (sq ft)**	**Number of Wells**
DINOSEB							
DINOSEB							
4/25/2011	3.2E+02	136	-141	70	4,949	7,583	9
10/15/2011	3.5E+02	128	-141	65	9,389	8,210	10
4/24/2012	3.3E+02	113	-129	72	8,928	8,495	10
10/15/2012	4.4E+02	124	-139	66	8,683	8,002	10
4/13/2013	3.2E+02	114	-130	72	8,886	8,472	10
12/15/2013	2.2E+02	100	-123	77	12,227	9,794	11
6/17/2014	3.1E+02	111	-132	69	10,063	8,725	11
4/21/2015	4.2E+02	120	-129	74	6,533	8,342	10

Attachment A-4
Mann-Kendall Summary Statistics for the B-Zone

All units are µg/L (not mg/L)

MAROS Statistical Trend Analysis Summary

Project: Brown & Bryant Superfund Site

Location: Arvin

User Name:

State: California

Time Period: 4/25/2011 to 4/21/2015

Consolidation Period: No Time Consolidation

Consolidation Type: Median

Duplicate Consolidation: Average

ND Values: 1/2 Detection Limit

J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Average Conc. (mg/L)	Median Conc. (mg/L)	All Samples "ND" ?	Mann-Kendall Trend	Linear Regression Trend
1,2,3-TRICHLOROPROPANE								
AMW-3R	T	8	8	2.2E-01	2.2E-01	No	NT	NT
AMW-4R	T	8	8	3.8E-01	3.7E-01	No	S	S
AR-1	T	8	8	1.7E-01	1.2E-01	No	NT	NT
BBW-1	T	6	6	5.6E-01	4.0E-01	No	S	NT
BBW-2	T	6	6	9.7E-01	9.6E-01	No	NT	S
BBW-3	T	6	6	1.5E-02	1.4E-02	No	D	D
PWB-1	T	8	8	1.7E-01	1.5E-01	No	S	NT
PWB-10	T	8	8	4.1E-01	4.1E-01	No	PI	I
PWB-11	T	8	8	3.5E+00	3.5E+00	No	NT	NT
PWB-12	T	8	8	1.9E+01	1.9E+01	No	NT	NT
PWB-13A	T	8	8	1.1E+01	1.0E+01	No	NT	NT
PWB-14	T	8	8	4.0E+00	3.0E+00	No	S	NT
PWB-15	T	8	7	7.6E-01	8.6E-01	No	I	NT
PWB-16	T	8	8	3.2E+00	3.2E+00	No	I	I
PWB-2	T	8	8	7.3E-01	5.1E-01	No	D	D
PWB-3	T	8	8	2.4E-01	2.5E-01	No	NT	NT
PWB-4	T	8	8	1.8E+01	1.4E+01	No	NT	PI
PWB-5	T	7	7	1.4E+01	1.4E+01	No	S	S
PWB-6	T	8	4	2.6E-03	2.0E-03	No	NT	NT
PWB-7A	T	8	8	4.8E+01	4.4E+01	No	I	I
PWB-8	T	8	8	7.7E+00	7.5E+00	No	S	PD
PWB-9	T	8	8	2.7E+00	2.6E+00	No	S	S
WB2-1	S	8	8	3.6E+01	1.4E+00	No	NT	I
WB2-2	T	8	8	1.0E+01	7.4E+00	No	D	D
WB2-3	T	8	8	5.1E-01	4.4E-01	No	D	D
WB2-4	T	8	8	8.2E-02	7.9E-02	No	S	S
1,2-DIBROMO-3-CHLOROPROPANE								
AMW-3R	T	8	1	4.4E-02	1.0E-02	No	NT	NT
AMW-4R	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
AR-1	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
BBW-1	T	6	0	1.0E-02	1.0E-02	Yes	ND	ND
BBW-2	T	6	0	1.0E-02	1.0E-02	Yes	ND	ND
BBW-3	T	6	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-1	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND

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All units are µg/L (not mg/L)

MAROS Statistical Trend Analysis Summary

Well	Source/ Tail	Number of Samples	Number of Detects	Average Conc. (mg/L)	Median Conc. (mg/L)	All Samples "ND" ?	Mann-Kendall Trend	Linear Regression Trend
1,2-DIBROMO-3-CHLOROPROPANE								
PWB-10	T	8	2	1.5E-02	1.0E-02	No	PD	D
PWB-11	T	8	1	9.5E-02	1.0E-02	No	NT	NT
PWB-12	T	8	8	3.1E+00	3.2E+00	No	NT	PI
PWB-13A	T	8	7	1.2E+00	1.0E+00	No	PI	I
PWB-14	T	8	8	2.0E-01	1.7E-01	No	D	D
PWB-15	T	8	6	1.2E+00	1.4E-01	No	PI	NT
PWB-16	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-2	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-3	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-4	T	8	8	4.0E-01	2.7E-01	No	NT	NT
PWB-5	T	7	7	6.0E-01	4.5E-01	No	S	S
PWB-6	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-7A	T	8	8	2.4E+00	9.3E-01	No	NT	NT
PWB-8	T	8	8	4.3E-01	4.6E-01	No	PD	D
PWB-9	T	8	7	1.0E-01	3.0E-02	No	NT	NT
WB2-1	S	8	2	1.6E-02	1.0E-02	No	NT	I
WB2-2	T	8	8	4.5E-01	3.6E-01	No	D	D
WB2-3	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
WB2-4	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMID								
AMW-3R	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
AMW-4R	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
AR-1	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
BBW-1	T	6	0	1.0E-02	1.0E-02	Yes	ND	ND
BBW-2	T	6	0	1.0E-02	1.0E-02	Yes	ND	ND
BBW-3	T	6	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-1	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-10	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-11	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-12	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-13A	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-14	T	8	2	3.1E+00	1.0E-02	No	NT	NT
PWB-15	T	8	1	5.4E-02	1.0E-02	No	NT	NT
PWB-16	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-2	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-3	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-4	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-5	T	7	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-6	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-7A	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-8	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
PWB-9	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
WB2-1	S	8	0	1.0E-02	1.0E-02	Yes	ND	ND
WB2-2	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND
WB2-3	T	8	0	1.0E-02	1.0E-02	Yes	ND	ND

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All units are µg/L (not mg/L)

MAROS Statistical Trend Analysis Summary

Well	Source/ Tail	Number of Samples	Number of Detects	Average Conc. (mg/L)	Median Conc. (mg/L)	All Samples "ND" ?	Mann-Kendall Trend	Linear Regression Trend
1,2-DIBROMOETHANE (ETHYLENE DIBROMID								
WB2-4	T	7	0	1.0E-02	1.0E-02	Yes	ND	ND
1,2-DICHLOROPROPANE								
AMW-3R	T	8	8	3.3E-01	3.2E-01	No	I	I
AMW-4R	T	8	8	1.2E+00	5.8E-01	No	PD	NT
AR-1	T	8	1	3.1E-01	1.0E-01	No	NT	NT
BBW-1	T	6	5	3.3E-01	3.0E-01	No	D	D
BBW-2	T	6	5	7.5E-01	8.1E-01	No	NT	S
BBW-3	T	6	0	1.0E-01	1.0E-01	Yes	ND	ND
PWB-1	T	8	5	2.3E-01	2.4E-01	No	PD	D
PWB-10	T	8	8	4.0E-01	4.0E-01	No	PI	PI
PWB-11	T	8	8	6.4E-01	6.7E-01	No	D	D
PWB-12	T	8	8	4.7E+00	4.7E+00	No	S	I
PWB-13A	T	8	8	1.3E+01	1.1E+01	No	D	D
PWB-14	T	8	7	1.5E+01	1.7E+01	No	D	S
PWB-15	T	7	7	6.5E+00	6.3E+00	No	PI	PI
PWB-16	T	8	8	8.8E+00	8.8E+00	No	D	PD
PWB-2	T	8	8	8.1E+00	5.1E+00	No	D	D
PWB-3	T	8	7	2.9E-01	2.7E-01	No	NT	NT
PWB-4	T	8	8	4.6E+00	3.4E+00	No	S	NT
PWB-5	T	7	7	2.6E+00	2.4E+00	No	S	S
PWB-6	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
PWB-7A	T	8	8	1.3E+01	1.3E+01	No	NT	S
PWB-8	T	8	8	2.1E+00	2.2E+00	No	S	S
PWB-9	T	8	8	1.1E+00	1.2E+00	No	NT	NT
WB2-1	S	8	8	3.3E+02	6.4E-01	No	NT	I
WB2-2	T	8	8	2.2E+00	1.0E+00	No	D	D
WB2-3	T	8	8	1.7E+00	9.1E-01	No	D	D
WB2-4	T	8	8	1.6E+00	1.6E+00	No	S	S
DINOSEB								
AMW-3R	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
AMW-4R	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
AR-1	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
BBW 1	T	6	0	1.0E 01	1.0E 01	Yes	ND	ND
BBW-2	T	6	0	1.0E-01	1.0E-01	Yes	ND	ND
BBW-3	T	6	1	1.5E-01	1.0E-01	No	NT	PI
PWB-1	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
PWB-10	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
PWB-11	T	8	7	4.5E-01	4.4E-01	No	NT	NT
PWB-12	T	8	8	2.7E+01	2.5E+01	No	S	S
PWB-13A	T	8	8	1.9E+00	1.5E+00	No	S	S
PWB-14	T	8	6	3.2E-01	2.4E-01	No	PD	PD
PWB-15	T	8	5	2.3E-01	1.2E-01	No	I	I
PWB-16	T	8	4	3.7E-01	2.4E-01	No	S	S
PWB-2	T	8	1	1.6E-01	1.0E-01	No	NT	NT

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All units are µg/L (not mg/L)

MAROS Statistical Trend Analysis Summary

Well	Source/ Tail	Number of Samples	Number of Detects	Average Conc. (mg/L)	Median Conc. (mg/L)	All Samples "ND" ?	Mann-Kendall Trend	Linear Regression Trend
DINOSEB								
PWB-3	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
PWB-4	T	8	8	1.7E+00	8.6E-01	No	PD	NT
PWB-5	T	7	7	2.1E+00	1.6E+00	No	NT	NT
PWB-6	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
PWB-7A	T	8	7	9.7E+00	6.9E+00	No	S	NT
PWB-8	T	8	7	7.3E-01	9.1E-01	No	D	D
PWB-9	T	8	8	7.8E-01	7.2E-01	No	S	S
WB2-1	S	8	3	6.3E+00	1.0E-01	No	NT	I
WB2-2	T	8	7	1.2E+00	7.1E-01	No	D	D
WB2-3	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND
WB2-4	T	8	0	1.0E-01	1.0E-01	Yes	ND	ND

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); No Detectable Concentration (NDC)

The Number of Samples and Number of Detects shown above are post-consolidation values.

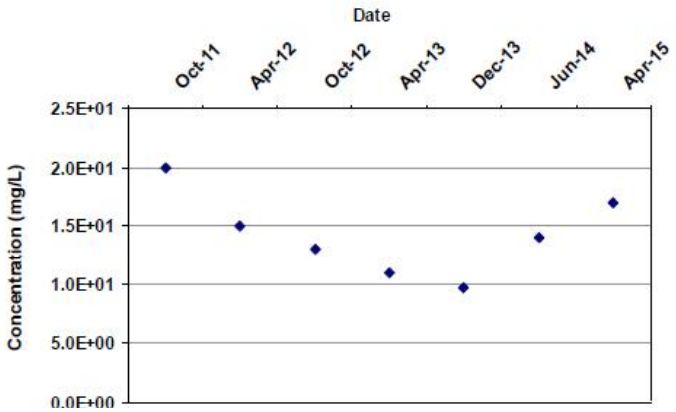
Attachment A-5
Time-Series Charts for
Selected B-Zone Wells

All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: PWB-5
Well Type: T
COC: 1,2,3-TRICHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -5

Confidence in Trend: 71.9%

Coefficient of Variation: 0.25

Mann Kendall Concentration Trend: (See Note) S

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PWB-5	T	10/15/2011	1,2,3-TRICHLOROPROPANE	2.0E+01		1	1
PWB-5	T	4/24/2012	1,2,3-TRICHLOROPROPANE	1.5E+01		1	1
PWB-5	T	10/15/2012	1,2,3-TRICHLOROPROPANE	1.3E+01		1	1
PWB-5	T	4/13/2013	1,2,3-TRICHLOROPROPANE	1.1E+01		1	1
PWB-5	T	12/15/2013	1,2,3-TRICHLOROPROPANE	9.7E+00		1	1
PWB-5	T	6/17/2014	1,2,3-TRICHLOROPROPANE	1.4E+01		1	1
PWB-5	T	4/21/2015	1,2,3-TRICHLOROPROPANE	1.7E+01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

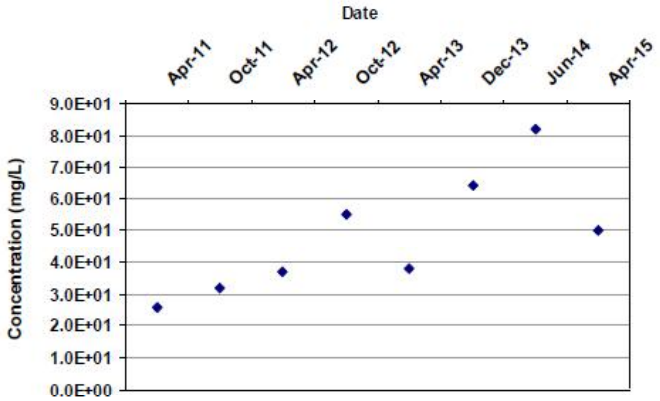
MAROS Version 2.2, 2006, AFCEE 2/19/2016 Page 1 of 1

All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: PWB-7A
Well Type: T
COC: 1,2,3-TRICHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 20

Confidence in Trend: 99.3%

Coefficient of Variation: 0.39

Mann Kendall Concentration Trend: (See Note) I

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PWB-7A	T	4/25/2011	1,2,3-TRICHLOROPROPANE	2.6E+01		1	1
PWB-7A	T	10/15/2011	1,2,3-TRICHLOROPROPANE	3.2E+01		1	1
PWB-7A	T	4/24/2012	1,2,3-TRICHLOROPROPANE	3.7E+01		1	1
PWB-7A	T	10/15/2012	1,2,3-TRICHLOROPROPANE	5.5E+01		1	1
PWB-7A	T	4/13/2013	1,2,3-TRICHLOROPROPANE	3.8E+01		1	1
PWB-7A	T	12/15/2013	1,2,3-TRICHLOROPROPANE	6.4E+01		1	1
PWB-7A	T	6/17/2014	1,2,3-TRICHLOROPROPANE	8.2E+01		1	1
PWB-7A	T	4/21/2015	1,2,3-TRICHLOROPROPANE	5.0E+01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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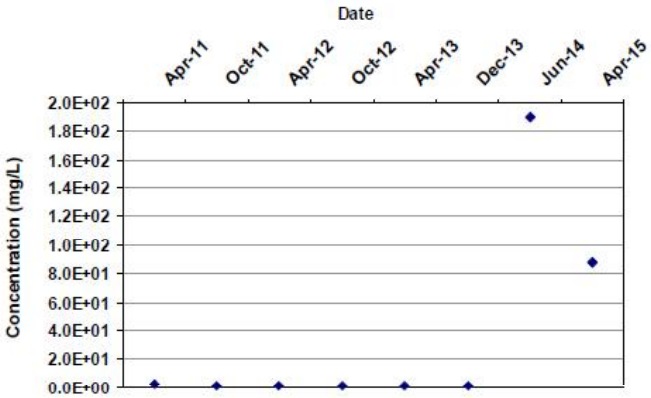
All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: WB2-1
Well Type: S
COC: 1,2,3-TRICHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -3

Confidence in Trend: 59.4%

Coefficient of Variation: 1.94

Mann Kendall Concentration Trend: (See Note) NT

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
WB2-1	S	4/25/2011	1,2,3-TRICHLOROPROPANE	1.7E+00		1	1
WB2-1	S	10/15/2011	1,2,3-TRICHLOROPROPANE	1.5E+00		1	1
WB2-1	S	4/24/2012	1,2,3-TRICHLOROPROPANE	1.2E+00		1	1
WB2-1	S	10/15/2012	1,2,3-TRICHLOROPROPANE	1.1E+00		1	1
WB2-1	S	4/13/2013	1,2,3-TRICHLOROPROPANE	1.1E+00		1	1
WB2-1	S	12/15/2013	1,2,3-TRICHLOROPROPANE	8.4E-01		1	1
WB2-1	S	6/17/2014	1,2,3-TRICHLOROPROPANE	1.9E+02		1	1
WB2-1	S	4/21/2015	1,2,3-TRICHLOROPROPANE	8.8E+01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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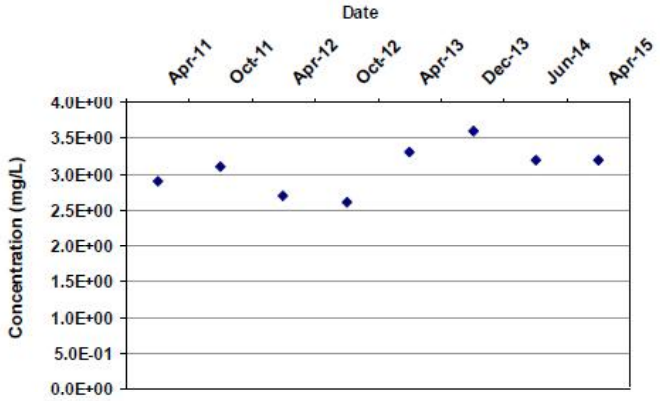
All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: PWB-12
Well Type: T
COC: 1,2-DIBROMO-3-CHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 9

Confidence in Trend: 83.2%

Coefficient of Variation: 0.11

Mann Kendall Concentration Trend: (See Note) NT

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PWB-12	T	4/25/2011	1,2-DIBROMO-3-CHLOROPROPA	2.9E+00		1	1
PWB-12	T	10/15/2011	1,2-DIBROMO-3-CHLOROPROPA	3.1E+00		1	1
PWB-12	T	4/24/2012	1,2-DIBROMO-3-CHLOROPROPA	2.7E+00		1	1
PWB-12	T	10/15/2012	1,2-DIBROMO-3-CHLOROPROPA	2.6E+00		1	1
PWB-12	T	4/13/2013	1,2-DIBROMO-3-CHLOROPROPA	3.3E+00		1	1
PWB-12	T	12/15/2013	1,2-DIBROMO-3-CHLOROPROPA	3.6E+00		1	1
PWB-12	T	6/17/2014	1,2-DIBROMO-3-CHLOROPROPA	3.2E+00		1	1
PWB-12	T	4/21/2015	1,2-DIBROMO-3-CHLOROPROPA	3.2E+00		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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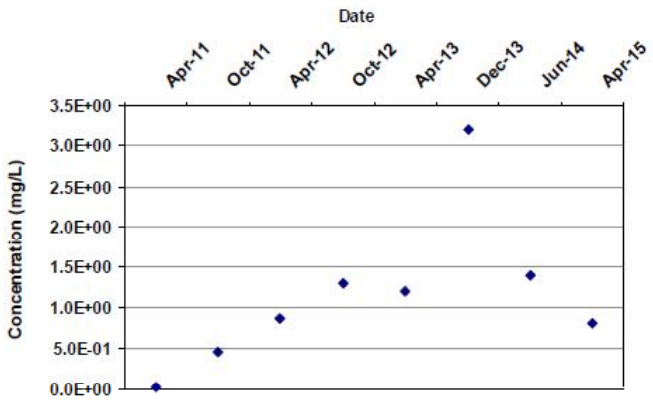
All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: PWB-13A
Well Type: T
COC: 1,2-DIBROMO-3-CHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 14

Confidence in Trend: 94.6%

Coefficient of Variation: 0.82

Mann Kendall Concentration Trend: (See Note) PI

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PWB-13A	T	4/25/2011	1,2-DIBROMO-3-CHLOROPROPA	1.0E-02	ND	1	0
PWB-13A	T	10/15/2011	1,2-DIBROMO-3-CHLOROPROPA	4.5E-01		1	1
PWB-13A	T	4/24/2012	1,2-DIBROMO-3-CHLOROPROPA	8.6E-01		1	1
PWB-13A	T	10/15/2012	1,2-DIBROMO-3-CHLOROPROPA	1.3E+00		1	1
PWB-13A	T	4/13/2013	1,2-DIBROMO-3-CHLOROPROPA	1.2E+00		1	1
PWB-13A	T	12/15/2013	1,2-DIBROMO-3-CHLOROPROPA	3.2E+00		1	1
PWB-13A	T	6/17/2014	1,2-DIBROMO-3-CHLOROPROPA	1.4E+00		1	1
PWB-13A	T	4/21/2015	1,2-DIBROMO-3-CHLOROPROPA	8.1E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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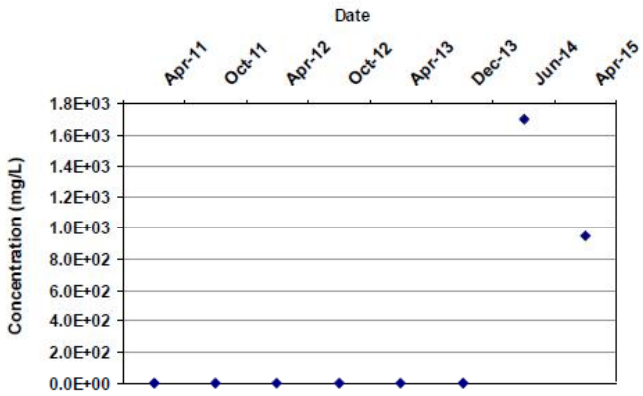
All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: WB2-1
Well Type: S
COC: 1,2-DICHLOROPROPANE

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -2

Confidence in Trend: 54.8%

Coefficient of Variation: 1.94

Mann Kendall Concentration Trend: (See Note) NT

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
WB2-1	S	4/25/2011	1,2-DICHLOROPROPANE	1.0E+00		1	1
WB2-1	S	10/15/2011	1,2-DICHLOROPROPANE	6.7E-01		1	1
WB2-1	S	4/24/2012	1,2-DICHLOROPROPANE	5.6E-01		1	1
WB2-1	S	10/15/2012	1,2-DICHLOROPROPANE	6.0E-01		1	1
WB2-1	S	4/13/2013	1,2-DICHLOROPROPANE	5.5E-01		1	1
WB2-1	S	12/15/2013	1,2-DICHLOROPROPANE	4.9E-01		1	1
WB2-1	S	6/17/2014	1,2-DICHLOROPROPANE	1.7E+03		1	1
WB2-1	S	4/21/2015	1,2-DICHLOROPROPANE	9.5E+02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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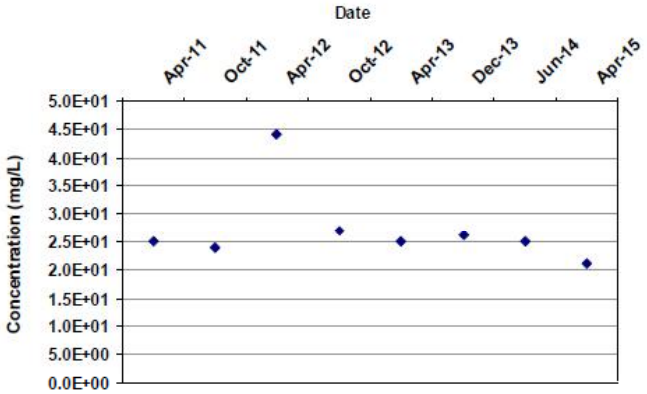
All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: PWB-12
Well Type: T
COC: DINOSEB

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -7

Confidence in Trend: 76.4%

Coefficient of Variation: 0.26

Mann Kendall Concentration Trend: (See Note) S

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PWB-12	T	4/25/2011	DINOSEB	2.5E+01		1	1
PWB-12	T	10/15/2011	DINOSEB	2.4E+01		1	1
PWB-12	T	4/24/2012	DINOSEB	4.4E+01		1	1
PWB-12	T	10/15/2012	DINOSEB	2.7E+01		1	1
PWB-12	T	4/13/2013	DINOSEB	2.5E+01		1	1
PWB-12	T	12/15/2013	DINOSEB	2.6E+01		1	1
PWB-12	T	6/17/2014	DINOSEB	2.5E+01		1	1
PWB-12	T	4/21/2015	DINOSEB	2.1E+01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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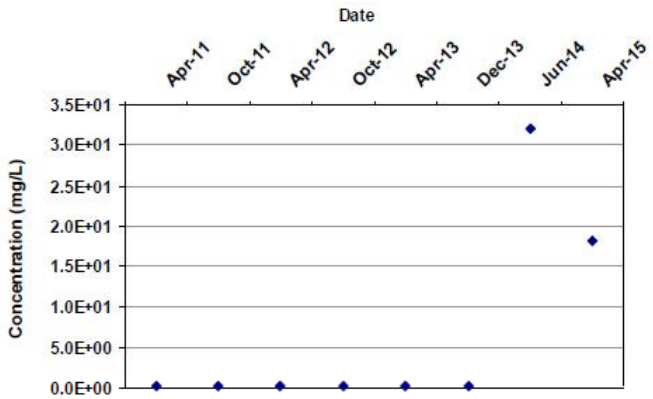
All units are µg/L (not mg/L)

MAROS Mann-Kendall Statistics Summary

Well: WB2-1
Well Type: S
COC: DINOSEB

Time Period: 4/25/2011 to 4/21/2015
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 6

Confidence in Trend: 72.6%

Coefficient of Variation: 1.91

Mann Kendall Concentration Trend: (See Note) NT

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
WB2-1	S	4/25/2011	DINOSEB	2.8E-01		1	1
WB2-1	S	10/15/2011	DINOSEB	1.0E-01	ND	1	0
WB2-1	S	4/24/2012	DINOSEB	1.0E-01	ND	1	0
WB2-1	S	10/15/2012	DINOSEB	1.0E-01	ND	1	0
WB2-1	S	4/13/2013	DINOSEB	1.0E-01	ND	1	0
WB2-1	S	12/15/2013	DINOSEB	1.0E-01	ND	1	0
WB2-1	S	6/17/2014	DINOSEB	3.2E+01		1	1
WB2-1	S	4/21/2015	DINOSEB	1.8E+01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

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Attachment A-6
Moment Analysis
for the B-Zone

Project: Brown & Bryant Superfund Site

Location: Arvin

User Name:

State: California

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	1,2,3-TRICHLOROPROPANE	0.19	24	99.9%	I
	1,2-DIBROMO-3-CHLOROPROPAN	0.86	10	86.2%	NT
	1,2-DIBROMOETHANE (ETHYLEN	0.47	8	80.1%	NT
	1,2-DICHLOROPROPANE	0.15	6	72.6%	NT
	DINOSEB	0.28	-4	64.0%	S
1st Moment: Distance to Source					
	1,2,3-TRICHLOROPROPANE	0.11	-8	80.1%	S
	1,2-DIBROMO-3-CHLOROPROPAN	0.13	4	64.0%	NT
	1,2-DIBROMOETHANE (ETHYLEN	0.36	-4	64.0%	S
	1,2-DICHLOROPROPANE	0.27	-16	96.9%	D
	DINOSEB	0.31	-22	99.8%	D
2nd Moment: Sigma XX					
	1,2,3-TRICHLOROPROPANE	0.19	2	54.8%	NT
	1,2-DIBROMO-3-CHLOROPROPAN	0.15	8	80.1%	NT
	1,2-DIBROMOETHANE (ETHYLEN	0.36	16	96.9%	I
	1,2-DICHLOROPROPANE	0.24	4	64.0%	NT
	DINOSEB	0.29	20	99.3%	I
2nd Moment: Sigma YY					
	1,2,3-TRICHLOROPROPANE	0.33	8	80.1%	NT
	1,2-DIBROMO-3-CHLOROPROPAN	0.39	10	86.2%	NT
	1,2-DIBROMOETHANE (ETHYLEN	0.41	10	86.2%	NT
	1,2-DICHLOROPROPANE	0.31	4	64.0%	NT
	DINOSEB	0.48	20	99.3%	I

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.25 **Saturated Thickness:** Uniform: 10 ft

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

Note: The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

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MAROS Spatial Moment Analysis Summary

Project: Brown & Bryant Superfund Site
Location: Arvin

User Name:
State: California

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	Estimated Mass (Kg)	Xc (ft)	Yc (ft)	Source Distance (ft)	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
1,2,3-TRICHLOROPROPANE							
4/25/2011	4.6E+02	192	-758	587	44,811	137,468	22
10/15/2011	6.0E+02	160	-768	588	41,810	107,414	23
4/24/2012	6.3E+02	227	-608	462	73,103	330,107	26
10/15/2012	7.4E+02	233	-606	464	70,182	225,030	26
4/13/2013	7.4E+02	234	-689	538	62,648	271,667	26
12/15/2013	7.6E+02	241	-712	562	60,849	294,364	26
6/17/2014	8.8E+02	215	-603	452	59,708	272,021	26
4/21/2015	8.4E+02	241	-646	502	68,356	225,358	26
1,2-DIBROMO-3-CHLOROPROPANE							
4/25/2011	1.4E+01	68	-666	470	43,788	100,854	22
10/15/2011	2.4E+01	128	-798	609	33,486	73,224	23
4/24/2012	2.8E+01	131	-699	513	54,863	273,548	26
10/15/2012	4.0E+01	156	-896	712	45,147	306,029	26
4/13/2013	2.8E+01	148	-724	542	53,613	285,221	26
12/15/2013	1.2E+02	200	-688	524	51,737	238,874	26
6/17/2014	2.9E+01	150	-727	546	51,656	281,159	26
4/21/2015	2.8E+01	137	-718	534	51,773	284,329	26
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)							
4/25/2011	1.4E+00	103	-734	542	72,152	321,862	22
10/15/2011	1.4E+00	103	-734	542	72,436	321,779	23
4/24/2012	3.7E+00	70	169	373	209,433	766,916	26
10/15/2012	4.4E+00	93	-78	148	178,854	1,016,077	25
4/13/2013	6.3E+00	205	-491	350	155,032	1,129,711	26
12/15/2013	5.7E+00	184	-387	255	166,028	1,130,254	26
6/17/2014	3.7E+00	70	169	373	209,433	766,916	26
4/21/2015	3.7E+00	70	169	373	209,433	766,916	26
1,2-DICHLOROPROPANE							
4/25/2011	5.2E+02	186	-1,070	887	53,649	288,101	22
10/15/2011	5.6E+02	189	-1,094	912	46,924	244,257	23
4/24/2012	5.6E+02	237	-841	680	84,646	632,800	26
10/15/2012	5.4E+02	216	-812	646	79,191	591,366	25
4/13/2013	5.3E+02	228	-867	702	80,759	628,679	26
12/15/2013	4.2E+02	152	-589	414	99,952	635,228	26
6/17/2014	6.9E+02	150	-643	464	68,041	573,454	26
4/21/2015	6.5E+02	152	-769	586	64,694	486,247	26

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Project: Brown & Bryant Superfund Site

Location: Arvin

User Name:

State: California

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	**Estimated Mass (kg)**	**Xc (ft)**	**Yc (ft)**	**Source Distance (ft)**	**Sigma XX (sq ft)**	**Sigma YY (sq ft)**	**Number of Wells**
DINOSEB							
DINOSEB							
4/25/2011	1.1E+02	153	-830	646	51,002	124,676	22
10/15/2011	2.1E+02	149	-765	582	37,420	88,339	23
4/24/2012	2.4E+02	173	-572	406	68,107	275,171	26
10/15/2012	2.1E+02	178	-570	406	71,200	309,000	26
4/13/2013	1.8E+02	183	-546	387	78,203	357,738	26
12/15/2013	9.8E+01	165	-424	272	100,954	528,176	26
6/17/2014	2.1E+02	172	-521	359	71,251	319,346	26
4/21/2015	2.1E+02	160	-453	294	91,285	417,489	26

Appendix C: ARARs Assessment

ARARs Analysis Appendix

Section 121 (d)(2)(A) of CERCLA 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 CERCLA site.

Chemical-specific ARARs for the A-zone groundwater were identified in the 1993 ROD. The cleanup ranges for the A-zone groundwater were set at 10 to 100 times the (then) current MCL to protect the B-zone groundwater. Chemical-specific ARARs identified in the 2007 ROD for the B-zone groundwater are shown in Table C-1. There were no contaminants of concern with B-zone groundwater cleanup level that exceed their current MCL.

Table C-1. Summary of Groundwater ARAR Changes for B-Zone Groundwater

Contaminant of Concern	2007 ROD cleanup level (µg/L)	State MCL (µg/L)	Federal MCL (µg/L)	Is the cleanup level above the current MCL?
Chloroform	80[1]	--	80[1]	No
1,2-Dibromo-3-chloropropane (DBCP)	0.2	0.2	0.2	No
1,2-Dichloropropane (1,2-DCP)	5	5	5	No
1,3-Dichloropropane (1,3-DCP)	0.5	0.5	--	No
Dinoseb	7	7	7	No
Ethylene dibromide	0.05	0.05	0.05	No
1,2,3-Trichloropropane (1,2,3-TCP)	0.5	--	--	There is no federal or state MCL for 1,2,3-TCP. The Cleanup goal is based on the Response Level, Drinking Water Program, California Department of Health Services, 1999; and available analytical practical quantification limit for 1,2,3-TCP.

Notes: [1]Total Trihalomethanes (sum of bromodichloromethane, dibromochloromethane, bromoform and chloroform), EPA MCL effective 01/01/04.

The following location- and action-specific ARARs have not changed since the last Five Year Review; and therefore, do not affect protectiveness:

- Fish & Game Code §3503 Prohibition-Destruction of Bird Eggs and Nests
- Fish & Game Regulations 14 CCR §472 Non-Game Animals
- NPDES Non-Point Source Discharge 40 CFR §122.26
- Anti-Degradation Policy SWRCB Resolution No. 68-16 Water Code §13140
- California Water Code §13140-13147, 13172, 13260, 13263, 13267, 13304, 27 CCR Div.2, Subdiv.1, Chap.3, Subchap.2, Art.2

- Sources of Drinking Water SWRCB Resolution No. 88-63
- Hazardous waste regulations Identification and Listing of Hazardous Waste 22 CCR Div. 4.5 Chap. 11 22 CCR §66264.13 22 CCR §66260.200
- Hazardous waste regulations Standards Applicable to Generators of Hazardous Waste 22 CCR Div. 4.5 Chap. 12
- Hazardous waste regulations Hazardous Waste Security 22 CCR §66264.14
- Hazardous waste regulations Preparedness and Prevention 22 CCR Div. 4.5, Chap. 14, Art. 3
- Hazardous waste regulations Hazardous Waste Facility General Inspection Requirements and Personnel Training 22 CCR §66264.15 -66264.16
- Hazardous waste regulations Water Quality Monitoring and Response Systems for Permitted Systems 22 CCR Div. 4.5, Chap. 14, Art. 6
- Hazardous waste requirements Closure and Post-Closure 22 CCR Div. 4.5, Chap. 14, Art. 7
- Hazardous waste regulations Use and Management of Containers 22 CCR Div. 4.5, Chap. 14, Art. 9
- Hazardous waste regulations Tank Systems 22 CCR Div. 4.5, Chap. 14, Art. 10
- Hazardous waste regulations Miscellaneous Units 22 CCR Div. 4.5, Chap. 14, Art. 16 22 CCR §66264.601 - 66264.603
- CCR, title 22, section 67391.1(a) DTSC Land use covenant
- CCR, title 22, section 67391.1(d), DTSC Land use covenant
- CCR, title 22, section 67391.1(f) DTSC Land use covenant
- CA Civil Code Section 1471(a) & (b)

Appendix D. Human Health and the Environment Risk Assessment

Human Health and the Environment Risk Assessment

1. Human Health Exposure

A human health risk assessment (HHRA) was completed for the Site as part of the 1993 Remedial Investigation/ Feasibility Study (RI/FS) Report for the soil OU and as part of the 2005 RI/FS Report for the groundwater OU. Both risk assessments were reviewed to identify any changes in exposure or toxicity that would impact protectiveness.

The 1993 HHRA characterized risks for surface soil. Risk for ingestion of contaminated surface soil was characterized for a child and for a young adult. Risk for ingestion of contaminated soil in the construction zone was characterized for an adult worker. Each of these scenarios exceeded the threshold of levels of concern to human health for the maximum detected concentration and only the child scenario had exposure that exceeded the threshold for the average detected concentration.

The 2005 HHRA identifies the following pathways for current and future receptors as complete based on the presence of all four pathways and the nature of the B&B Site, as well as the assumption that pavement, concrete, buildings, and asphalt caps could be removed to expose the underlying soil.

- Ingestion and direct contact with residual surface soil (0-10 feet below ground surface) for on-site maintenance workers;
- Inhalation of suspended particulates or organic vapor in outdoor air for off-site residents and commercial/industrial workers and on-site maintenance workers and commercial/industrial workers;
- Inhalation of indoor air contaminants in soil and groundwater (particulate matter from soils and VOCs from soils and groundwater) for off-site residents and commercial/industrial workers and on-site commercial/industrial workers;
- Ingestion and dermal contact of contaminated B-zone groundwater from untreated water supply for future potential off-site resident;
- Ingestion of contaminated City Well water for potential future on- and off-site commercial/industrial worker.

There have been no changes to exposure assumptions that could affect the protectiveness of the remedy.

2. Vapor Intrusion

Vapor intrusion was evaluated in the 2004 OU-2 RI/FS, and soil vapor sampling was performed in 2006 to evaluate whether there were complete exposure pathways on- and off-site. The 2006 Soil Vapor Report used a two-tiered analysis to determine if COCs were a risk to human health. The first tier was a comparison of maximum detected soil-vapor concentrations of detected constituents to the California Human Health Screening Levels (CHHSLs). The results for this analysis were that all detected constituents were below their respective CHHSLs. The second tier used the Johnson and Ettinger Model to further evaluate on- and off-site risks from soil-vapor exposure. The results from the

model indicate that the trace level constituents detected in off-site soil gas are orders of magnitude below the conservative regulatory threshold applied to unrestricted land use throughout California by EPA.

As part of this FYR the COC concentrations in the A-zone groundwater nearest the warehouse (well WA-5) were evaluated, based on the 2015 vapor intrusion guidance, "OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor to Indoor Air". Target groundwater concentrations for the commercial exposure scenario are compared to A-zone groundwater concentrations at well WA-5 from the April 2015 sampling. 1,3-Dichloropropane and dinoseb are not included in the table as they do not have a target groundwater concentration.

Contaminant of Concern	VISL Target Groundwater Concentrations (µg/L)	WA-5 Concentration in A-zone groundwater in April 2015
Chloroform	3.6	0.56
1,2-Dibromo-3-chloropropane	0.34	<0.05
1,2-Dichloropropane	11	5.3
Ethylene Dibromide	0.77	<0.05
1,2,3-TCP	94	0.5

All COCs have A-zone groundwater concentrations lower than the VISL Calculator target groundwater concentration. Therefore, vapor intrusion does not pose a risk to occupants at the warehouse onsite.

3. Toxicity Values

EPA's Integrated Risk Information System (IRIS) has a program that can be used to update toxicity values used by the Agency in risk assessment when newer scientific information becomes available. In the past five years, there have been a number of changes to the toxicity values for certain contaminants of concern at the Site. Groundwater and soil concentration results are compared to EPA's Regional Screening Levels (RSLs) as a first step in determining whether response actions may be needed to address potential human health exposures. The RSLs are chemical-specific concentrations for individual contaminants that correspond to an excess cancer risk level of $1x10^{-6}$ (or a Hazard Quotient (HQ) of 1 for non-carcinogens), and they have been developed for a variety of exposures scenarios (e.g. residential, commercial/industrial). RSLs are not de facto cleanup standards for a Superfund site, but they do provide a good indication of whether actions may be needed. Table D-1 below presents tap water RSLs.

Table D-1. Summary of Resident Tap Water (Drinking Water) RSLs (November 2015) for COCs at the Site

Contaminant of Concern	RSL for cancer risk in excess of $1x10^{-6}$ (µg/L)	Protective cancer risk range (µg/L)	RSL for non-cancer hazard (µg/L)	2007 ROD Selected Cleanup Level for Groundwater Zone B (µg/L)
Chloroform	0.22[1]	0.22-22	97[1]	80
1,2-dibromo-3-chloropropane	0.00033[1]	0.00033-0.033	0.37[1]	0.2
1,2-dichloropropane	0.44[1]	0.44-44	8.3[1]	5
1,3-dichloropropane	--	--	110[2]	0.5
Dinoseb	--	--	15[1]	7
Ethylene Dibromide	0.0075[1]	0.0075-0.75	17[1]	0.05
1,2,3-TCP	0.00075[1]	0.00075-0.075	0.62[1]	0.5

1. EPA Region 9 RSL (November 2015)
2. California Modified Tap Water RSLs (October 2015)

Any concentration below the cancer RSL indicates that cancer risk is low, while concentrations significantly above the cancer RSL may indicate an increase in cancer risk. For all COCs, the tap water RSLs for cancer risk are less than the cleanup levels selected in the 2007 ROD. For 1,2-dichloropropane, and ethylene dibromide the cleanup levels are within the acceptable cancer risk range of $1x10^{-6}$ to $1x10^{-4}$ and are therefore considered protective with respect to cancer risks.

Selected cleanup levels for chloroform, 1,2-dibromo-3-chloropropane, and 1,2,3-TCP were greater than their respective tap water RSLs for cancer risk.

- For chloroform, the cancer RSL (0.22 µg/L) is less than the selected cleanup level (80 µg/L), which was the MCL at the time of the ROD. There have been no detections of chloroform in any of the City of Arvin wells since October 2011. Recent B-zone groundwater sampling performed in April 2015 detected concentrations of chloroform ranging from 0.390-17.0 µg/L. Even though the RSL is lower than the MCL EPA considers the MCL to be protective.

- For 1,2-dibromo-3-chloropropane, the cancer RSL (0.00033 µg/L) is less than the selected cleanup level (0.2 µg/L), which was the MCL at the time of the ROD. Recent B-zone groundwater sampling performed in April 2015 detected concentrations of 1,2-dibromo-3,chloropropane ranging from 0.023-3.2 µg/L. Even though the RSL is lower than the MCL EPA considers the MCL to be protective.

- For 1,2,3-TCP, the cancer RSL (0.00075 µg/L) is less than the selected cleanup level (0.5 µg/L), which was the response level for the Drinking Water Program of the California Department of Health Services. Recent B-zone groundwater sampling performed in April 2015 detected concentrations of 1,2,3-TCP ranging from 0.0053-88.0 µg/L. 1,2,3-TCP was also detected in the down-gradient City of Arvin drinking water well CW-1 at 0.12µg/L, which is also outside of the cancer risk range. In 2012, EPA began sampling three background wells to determine a background concentration for 1,2,3-TCP. Results from the analysis show that the background concentration for 1,2,3-TCP is 1.3 µg/L in the B-zone groundwater. The

background level is above both the EPA cancer RSL and the Drinking Water Program of the CDHS response level.

For non-cancer risk, all COCs have cleanup levels below the tap water RSLs for non-cancer risk. Any concentration below the non-cancer RSL indicates that no adverse non-cancer health effect from exposure is expected.

Several COCs (1,2-dibromo-3-chloropropane, 1,2-dichloropropane, dinoseb and 1,2,3-TCP) were detected in the most recent groundwater sampling event at levels above their respective non-cancer RSLs. For these COCs, however, the cleanup level is below the non-cancer RSLs so the cleanup level is protective.

Contamination at the B&B Site has not affected drinking water sources in the City of Arvin area. The perched A-zone groundwater is not a current or a potential source of potable water in the area of the B&B Site. The contamination in the perched aquifer A-zone does pose a potential threat to the underlying unconfined regional aquifer (B-zone) and the confined C-zone aquifer that is used for municipal drinking water. Public and private wells within 3 miles of the site provide drinking water to 7,200 people and irrigate 19,600 acres of cropland. Arvin City Well CW-l is 1,500 feet down-gradient from the Site. None of these supply wells are known to produce water from the A-zone or B-zone. If contamination is allowed to migrate, the Arvin City Well CW-1 could be significantly impacted by contamination.

Further, regulations such as the Safe Drinking Water Act prohibit water suppliers form serving water contaminated in excess of drinking water standards (MCLs) to consumers.

In the 1993 ROD a soil cleanup level was developed assuming a child ingests 0.2 mg/day of soil over a five-year period using calculations for RCRA no-action. Table D-2 below presents soil RSLs.

Table D-2. Summary of Resident Soil RSLs (2015) for COCs at the Site

Contaminant of Concern	RSL for cancer risk in excess of $1x10^{-6}$ (mg/kg)	Protective cancer risk range (mg/kg)	Child RSL for non-cancer hazard (,g/kg)	1993 ROD Selected Cleanup Level for Soil (mg/kg)
Dinoseb	--	--	63	80

EPA has insufficient data to determine if dinoseb can increase the risk of cancer in humans. The total non-cancer RSL (63 mg/kg) for dinoseb is less than the cleanup level (80 mg/kg) selected in the 1993 ROD; however, the cleanup level was determined using the non-cancer ingestion screening level for a child which is currently 78 mg/kg. Most contaminated soil within the top 7 feet was placed under the RCRA cap, so actual exposure to contaminated soil is unlikely. Therefore, the soil cleanup level selected in the 1993 ROD is still protective.

4. Ecological risk

A biological constraints analysis was performed in 2002 at the B&B Site. There are no significant ecological risks associated with OU-1 and OU-2; however, the cap should continue to be inspected for possible animal burrows. If observed, burrows should be filled and sealed to ensure the integrity of the cap and to maintain the protectiveness of the remedy.

Appendix E: Site Inspection Checklist

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Brown and Bryant Superfund Site	**Date of inspection:** January 29, 2016
Location: Arvin, Ca	**EPA ID:**
Agency, office, or company leading the five-year review: EPA	**Weather/temperature** Sunny/ 64 degrees F

Remedy Includes: (Check all that apply)

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

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

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

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

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

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

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

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

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

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

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

1. **O&M Documents**

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

Remarks

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

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

IV. O&M COSTS

1. **O&M Organization**

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

2. **O&M Cost Records**

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

Total annual cost by year for review period if available

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

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

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

A. Fencing

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

Remarks Fence and gates are in good condition. Gates remain locked when site is not in use.

B. Other Access Restrictions

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

Remarks Signs are posted on fence and building.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

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

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

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

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

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

D. General

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

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

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

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

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

B. Other Site Conditions

Remarks

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☒ Location shown on site map ☐ Settlement not evident
Areal extent variable Depth variable
Remarks There are some low spots that experience ponding after rain. Most of this ponding is occurring on the concrete cap and not the RCRA cap.

2. **Cracks** ☒ Location shown on site map ☐ Cracking not evident
Lengths ~200ft Widths 1/2 in Depths 4 inches
Remarks There was one large crack that extends the east side of the RCRA cap and is approximately 200 ft long. The crack is at the edge of the RCRA cap where the cap slopes to the fence. This crack could be evidence of sliding of the east side of the cap. There were some minor cracks extending from previously repaired cracks.

3. **Erosion** ☒ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks The drain on the east side of the concrete cap that drains to the edge of the fence is eroding the soil at the edge of the cap.

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

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

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

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

8.	**Wet Areas/Water Damage**	☐ Wet areas/water damage not evident	
	☐ Wet areas	☐ Location shown on site map	Areal extent_____
	■ Ponding	☐ Location shown on site map	Areal extent_____
	☐ Seeps	☐ Location shown on site map	Areal extent_____
	☐ Soft subgrade	☐ Location shown on site map	Areal extent_____
	Remarks		
9.	**Slope Instability** ☐ Slides	☐ Location shown on site map	☐ No evidence of slope instability
	Areal extent_____		
	Remarks		
B. Benches	■ N/A	■ Applicable	
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	☐ Location shown on site map	☐ N/A or okay
	Remarks		
2.	**Bench Breached**	☐ Location shown on site map	☐ N/A or okay
	Remarks		
3.	**Bench Overtopped**	☐ Location shown on site map	☐ N/A or okay
	Remarks		
C. Letdown Channels	■ Applicable	■ N/A	
	(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement**	☐ Location shown on site map	☐ No evidence of settlement
	Areal extent_____	Depth_____	
	Remarks		
2.	**Material Degradation**	☐ Location shown on site map	☐ No evidence of degradation
	Material type_____	Areal extent_____	
	Remarks		
3.	**Erosion**	☐ Location shown on site map	☐ No evidence of erosion
	Areal extent_____	Depth_____	
	Remarks		

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

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

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

D. Cover Penetrations ☒ Applicable ☐ N/A

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

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

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

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

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

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

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

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

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

F. Cover Drainage Layer ☐ Applicable ☒ N/A

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

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

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

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

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

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

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

H. Retaining Walls ☐ Applicable ☒ N/A

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

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

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

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
Areal extent_____ Depth_____
Remarks There is some siltation where ponding occurs and where there is drainage channel off cap. Drainage channel is approximately 60 feet long, 4 inches wide and is sloping down 1 inch to the east.

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

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks The drain on the east side of the concrete cap that drains to the edge of the fence is eroding the soil at the edge of the cap.

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

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

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

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

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

1. **Pumps, Wellhead Plumbing, and Electrical**
☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks One extraction well is not used because there is no water to extract. The electrical controls system was upgraded and now shows the gallons of extracted water per holding tank, status of extraction wells, and maintenance/warning logs.

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☒ Good condition ☐ Needs Maintenance

Remarks Extraction system has been upgraded to feature remote control of extraction wells and pumping rates. The condensation in the airlines was mitigated by installing new regulators. Pipelines are guarded with jersey barriers.

3. **Spare Parts and Equipment**

☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks Current contractor is working to obtain a spare pump similar to the pumps currently installed in extraction wells.

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

1. **Collection Structures, Pumps, and Electrical**

☐ Good condition ☐ Needs Maintenance

Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☐ Good condition ☐ Needs Maintenance

Remarks

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☒ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☒ N/A

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☐ Carbon adsorbers

☐ Filters_____

☐ Additive (*e.g.*, chelation agent, flocculent)_____

☐ Others_____

☐ Good condition ☐ Needs Maintenance

☐ Sampling ports properly marked and functional

☐ Sampling/maintenance log displayed and up to date

☐ Equipment properly identified

☐ Quantity of groundwater treated annually_____

☐ Quantity of surface water treated annually_____

Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☐ Good condition ☐ Needs Maintenance

Remarks

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

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

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

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

D. Monitoring Data

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

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

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks MNA is part of the remedy for OU-2 however current development of the conceptual site model has put MNA on hold.

X. OTHER REMEDIES

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

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

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

The goal of the remedy is to 1) remove or control COCs in the A-zone groundwater such that it no longer is a source of contamination to the B and C zone groundwater, 2) restore the B-zone groundwater to its potential beneficial use as drinking water, and 3) prevent potential exposure to contaminated groundwater. Overall, the remedy is functioning to remove contaminated groundwater from the A-zone. The system has been removing on average 100 gallons a day continuously since October 2015. Currently, MNA evaluation has been put on hold until more information from the continuous pumping of the A-zone can be collected. There also is not currently any institutional control preventing people from installing drinking water wells in the B-Zone.

B. Adequacy of O&M

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

Previous attempts to repair cracks with sealant have not been effective evident by the extension of previously filled cracks.

C. Early Indicators of Potential Remedy Problems

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

There were no early indicators suggested during the site inspection that would indicate there are issues with the remedy or protectiveness.

D. Opportunities for Optimization

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

Appendix F: Site Inspection Photos

Photo 1: Extracted water storage containers in secondary containment

Photo 2: Operating system controls

Photo 3: Piping into storage tanks

Photo 4: Camera to observe inside warehouse remotely

Photo 5: Hazardous waste label on extracted water containers

Photo 6: Secondary containment and barrels used for monitoring sampling

Photo 7: Hazardous waste label on investigation derived waste from GW sampling activities

Photo 8: Extraction well

Photo 9: Extraction well pressure gauge

Photo 10: Extraction well piping

Photo 11: Extraction well piping protected by “Jersey barrier”

Photo 12: Example of monitoring wells and ballards protecting a monitoring well

Photo 13: Depression area in non-RCRA cap

Photo 14: “Jersey barriers” protecting piping into extraction system

Photo 15: “Jersey barriers” protecting piping into extraction system

Photo 16: Ponding area on west side of building

Photo 17: Small office area and shed inside warehouse

Photo 18: View of northeast corner of property

Photo19: View of east half of non-RCRA cap.

Photo 20: Berm around building

Photo 21: View of west side of property facing south

Photo 22: Sedimentation found near ponding area on west side of warehouse

Photo 23: Example of repaired crack that has reopened

Photo 24: Example of vegetation growing along bottom of fence impeding view to check integrity of fence

Photo 25: Example of vegetation growing in repaired crack

Photo 26: View of RCRA cap facing northeast

Photo 27: Crack on RCRA cap with vegetation growing

Photo 28: Crack that extends length of east side of RCRA cap. Pocket knife placed in crack to show depth of crack

Photo 29: Length of crack shown in Photo 28

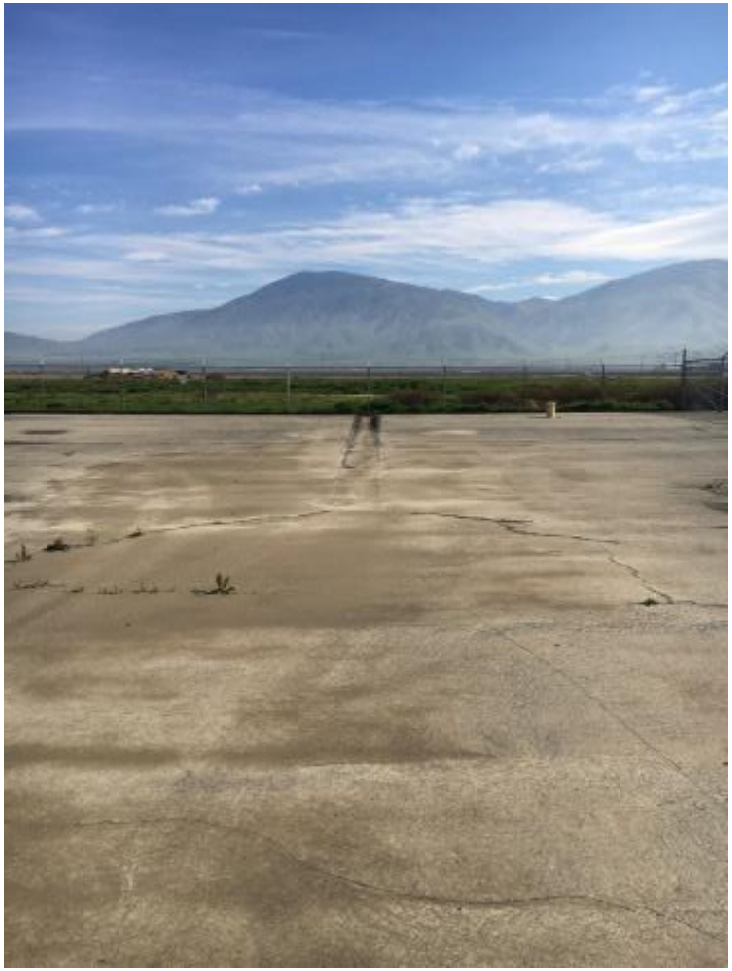

Photo 30: Shallow channel from depression area to aid with drainage from the cap. Some sedimentation evident.

Photo 31: Drainage of small channel causing minor undercutting of non-RCRA cap.

Photo 32: Entrance on north side of property. Gate is locked when no one is on site.