

OCTOBER 2012 GROUNDWATER SAMPLING REPORT

•FINAL•

**Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California**

**Contract No. W912PP-10-D-0014
Task Order No. 0010**

**Prepared for:
U.S. Army Corps of Engineers
Albuquerque District
Albuquerque, New Mexico**

**Prepared by:
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TABLE OF CONTENTS

ABBREVIATIONS, ACRONYMS, & SYMBOLS..... v

1.0 INTRODUCTION..... 1

2.0 BACKGROUND INFORMATION..... 1

 2.1 SITE BACKGROUND 1

 2.2 PREVIOUS INVESTIGATIONS 2

 2.3 SITE GEOLOGY AND HYDROGEOLOGY 3

 2.4 WELL DESCRIPTION..... 4

 2.5 WELL CONSTRUCTION AND GROUNDWATER DEPTHS 4

 2.6 BARCAD® SYSTEM..... 5

 2.7 WELL MAINTENANCE ACTIVITIES..... 5

3.0 SCOPE OF SAMPLING AND ANALYSIS..... 6

4.0 SAMPLING PROCEDURES..... 7

 4.1 WATER-LEVEL MEASUREMENTS 7

 4.2 BARCAD® PURGING 7

 4.3 LOW FLOW PURGING 7

 4.4 WELL SAMPLING..... 7

 4.5 DUPLICATE SAMPLES..... 9

 4.6 REPLICATE AND SPLIT SAMPLES..... 9

 4.7 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE (MS/MSD) 9

 4.8 EQUIPMENT BLANKS 9

 4.9 TRIP BLANKS 9

 4.10 TEMPERATURE BLANKS 9

 4.11 LEVEL III AND IV DATA VALIDATION 10

5.0 DECONTAMINATION PROCEDURES 10

6.0 DISPOSAL OF RESIDUAL MATERIALS..... 10

7.0 CONCLUSIONS..... 11

 7.1 GROUNDWATER DEPTHS AND FLOW DIRECTION..... 11

 7.2 CONTAMINANTS OF CONCERN IN THE A-ZONE..... 12

 7.3 CONTAMINANTS OF CONCERN IN THE B-ZONE..... 13

 7.4 OTHER LABORATORY RESULTS 14

 7.5 SAMPLING PARAMETER MEASUREMENTS 15

8.0 REFERENCES..... 16

FIGURES

- 1 SITE LOCATION MAP
- 2 SITE PLAN AND WELL LOCATIONS
- 3 A-ZONE GROUNDWATER ELEVATION CONTOURS
- 4 B-ZONE GROUNDWATER ELEVATION CONTOURS

-
- 5 A-ZONE – 1,2-DCP ISOCONCENTRATION MAP
 - 6 A-ZONE – CHLOROFORM ISOCONCENTRATION MAP
 - 7 A-ZONE – 1,2,3-TCP ISOCONCENTRATION MAP
 - 8 B-ZONE – 1,2-DCP ISOCONCENTRATION MAP
 - 9 B-ZONE – CHLOROFORM ISOCONCENTRATION MAP
 - 10 B-ZONE – DINOSEB ISOCONCENTRATION MAP
 - 11 B-ZONE – 1,2,3-TCP ISOCONCENTRATION MAP
 - 12 B-ZONE – DBCP ISOCONCENTRATION MAP

TABLES

- 1 GROUNDWATER WELL DEPTHS AND ELEVATIONS
- 2 CHEMICALS OF CONCERN IN A-ZONE GROUNDWATER
- 3 SUMMARY OF CHEMICALS OF CONCERN IN A-ZONE GROUNDWATER
- 4 CHEMICALS OF CONCERN IN B-ZONE GROUNDWATER
- 5 SUMMARY OF CHEMICALS OF CONCERN IN B-ZONE GROUNDWATER
- 6 RESULTS OF WET CHEMISTRY ANALYSIS
- 7 SUMMARY OF WET CHEMISTRY ANALYSIS

APPENDICES

- A DAILY FIELD LOGS
- B LABORATORY REPORTS (*PROVIDED WITH HARD COPY ON CD-ROM*)
- C DATA VALIDATION AND AUTOMATED DATA REVIEW (ADR) REPORTS (*ADR IS PROVIDED WITH HARD COPY ON CD-ROM*)
- D GROUNDWATER ELEVATION GRAPHS

ABBREVIATIONS, ACRONYMS, & SYMBOLS

°C	degrees celsius
%RPD	Relative Percent Difference
µg/L	micrograms per liter
1,2,3-TCP	1,2,3-Trichloropropane
1,2-DCP	1,2-Dichloropropane
1,3-DCP	1,3-Dichloropropane
B&B	Brown & Bryant, Inc.
bgs	below ground surface
COC	chemicals of concern
DBCP	1,2-Dibromo-3-chloropropane
Eco	Eco & Associates, Inc.
EDB	ethylene dibromide
Emax	Emax Laboratories, Inc.
gpm	gallon per minute
HCl	hydrochloric acid
IDW	investigation-derived wastes
L	liter
MCL	maximum contaminant level
mg/L	milligrams per liter
mL	milliliter
MNA	monitored natural attenuation
mS/cm	milli Siemens per centimeter
MS/MSD	matrix spike and matrix spike duplicates
mV	millivolt
NELAP	National Environmental Laboratory Accreditation Program
NPL	National Priorities List
NTU	Nephelometric Turbidity Unit
OU	operable unit
PPE	personal protective equipment
ppm	parts per million
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource and Conservation Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOA vial	volatile organic analysis vial
VOC	volatile organic compound

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1.0 INTRODUCTION

This report describes the October 2012 groundwater-sampling event conducted at the former Brown & Bryant, Inc. (B&B) Superfund Site (hereafter, referred to as the "Site") located in the City of Arvin, Kern County, California (Figure 1). Groundwater at this Site was impacted with chlorinated solvents, herbicides, and pesticides during B&B's occupancy. Eco & Associates, Inc. (Eco) was retained by the U.S. Army Corps of Engineers (USACE) to perform groundwater monitoring at the Site. This monitoring has been performed under Purchase Order No. W912PP-12-P-0154.

This report was prepared in general conformance with the Workplan prepared by Eco & Associates, Inc. (Eco 2007) modified to include additional sampling for added constituents resulting from EPA and USACE project reviews conducted in March 2011. Revised Groundwater Sampling and Analysis Plan and Quality Assurance Project Plan (both dated August 2011) were used for this sampling event.

2.0 BACKGROUND INFORMATION

2.1 SITE BACKGROUND

The B&B Arvin facility is located at 600 South Derby Street in Arvin, California, about 18 miles southeast of the City of Bakersfield. The Site is located on the east side of Arvin in a light industrial and commercial area. Residential properties are located west of the Site and agricultural fields are located east of the Site.

The B&B facility operated as a pesticide re-formulator and custom applicator facility from 1960 to 1989. The facility formulated agricultural chemicals including pesticides, herbicides, fumigants, and fertilizers for sale to the local farming community between 1960 and 1968. In 1981, the facility was licensed under the Resource and Conservation Recovery Act (RCRA) as a hazardous waste transporter. Contamination of soil and groundwater resulted from

inadequate procedural controls, chemical spills during operations, and leaks from a surface wastewater pond and sumps. The largest releases on-site were from the wastewater pond, a sump area, and a dinoseb spill area (U.S. Environmental Protection Agency [USEPA 1993a]).

The wastewater pond located in the southwest portion of the Site was originally excavated as an unlined earthen pond in 1960. The pond was used to collect run-off water from the yard and from two sumps (since excavated). The pond was also used to collect rinse water from rinsing tanks used for fumigants. Excess pond water and rainwater run-off also collected in a topographically low area to the east and south of the pond. In addition, ponded water from precipitation and irrigation from the east has occasionally breached the berm in the southeast corner of the pond and drained into the pond. The pond was double lined with a synthetic liner in November 1979. The liner and additional soil were excavated in August 1987. Approximately 640 cubic yards of soil that showed visible signs of contamination were removed from the pond at that time. The depths of this excavation ranged from approximately one and one-half feet on the sides to five feet on the bottom (USEPA 1993a).

In 1960, an unlined earthen sump was constructed in the center of the Site. The sump was used to collect wash water from a pad where equipment and tanks used for liquid fertilizers and fumigants were washed. Water from the sump was drained to the pond through an underground pipeline. In 1980, the sump was replaced with two double lined sumps, and two lined sand traps were installed west of the pond. Dinoseb was stored in a smaller tank storage area along the eastern fence, just north of the pond. In 1983, there was a significant dinoseb spill in this area. As a result, the soil and groundwater underlying this portion of the Site has been reported with the highest concentrations of dinoseb. USEPA excavated highly contaminated soil from this area in the mid-1990s (USEPA 1993a).

In 1989, the Site was listed on the National Priorities List (NPL). In the same year, all operations at the Site ceased. Subsequently, various emergency and removal actions were initiated to minimize or eliminate immediate threats to human health and the environment (USEPA 1993a).

Currently, the Site is vacant. A warehouse is located on the property. The property is secured by a chain-link fence and paved with asphalt. The asphalt acts as a RCRA cap in the southern portion of the Site and a non-RCRA cap in the northern portion.

2.2 PREVIOUS INVESTIGATIONS

A review of the available reports generated between 1987 through 2006 indicates that the Site has been the subject of several investigations to assess the nature and extent of contamination. Based on the available documents, the Site investigations were conducted under two separate operable units (OUs): OU-1 and OU-2.

The study area for the OU-1 investigations included surface soil, the unsaturated A-zone, and the A-zone groundwater. The A-zone includes unsaturated soils below ground surface (bgs), which may vary in thickness from 65 to 85 feet, and the first water-bearing unit, the A-zone groundwater. The depth to the saturated zone generally varies between 65 and 75 feet bgs. The base of the A-zone is a thin sandy clay layer between 75 and 85 feet bgs. The A-zone groundwater occurs beneath the entire Site but pinches out between 500 and 600 feet south of the Site, 200 feet east of the Site, and 300 feet west of the Site.

The study area for the OU-2 investigation includes the unsaturated zone beneath the A-zone aquifer and the B-zone aquifer. The B-zone includes unsaturated soil beneath the A-zone and the second lowest water-bearing unit (B-zone groundwater) at 140 to 165 feet bgs. The B-zone

extends to at least 250 feet bgs and ends at a clay layer that confines the drinking water aquifer (the C-zone) beneath it.

Subsurface investigations conducted on-Site to date have confirmed the presence of a number of potentially hazardous substances in the groundwater. Fifty-six organic compounds were found within A-zone groundwater samples and 11 were found in B-zone groundwater samples. The primary chemicals of concern (COCs) are as follows:

- 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)
- Dinoseb

The contamination in the perched aquifer poses a potential threat to the underlying unconfined regional aquifer (B-zone) and the C-zone aquifer that is used for municipal drinking water. Public and private wells within 3 miles of the Site provide drinking water to 19,304 people and irrigate 19,600 acres of cropland. City of Arvin Well #1 (CW-1) is located towards the southwest approximately 1,500 feet from the Site (USEPA 1993b).

2.3 SITE GEOLOGY AND HYDROGEOLOGY

The subject Site is underlain with 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 these soils. The soils are generally thinly interbedded with textural changes occurring every few vertical inches. These textural changes are also believed to occur laterally.

The Site geology has been divided into two zones: the A-zone and the B-zone. The A-zone includes unsaturated soil at 65 to 75 feet bgs and includes the first water bearing unit, the A-zone groundwater. The depth to the saturated zone (see groundwater depths on Table 1) varied between 65 and 85 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 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.

The B-zone includes unsaturated soil beneath the A-zone and the second lowest water-bearing unit (B-zone groundwater) at 140 to 165 feet bgs. The B-zone extends to at least 250 feet bgs and ends at a clay layer that confines the drinking water aquifer beneath it. The top of the clay layer may be as deep as 300 feet and is reported to be 20 to 40 feet thick (Eco 2011).

The following is a description of the A- and B-zone groundwater conditions as described in the project Remedial Investigation/Feasibility Study report (RI/FS) (Panacea 2005):

A-zone: 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 provide pathways for vertical flow of groundwater from the A-zone into the B-zone. The soils under the A-zone aquitard, and at the top of the B-zone, are unsaturated to a

depth of approximately 140 feet (Elevation 286). 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 ¼ gallon per minute (gpm).

B-zone: The B-zone groundwater 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 to the south, and the gradient is relatively flat (0.0004 ft/ft). The hydraulic conductivity in the B-zone is much higher than that for the A-zone. Past pump tests for the water-bearing unit at 170 feet bgs indicated that wells could be pumped at seven gpm for an extended period without appreciable drawdown.

The above A-zone and B-zone conditions are groundwater descriptions as provided in the 2005 RI/FS document. Since then, periodic groundwater sampling and monitoring events have been performed and the groundwater conditions were described in the reporting for these events. The most recent sampling event is discussed in this report including a description of changes since the RI/FS document was prepared.

2.4 WELL DESCRIPTION

The 44 groundwater monitoring wells at the Site and on the adjoining properties were constructed between 1984 and 2007 and installed at locations designed to assess the extent of the contaminant plume, contaminant concentrations, and aquifer characteristics. Another four wells were installed at the Site in 2010 (PWB-13A through PWB-16). Also, three background wells were installed upgradient of the site in August 2012 — BBW-1, BBW-2, and BBW-3. A list of the 51 groundwater monitoring wells is provided on Table 1. The coordinates (NAD83, Zone 5) for the wells are also presented on that table. The locations of these wells are shown on Figure 2.

Fifty-one wells, 14 on-Site and 37 offsite, are used to sample for A- & B-zone groundwater and to assess the COCs in groundwater. Twenty-five of these wells are screened within the A-zone aquifer, and 26 are screened within the B-zone aquifer. Ten of the 25 A-zone wells listed on Table 1 were not sampled because water was below the BarCad® elevation and at these wells the groundwater depth was reported to be “not measured”. These wells are: AMW-1P, AMW-2P, AP-1, AP-2, AP-4, EPAS-1, PWA-5, PWA-6, WA-4, WA-7, and WA-8. At an additional five wells (EPAS-1, EPAS-4, PWA-1, PWA-4, and WA-6) samples were not collected because little water was measured and there was not sufficient recharge following purging at these wells. The city well was not sampled during this sampling event.

The wells sampled during this study (Figure 2) are spaced widely within the known contaminant plume and along portions of the plume’s perimeter. These wells were intended to provide sufficient data to delineate the on-Site and offsite extent of the seven COCs listed in Section 2.3 of this report. A history of the COC concentrations reported for each of these wells is provided in the analytical summary attached as Tables 2 and 4 of this report.

2.5 WELL CONSTRUCTION AND GROUNDWATER DEPTHS

The on-Site wells used during this study vary in construction. Details of the well depths, screen intervals, and diameters are provided on Table 1. The groundwater depths measured during this study (October 2012), and surveyed casing elevations are provided on Table 1.

All wells sampled for this monitoring event were equipped with dedicated BarCad® groundwater-sampling equipment. Since the installation of the BarCad® system,

measurements of pH, conductivity, and temperature of water samples were only collected during each of the two purges from the BarCad[®] system.

2.6 BARCAD[®] SYSTEM

The BarCad[®] system is a groundwater-sampling instrument designed for permanent installation at a fixed elevation in groundwater monitoring wells. The BarCad[®] system is made up of the following:

- A BarCad[®] unit consisting of a ceramic porous filter (approximately 1½ inches in diameter and 16 inches long)
- One-inch-diameter polyvinyl chloride (PVC) stinger pipe connecting the BarCad[®] unit to the top of the well
- Stainless steel probe with polyethylene tubing leading up the inside of the PVC stinger pipe to the wellhead

The wellhead is attached to the top of the PVC riser tube from the BarCad[®] unit. The wellhead assembly consists of an airtight Swagelok[®] fitting for the polyethylene tubing to exit the interior of the PVC stinger pipe, and a quick-connect fitting to connect the pressurized inert gas supply.

The BarCad[®] groundwater-sampling system works by applying pressurized inert gas (nitrogen) to the inside of the PVC stinger pipe, which in turn pressurizes the water column inside the BarCad[®] unit and drives the existing water into the stainless steel probe and up the polyethylene tubing to the surface. Subsequently, the inert gas displaces all of the water in the BarCad[®] unit and PVC stinger pipe through the stainless steel probe and polyethylene tubing and purges the BarCad[®] system of all existing water. After the system has been purged, inert gas pressure is removed from the BarCad[®] system to allow groundwater to flow into the BarCad[®] unit. Inert gas pressure is then reapplied, and the resulting water can be collected for laboratory analysis.

One well volume of groundwater is purged (completely) from the BarCad[®] reservoir in a single purge event. After the reservoir has been emptied of groundwater and the nitrogen pressure is released, the BarCad[®] reservoir again opens to the aquifer allowing fresh groundwater to infill the BarCad[®] reservoir. During groundwater purging at the Site, groundwater is purged from the BarCad[®] reservoir three times. The initial purge removes all possible stagnant water from the BarCad[®] reservoir. The second purge is expected to rinse initial groundwater from the reservoir and tubing. The groundwater removed during the fourth purge is anticipated to be representative of the adjoining aquifer. This groundwater is collected and submitted for chemical analysis. The pH, temperature, and conductivity measurements of each well volume purged (one reservoir volume) are anticipated to be similar. Due to the nature of the BarCad[®] system, these measurements are not required to ensure that representative formation water is being collected.

2.7 WELL MAINTENANCE ACTIVITIES

Well maintenance activities were not performed on A-zone and B-zone wells during the October 2012 sampling event. Observations of the wells showed them to be serviceable and requiring no maintenance.

3.0 SCOPE OF SAMPLING AND ANALYSIS

The objective of the sampling and analysis effort was to assess the possible presence and concentration of COCs in groundwater in both the A- and B-zones beneath the Site and the adjoining properties.

Table 1 lists all of the monitoring wells used in this study. At 10 of the 25 wells, the groundwater was not measured as it was below the BarCad® elevation. At another 5 wells there was insufficient recharge of water following purging to sample the wells. Ten wells were sampled in the A-zone. Twenty-six wells are included in the sampling for the B-zone including Wells BBW-1 through BBW-3. All of these wells were sampled.

The locations of A- & B-zone wells are shown in Figure 2.

During the October 2012 sampling event, the collected groundwater samples were tested for the seven COCs as well as any other constituents reported for each analytical method. The COCs and test methods are provided in the following table:

TEST METHODS

CONSTITUENT	ANALYTICAL METHOD
Chloroform	EPA 8260B
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260 SIM
1,2-Dichloropropane (1,2-DCP)	EPA 8260B
1,3-Dichloropropane (1,3-DCP)	EPA 8260B
1,2,3-Trichloropropane (TCP)	EPA 8260 SIM
Ethylene dibromide (EDB)	EPA 8260 SIM
Dinoseb	EPA 8151A

In addition to the COCs, the groundwater samples were analyzed for nitrate-N, nitrite-N, and sulfates (EPA Method 300.0) for selected B-zone wells. Additional analysis for select B-zone water samples was performed as follows: total organic carbon (EPA Test Method 415.1); ferrous iron (Test Method SM3500); sulfides (Test Method SM4500S2D); dissolved methane, and dissolved hydrogen (Test Method RSK175).

The daily logs during sampling are presented in Appendix A.

All of the samples were collected using approved techniques following proper chain-of-custody protocols. Each of the groundwater samples were analyzed by EMAX Laboratories, Inc. (EMAX) except the dissolved methane and dissolved hydrogen analysis. The dissolved methane and dissolved hydrogen analysis was sub-contracted to Air Technology Laboratories of the City of Industry.

EMAX is accredited by the National Environmental Laboratory Accreditation Program (NELAP). For quality assurance/quality control (QA/QC) purposes, three matrix spike and matrix spike duplicates (MS/MSD) and four field duplicate samples were collected for

analysis. Three trip blanks were collected during the groundwater sampling. These QA/QC samples were placed in the cooler along with the other samples collected at that time. The trip blank containers were placed in the coolers at the laboratory when the containers were shipped to Eco. After sampling, the containers were returned in the same cooler where they were initially placed by the laboratory.

Sample analysis results are summarized on Tables 2, 4 and 6. The laboratory reports are presented in Appendix B. In addition to the results tables, the frequency of the observations and the maximum, minimum and average concentrations for the wells sampled are reported on Tables 3, 5, and 8.

4.0 SAMPLING PROCEDURES

4.1 WATER-LEVEL MEASUREMENTS

Prior to sampling, each well was sounded for depth to water from a surveyed point on the top fitting of the BarCad[®] pipe casing. All of the water depth measurements were collected prior to groundwater purging. An electronic sounder, precise to the nearest ± 0.01 foot, was used to measure the depth to water in each well. Significant groundwater fluctuations resulting from barometric or other changes are not anticipated in the data collected.

4.2 BARCAD[®] PURGING

Two BarCad[®] sampler volumes of water were purged from each well. Water quality measurements (including pH, conductivity, turbulence, salinity, and temperature) were made during purging. These measurements are reported in the daily sampling logs presented in Appendix A.

4.3 LOW FLOW PURGING

Purging of Wells BBW-1 through BBW-3 was conducted using a low-flow, minimum draw-down (LF/MD) sampling system. Wells were purged and sampled with a portable, decontaminated, bladder sampling pump using LF/MD techniques. Dedicated tubing was used for each well. During purging, field parameters (pH, temperature, electrical conductivity [EC], oxidation-reduction potential [ORP], dissolved oxygen [DO], and turbidity) were measured and recorded on sampling logs. Purging continued until parameters stabilized, indicating that representative formation water is entering the well.

4.4 WELL SAMPLING

Prior to sampling each well, on-site personnel measured the water depth in each well as described in Section 4.1. The wells were then purged as described in Section 4.2 for BarCad[®] wells or Section 4.3 for wells BBW-1 through BBW-3. Each well was sampled immediately following purging. The water sample was collected directly from the discharge tubing associated with each well. This tubing is dedicated to each well, not moved from well to well. Immediately prior to sampling, the flow of nitrogen gas was adjusted and/or the discharge tubing kinked so that a gentle stream of water was obtained.

The sample container type, size, and preservative for each specific analysis are provided in the following table:

CONTAINER TYPE, SIZE, AND PRESERVATIVE FOR ANALYSIS

Constituent	EPA Analytical Method	Container Type	Container Size	Volume Required	Preservative
Chloroform	8260B	Glass (VOA vial)	40 mL	120 mL (3 vials)	HCl
1,2-Dichloropropane					
1,3-Dichloropropane	8260B	Glass (VOA vial)	40 mL	120 mL (3 vials)	HCl
1,2,3-Trichloropropane	8260 SIM	Glass (VOA vial)	40 mL	120 mL (3 vials)	HCl
1,2-Dibromo-3-chloropropane					
Ethylene dibromide	8260 SIM	Glass (VOA vial)	40 mL	120 mL (3 vials)	HCl
Dinoseb	8151A	Amber glass	1 L	1 L	None
Nitrates Nitrites Sulfates	300.1	Polyethylene	250 mL	250 mL	None
Total Organic Carbon	415.1	Polyethylene	125 mL	125 mL	HCl
Ferrous Iron	SM3500	Polyethylene	250 mL	250 mL	None
Sulfide	SM4500	Polyethylene	250 mL	250 mL	Zinc Acetate and Sodium Hydroxide
Dissolved Methane	RSK175	Glass (VOA vial)	40 mL	1 L	None
Dissolved Hydrogen	RSK175	Glass (VOA vial)	40 mL	1 L	None

Notes: L = liter; mL = milliliters; HCl = hydrochloric acid; VOA vial = volatile organic analysis vial

At each sampling location, all bottles designated for a particular analysis were filled sequentially before bottles designated for the next analysis were filled. If a duplicated sample was to be collected at this location, all bottles designated for a particular analysis for both sample designations were filled sequentially before bottles for another analysis were filled. On the fill sequence for duplicate samples, bottles with the two different sample designations alternated. Groundwater samples were transferred from the tubing directly into the appropriate sample containers with preservative (if required), then chilled, and processed for shipment to the laboratory.

Vials for volatile organic compound (VOC) analysis were filled first to minimize aeration of water in the well. The vials were inverted and checked for air bubbles to ensure zero headspace. If any air bubbles appeared, the vial contents were emptied into the container and transferred to the portable on-Site storage tank; the vial discarded; and a new sample collected.

4.5 DUPLICATE SAMPLES

Four duplicate samples were collected during this round of sampling and submitted to the laboratory. The duplicate samples (FDUP-1 through FDUP-4) were collected from wells BBW-3, PWB-4, WB2-2, and EPAS-2. These duplicate samples were collected for quality control (QC) purposes. The samples were preserved, packaged, and sealed in the manner described in the Workplan (Eco 2007). Analytical results for the duplicate samples and original samples are evaluated in the data validation. Relative percent difference (%RPD) was calculated for all duplicate analysis and the results were within the acceptance limits for each analysis.

4.6 REPLICATE AND SPLIT SAMPLES

No replicate or split samples were collected for this sampling event.

4.7 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE (MS/MSD)

An MS/MSD was performed on the samples collected from A-zone well WA-1 and B-zone wells WB2-3, and AMW-3R. The MS/MSD is used to monitor the precision and accuracy of the results of laboratory's analytical procedures. Analytical results for the MS/MSDs are reviewed as part of the Data Validation Report provided herein as Appendix C.

4.8 EQUIPMENT BLANKS

Equipment blank (EB-1) was obtained after sampling Wells BBW-1 through BBW-3. The equipment blank was collected after the sampling equipment was decontaminated. Deionized water was poured through the bladder pump and the water was collected in two 40 ml VOA vials, placed in the ice chest and transported to the analytical laboratory for VOC analyses using EPA Method 8260B to verify decontamination procedures.

4.9 TRIP BLANKS

Selected coolers shipped to the laboratory contained trip blanks that were submitted for laboratory analysis. The trip blanks were labeled TB-1 through TB-3. Trip blanks are used to evaluate whether the shipping and handling procedures introduced contaminants into the sample stream and whether cross contamination in the form of VOC migration had occurred among the collected samples. The trip blanks were not opened in the field and were shipped to the laboratory in the same cooler with the samples collected for VOC analysis. Each trip blank was preserved, packaged, and sealed in the manner described in the Workplan (Eco 2007). None of the trip blanks contained any detectable concentrations of VOCs.

4.10 TEMPERATURE BLANKS

To evaluate potential effects of sample transportation and handling on data quality, temperature blanks were enclosed in each ice-cooled chest. A 40-mL vial was used as a temperature blank container in each ice chest. Each temperature blank was clearly marked in order to indicate its purpose to the laboratory. The temperature blanks were handled in exactly the same manner as the actual samples. The temperature blanks were received by the laboratories at between 2.4 and 3.2 degrees Celsius (°C). The data validation report in Appendix C considers the cooler temperature in the data review.

4.11 LEVEL III AND IV DATA VALIDATION

Level III and Level IV data validation were performed on the analytical data as part of this groundwater sampling event. A report summarizing the data validation is provided as Appendix C. Level III data validation examined QA/QC elements such as holding time, (both extraction and analysis), critical quality control measures, and completeness of the results, extraction logs, instrument injection logs and summaries of initial and continuing calibrations for the following EPA methods of analysis:

- VOCs by EPA Method 8260B
- Fumigants (EDB; DBCP; and 1, 2, 3-TCP) by EPA Method 8260 SIM
- Dinoseb by EPA Method 8151A
- Nitrates and sulfates by EPA Method 300
- Total organic carbon by EPA Method 415.1
- Ferrous Iron by Method SM3500
- Sulfide by Method SM4500
- Dissolved Methane and Dissolved Hydrogen by Method RSK175.

The analytical results, QC results, initial calibration, and related continuing calibration data were comprehensively compared with the corresponding raw data and chromatograms presented for Level IV data validation. The laboratory reports of results of analyses are presented in Appendix B and the data validation reporting is presented in Appendix C.

All samples were analyzed for each of the components listed in the corresponding EPA Methods. The evaluation indicated that all the analytical work was performed as requested on the chain of custody. The extraction and analytical holding times were met for all samples in each method and subsequent dilutions.

Generally, the analytical data generated as part of this sampling event were considered acceptable and met quality control acceptance limits for each EPA Method, with some technical variations. Deviations are discussed in section 4.0 of the data validation report in Appendix C. All data were reported to be reliable for purposes of this project.

5.0 DECONTAMINATION PROCEDURES

Decontamination of sampling equipment (water meter) was conducted to assure the quality of samples collected. Decontamination was conducted before and after each use of a piece of equipment. Decontamination procedures included the following:

1. Non-phosphate detergent (Alconox[®]) and tap-water wash (using a brush)
2. Tap-water rinse
3. De-ionized/distilled water rinse (twice)

6.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples during on-Site groundwater monitoring and sampling, Eco generated different types of potentially contaminated investigation-derived wastes (IDW) that include the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids
- Purged groundwater and excess groundwater collected for sample container filling

Used PPE and disposable equipment was double bagged and placed in a municipal refuse dumpster. These wastes were not considered hazardous and were sent to an unknown municipal landfill. Any PPE and disposable equipment that was disposed of was rendered inoperable before disposal in the refuse dumpster.

Decontamination fluids that were generated during sampling activities consisted of de-ionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination water was sufficiently low to allow disposal at the Site. The water (and water with detergent) was poured into the portable on-Site storage tank.

Purged groundwater was poured into the portable on-Site storage tank. The groundwater and decontamination water were stored on-Site pending the analytical results. This water will be transported offsite by a licensed transporter to a State-certified recycler.

7.0 CONCLUSIONS

7.1 GROUNDWATER DEPTHS AND FLOW DIRECTION

In October 2012, groundwater depths and elevations were measured as follows and are presented in Table 1:

A-zone

- Deepest water is observed in well EPAS-1 (87.82 feet) and shallowest in WA-2 (65.83 feet). At 10 wells water elevations could not be measured as the water was below the BarCad[®] elevation. These are reported Not Measured or NM.
- Highest elevation of 362.41 feet (WA-2) and lowest elevation of 345.74 feet (EPAS-1).

The groundwater flow for the A-zone is depicted in a contour plot for groundwater elevations (Figure 3). As typically observed in previous monitoring events, lower water elevations are observed in EPAS-1 (southwest of the site and just east of the railroad spur in that area) and PWA-2 (near the southeast tip of the site). A-zone water apparently flows towards these two areas. Further south in the area of WA-2 the flow appears to be in a generally southwest direction.

B-zone

- Deepest in well WB2-4 (150.86 feet) and shallowest in PWB-15 and PWB-16 (127.68 feet and 127.71, respectively).
- Highest elevation of 303.19 feet (BBW-2) and lowest elevation of 274.55 feet (WB2-4).

The groundwater flow for the B-zone is depicted in a contour plot for groundwater elevations (Figure 4). The measured groundwater elevations in Wells AMR-3R and WB2-4 are significantly relative to other B-zone wells and these two heavily influence the B-zone groundwater flow. Upgradient of the site the general B-zone groundwater flow is towards the

south to southwest. In a separate assessment of water flow in the B-zone, the flow pattern was evaluated by filtering out the measurements of wells screened below 170 feet below adjacent ground surface. When assessed using the “filtered” data, the B-zone groundwater flow south of the site appears to bend to a more southeasterly direction. The wells that were not used in the contour map are listed with an associated “asterisk” in Figure 4.

Groundwater elevations as a function of time for all wells (A-zone and B-zone) are plotted for the period that the wells have been monitored. These plots are presented in Appendix D. These plots show the water elevations since the installation of the wells. As a general observation it appears the A-zone groundwater was untypically high when many of the wells were installed in the 2002 to 2004 time frame. Water elevations are generally about five to eight feet lower now. As an example, WA-2 was reported at a high of about ~ El. 367 in 2004 and a low of ~ El. 358.5 in 2008 and is now about where it was report prior to 2000 at ~ El. 362.5. Conversely, the B-zone wells show increased water since the mid-2000. As an example, PWB-2 was reported at ~ El. 285 in 2002 and is at ~ El. 298.5 now.

Some groundwater depth measurements in the A-zone appear anomalous making for erratic groundwater flow interpretations. At ten wells, the groundwater depths are not measureable in the BarCad installations because the water has dropped below an elevation where it is measureable. To better understand the A-zone groundwater elevations at and near the Site, BarCads will be removed and the wells cleaned allowing the measurement of static groundwater depths. At certain wells the BarCad will be reinstalled along with a standpipe piezometer to compare groundwater depth measurements for those wells. There should be improved interpretation of A-zone groundwater elevations and flow after the next few sampling events.

There are some B-zone wells where groundwater depths are assessed to be anomalous as well. Rehab or a revised procedure for groundwater depth measurements at these wells will be assessed after the completion of the planned work for the A-zone wells.

7.2 CONTAMINANTS OF CONCERN IN THE A-ZONE

Table 2 presents the analytical results for the COCs reported in groundwater samples collected from the A-zone. A summary of the COCs in the A-zone for the October 2012 sampling event are presented in Table 3. Isoconcentration maps (contours) are plotted for COCs for which there are sufficient data: 1,2-DCP, chloroform, and 1,2,3,-TCP (Figures 5, 6, and 7). The following observations are made for A-zone sampling results for COCs where ten wells were sampled and the samples analyzed for COCs:

- 1,2,3-TCP was reported in all ten wells at concentrations above its California Department of Public Health (CDPH) Notification Level of 0.005 µg/L. The highest concentration was in PWA-2 at 1,100 µg/L.
- Chloroform was report in nine wells but none of the concentrations exceeded the B-zone Cleanup Levels for chloroform of 80 µg/L. The highest concentration for chloroform was at WA-2 at 53 µg/L.
- 1,2-DCP was reported for seven wells and at four wells the concentrations exceeded its B-zone Cleanup Levels of 5 µg/L. The highest concentration for 1,2-DCP was at PWA-2 at 6,600 µg/L.
- Dinoseb was reported at five wells and at four wells the concentrations exceeded its B-zone Cleanup Levels of 7 µg/L. The highest concentration for dinoseb was also at PWA-2 at 9,100 µg/L.

- Other COCs 1,3-DCP, DBCP, and EDB were reported less frequently and were typically present in the same wells along with the more frequently found COCs. They were all also reported above their respective B-zone Cleanup Levels when reported.
- EPAS-2, EPAS-3, and PWA-2 were the three wells where contaminants were reported in highest concentrations and represent the heavier contaminated areas of the A-zone among the areas monitored by the installed wells. This is also generally represented in the contour plots for COCs in the A-zone – Figures 5, 6, and 7.

The highest concentrations for COCs are in wells south of the Site (EPAS-2, EPAS-3, WA-3, and PWA-2). The wells with the relatively high COC concentrations are located coincidentally with the areas of the A-zone where the water level elevations are low. The trend for the presence of contaminants in the A-zone appears relatively unchanged from the COC concentrations reported for the last three monitoring events (Fall 2011, Spring 2012, and Fall 2012).

7.3 CONTAMINANTS OF CONCERN IN THE B-ZONE

Table 4 presents the analytical results for the COCs reported in groundwater samples collected from the B-zone. A summary of the COCs in the B-zone for the October 2012 sampling event are presented in Table 5. Isoconcentration maps (contours) are plotted for five COCs: 1,2-DCP, chloroform, dinoseb, 1,2,3-TCP, and DBCP. The isoconcentration maps are presented on Figures 8 through 12. The following observations are made for B-zone sampling results for COCs where twenty six (26) wells were sampled and the samples analyzed for COCs:

- 1,2,3-TCP was reported in all twenty six wells and at twenty five wells was reported at concentrations above its California Department of Public Health (CDPH) Notification Level of 0.005 µg/L. The highest concentration was in PWB-7A at 55.0 µg/L.
- 1,2-DCP was reported for twenty three wells and at six wells the concentrations exceeded its B-zone Cleanup Levels of 5 µg/L. The highest concentration for 1,2-DCP was at PWB-14 at 17 µg/L.
- Chloroform was reported in thirteen wells but none of the concentrations exceeded the B-zone Cleanup Levels for chloroform of 80 µg/L. The highest concentration for chloroform was at PWB-13A at 14 µg/L.
- Dinoseb was reported at eleven wells and at two wells the concentrations exceeded its B-zone Cleanup Levels of 7 µg/L. The highest concentration for dinoseb was at PWB-12 at 27 µg/L.
- DBCP was reported less frequently at nine wells but at seven of these wells the concentrations exceeded its B-zone Cleanup Levels of 0.2 µg/L. As with dinoseb, the highest concentration for DBCP was at PWB-12 at 2.6 µg/L.
- 1,3-DCP and EDB were not reported above laboratory detection limits in any of the wells sampled.
- Both of the commonly reported contaminants, 1,2-DCP and 1,2,3-TCP were also reported in the background monitoring wells.

- The highest concentrations for dinoseb and DBCP were both reported at PWA-12. For other COCs the highest concentrations were in other wells (not PWA-12) indicating low commonality in the presence of the COC contaminants in the B-zone.

The highest concentrations for COCs in the B-zone are in two areas offsite:

1. The first area is closer to the Site but to the southwest. As an example, 1,2-DCP at 6.6 µg/L (130 percent of its B-zone Cleanup Level of 5 µg/L) at PWB-2, see Figure 8.
2. The other area is located further to the south and southeast of the Site (see isoconcentration maps Figures 8 through 12). This area is illustrated by dinoseb at 27 µg/L in PWB-12 (almost 400 percent of its B-zone cleanup level of 7 µg/L) and DBCP at 2.6 µg/L in the same well (about 13 times its B-zone Cleanup Level of 0.2 µg/L).

The general trend for the presence of contaminants in the B-zone appears relatively unchanged from the concentrations reported for the last three monitoring events (Fall 2011, Spring 2012, and Fall 2012).

B-zone concentrations for 1,2-DCP and 1,2,3-TCP are not defined to establish the limits of the plume – to non-detect, to B-zone cleanup levels, or to background concentrations for the respective compounds. For chloroform, the 80 µg/L contour is established so further definition is not necessary. The background concentrations for 1,2-DCP and 1,2,3-TCP are being assessed, and additional wells are necessary to define the plumes for these compounds.

7.4 OTHER LABORATORY RESULTS

Results for other laboratory analyses are presented on Table 6. The table includes the results for the following analyses:

- Nitrate as nitrogen (nitrate-N) and nitrite as nitrogen (nitrite-N)
- Sulfate and sulfide
- Total Organic Carbon (TOC)
- Ferrous Iron, and
- Dissolved methane and dissolved hydrogen.

A summary of these analysis results for the October 2012 sampling event are presented in Table 7. The following observations are made regarding these sampling results:

- Nitrate as nitrogen was reported for all twenty six wells sampled. At twenty four of the twenty six it was reported above its Maximum Contaminant Level (MCL) of 10 mg/L. The highest concentration for nitrate-N was reported for PWB-12 at 61.2 mg/L.
- Sulfate was reported for all twenty six wells sampled but was not above its MCL of 250 mg/L at any of the wells. The highest concentration of sulfate was for AR-1 at 232 mg/L.
- Total organic carbon was reported for all wells except for WB2-4. The highest concentration for TOC was at PWB-7A at 0.959 mg/L.
- Other analyses yielded either no detection or detection at a single well. Nitrite-N at WB2-3 (12 mg/L), sulfide at PWB-9 (0.038 mg/L), ferrous iron at PWB-11

(0.551 mg/L) and dissolved methane at WB2-3 (0.0088 mg/L) were single well detections. Dissolved hydrogen was not reported for any of the wells sampled.

7.5 SAMPLING PARAMETER MEASUREMENTS

Measurements were made for the following parameters while sampling including purge measurements:

- pH
- Conductivity (milliSiemens per centimeter (mS/cm))
- Turbidity (nephelometric turbidity units – NTU)
- Dissolved oxygen (mg/L)
- Temperature (degrees Centigrade – °C)
- Salinity (parts per million or [ppm])
- Oxygen-reduction Potential [ORP] (millivolts – mV)

The measurements made during sampling are reported in Appendix A. The following is a summary of the A-zone and B-zone measurements that were made. The data are from measurements made for the last purge volume.

A-ZONE:

The measurements made during the last purge volume for the ten wells that were sampled may be summarized as follows:

STATISTICAL SUMMARY A-ZONE MEASUREMENTS FOR 10 WELLS MADE DURING LAST PURGE

PARAMETER	UNITS	MAXIMUM	MINIMUM	AVERAGE
pH	-	8.06	6.83	7.54
Conductivity	mS/cm	9.45	0.885	2.64
Turbidity	NTU	17.30	0.70	5.95
Dissolved oxygen	mg/L	7.14	3.40	5.91
Temperature	°C	23.76	20.11	22.11
Salinity	ppm	5.30	0.40	1.37
ORP	mV	209	-9	148

B-ZONE:

The measurements made during the last purge volume for the twenty six wells that were sampled may be summarized as follows:

STATISTICAL SUMMARY
B-ZONE MEASUREMENTS FOR 26 WELLS MADE DURING LAST PURGE

PARAMETER	UNITS	MAXIMUM	MINIMUM	AVERAGE
pH	-	8.94	6.83	7.68
Conductivity	mS/cm	1.81	0.70	1.31
Turbidity	NTU	182	1.10	37.12
Dissolved oxygen	mg/L	8.07	2.18	6.32
Temperature	°C	25.82	19.22	22.72
Salinity	ppm	0.90	0.30	0.64
ORP	mV	206	0.50	150.71

8.0 REFERENCES

- Eco & Associates, Inc., 2007. *Site-Specific Groundwater Sampling and Analysis Plan*, Brown & Bryant Superfund Site, Arvin, California, December 4, 2007.
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- U.S. Environmental Protection Agency (USEPA), Region IX, 1993a. *Operable Unit One Feasibility Study*, Brown & Bryant Super Fund Site, Arvin, California, dated March 1993.
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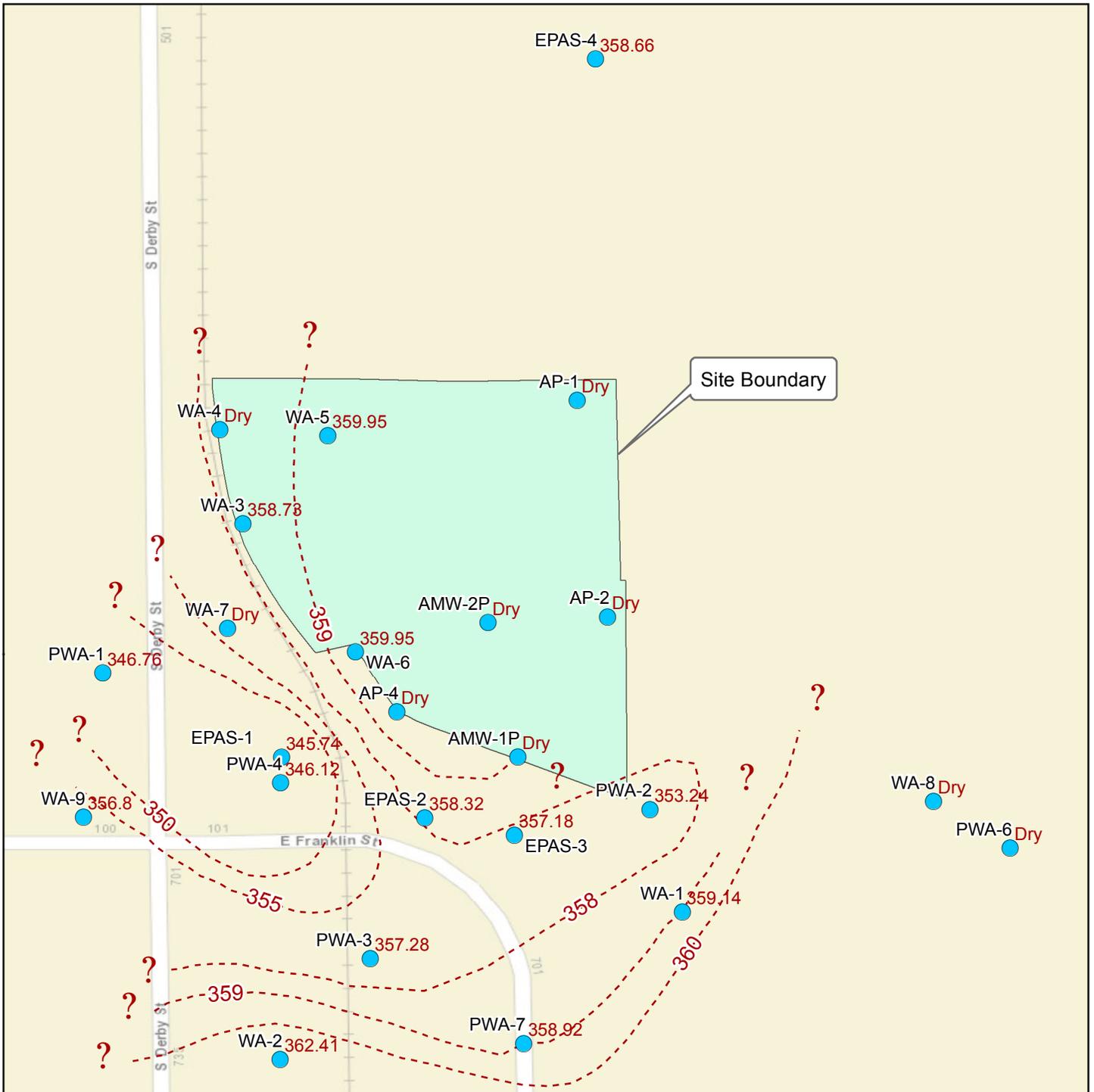
FIGURES



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SITE REGIONAL MAP
Brown & Bryant Superfund Site
600 South Derby Street, Arvin, CA
 Project No. Eco-12-548 Dated: December 2013

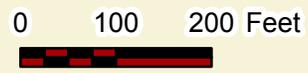
FIGURE
1



LEGEND:

- A-Zone Wells (water elevation in feet above msl as numbers)
- Fall 2012 Groundwater Contours (feet above msl)

Dry - Water level not measured at these wells as it was below the BarCad elevation
 msl - Mean Sea Level (NGVD'29)



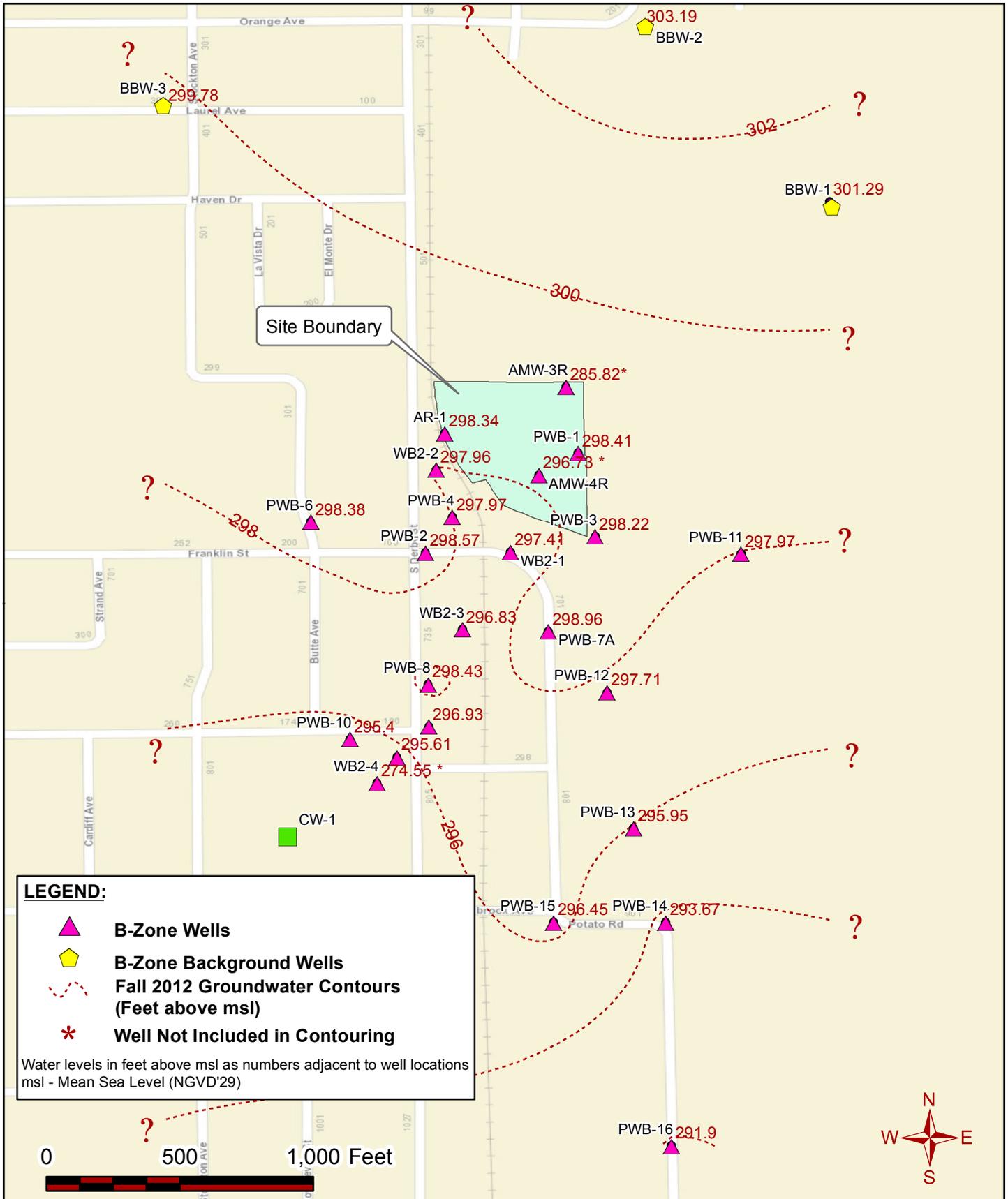
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A-Zone Groundwater Contours
Brown & Bryant Superfund Site
600 South Derby Street, Arvin, CA

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FIGURE
3

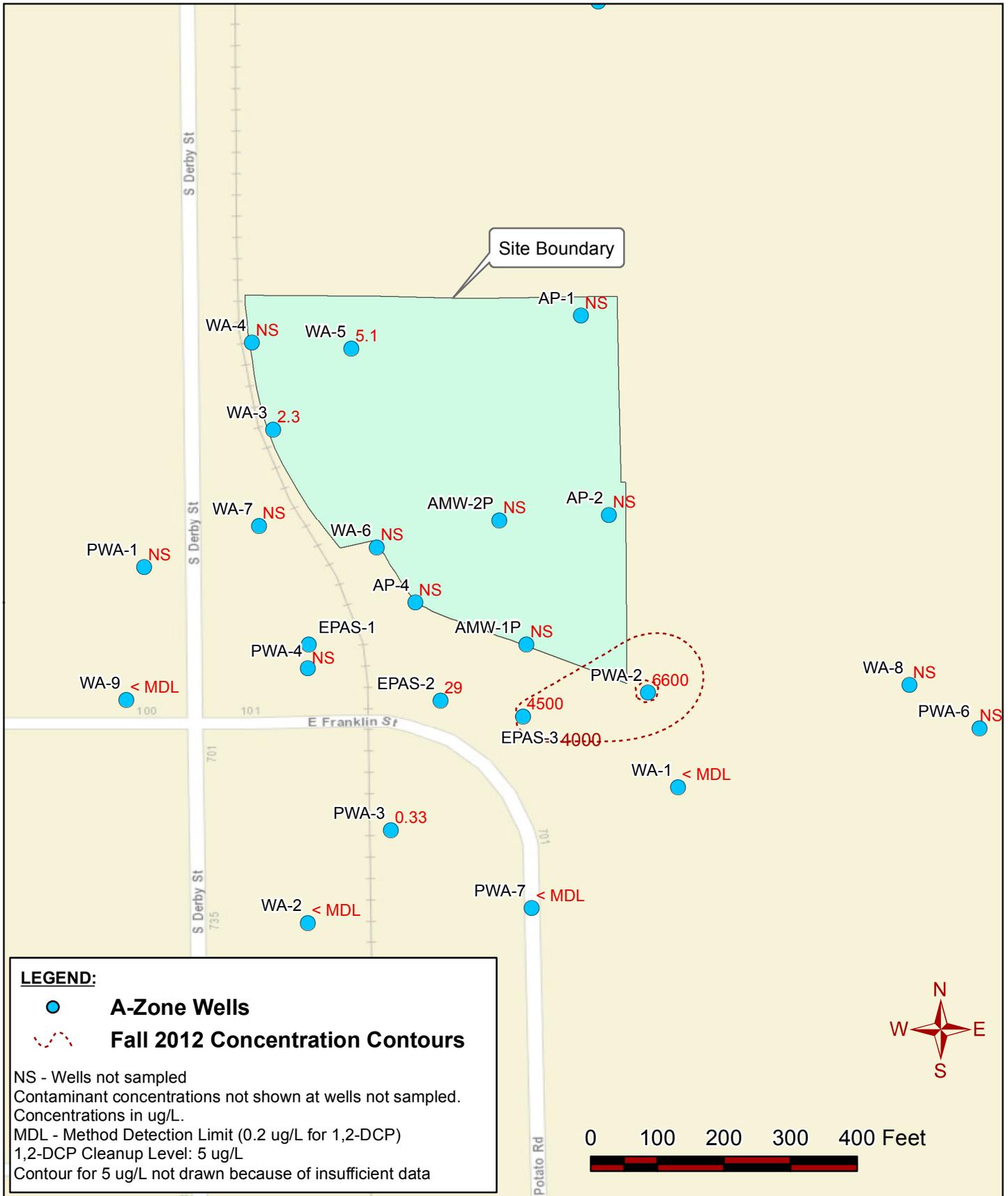


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B-Zone Groundwater Contours
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FIGURE
4



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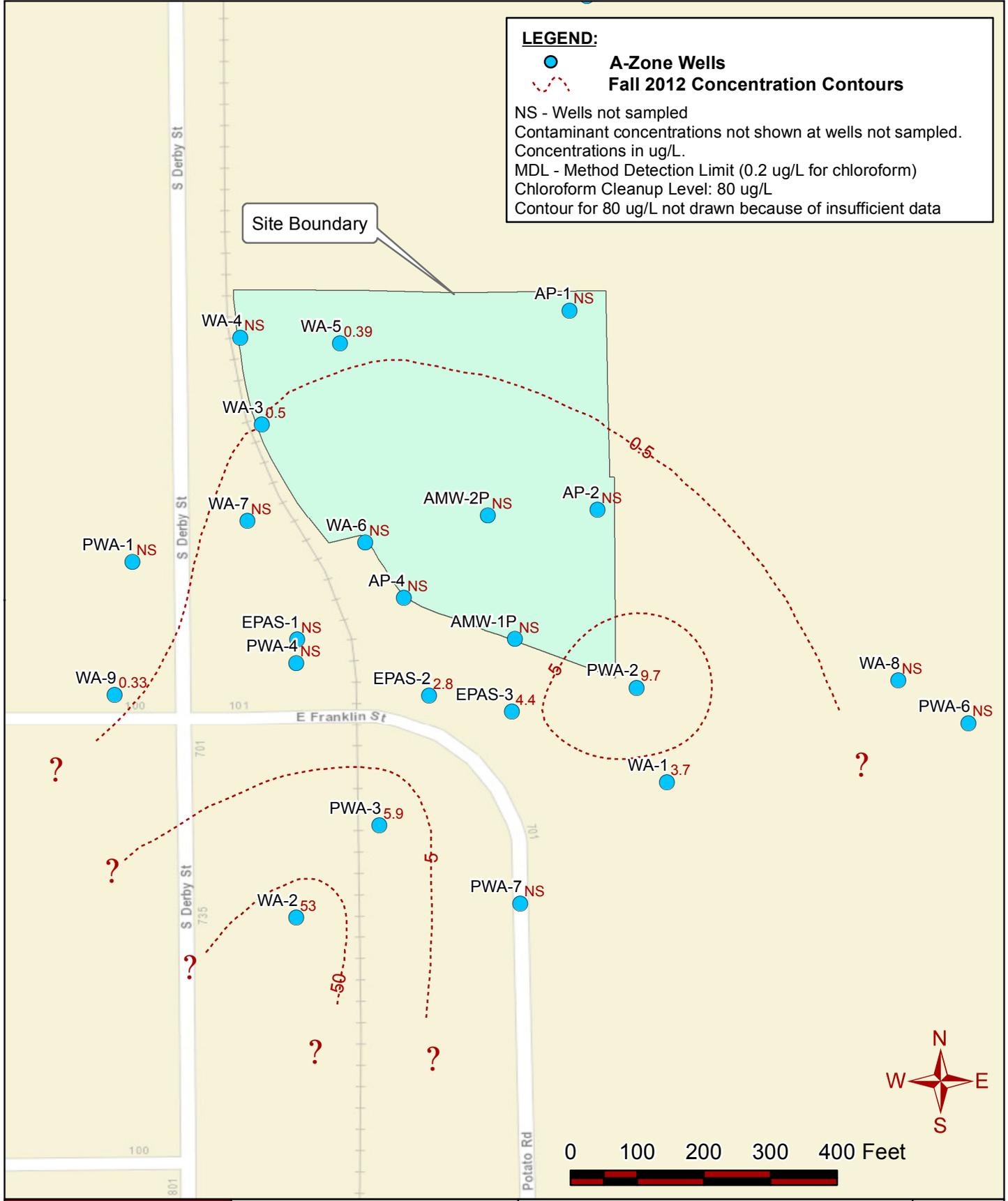
A-Zone Isoconcentration Map
1,2-DCP
Brown & Bryant Superfund Site
600 South Derby Street, Arvin, CA
 Project No. Eco-12-548 Dated December 2013

FIGURE
5

LEGEND:

- A-Zone Wells
- - - Fall 2012 Concentration Contours

NS - Wells not sampled
 Contaminant concentrations not shown at wells not sampled.
 Concentrations in ug/L.
 MDL - Method Detection Limit (0.2 ug/L for chloroform)
 Chloroform Cleanup Level: 80 ug/L
 Contour for 80 ug/L not drawn because of insufficient data



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**A-Zone Isoconcentration Map
 Chloroform**

**Brown & Bryant Superfund Site
 600 South Derby Street, Arvin, CA**

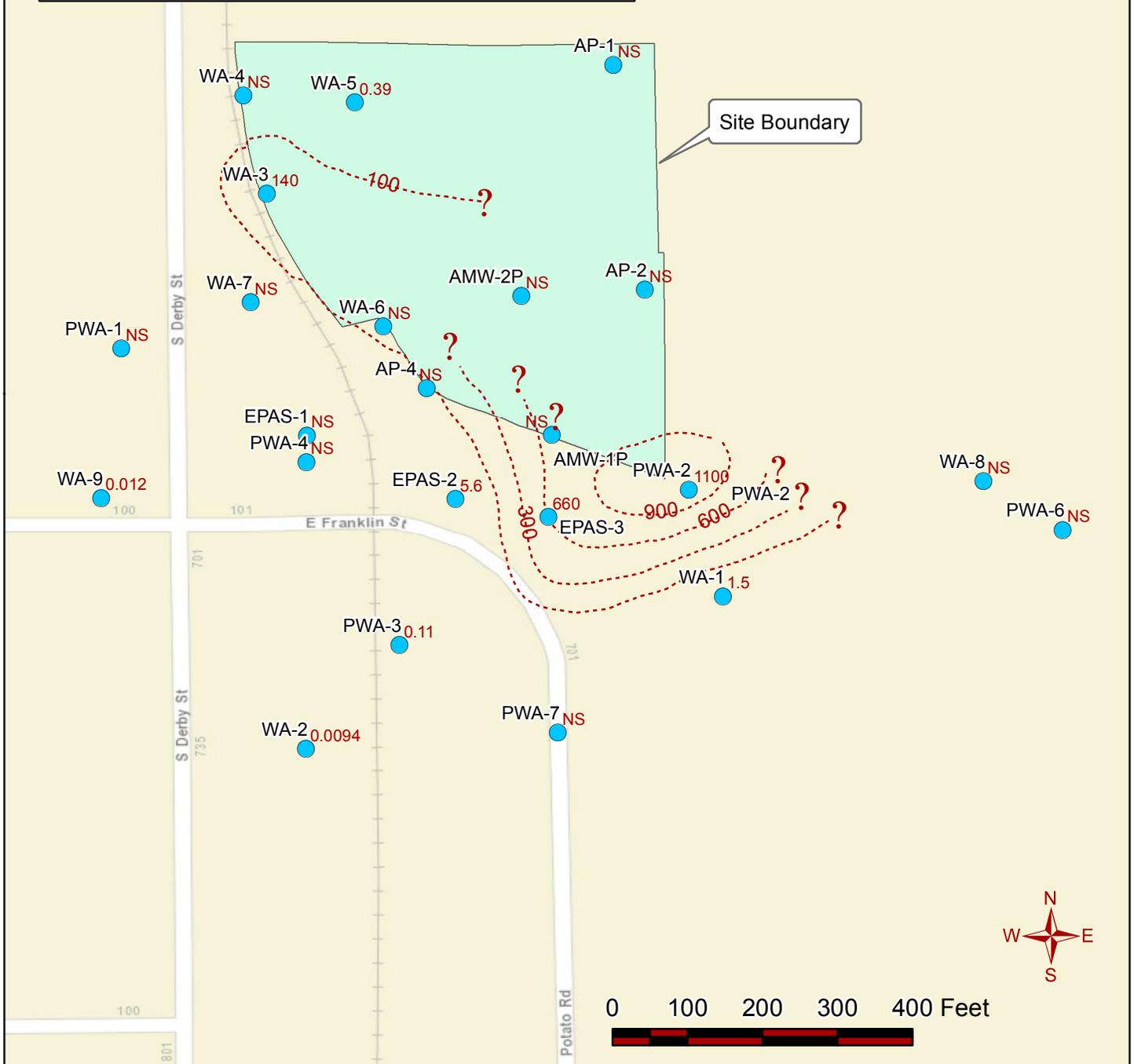
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FIGURE
6

LEGEND:

- **A-Zone Wells**
- - - **Fall 2012 Concentration Contours**

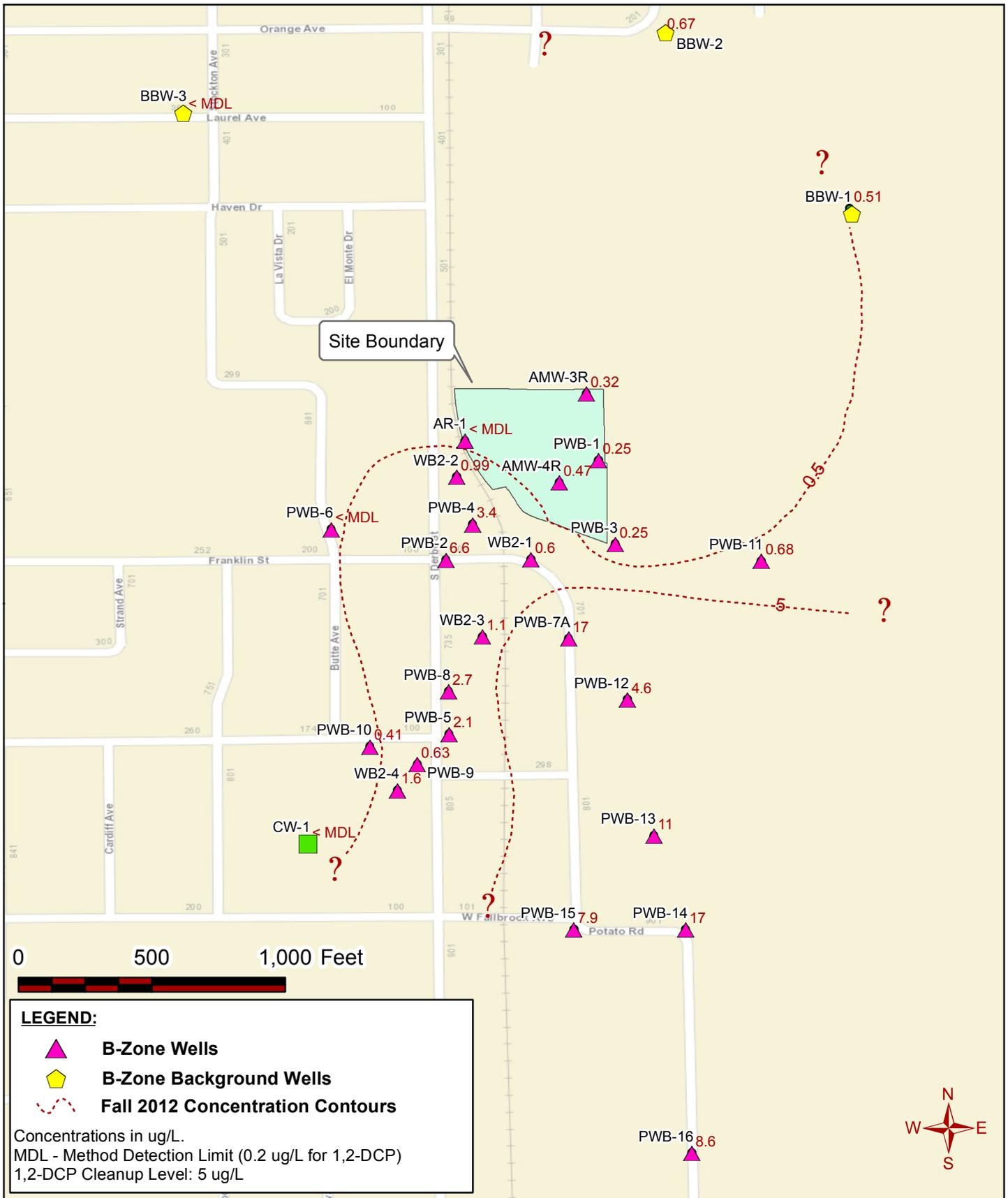
NS - Wells not sampled
 Contaminant concentrations not shown at wells not sampled.
 Concentrations in ug/L.
 MDL - Method Detection Limit (0.0025 ug/L for 1,2,3-TCP)
 1,2,3-TCP California Notification Level: 0.005 ug/L
 Contour for 0.005 ug/L not drawn because of insufficient data



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A-Zone Isoconcentration Map
1,2,3-TCP
Brown & Bryant Superfund Site
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FIGURE
7



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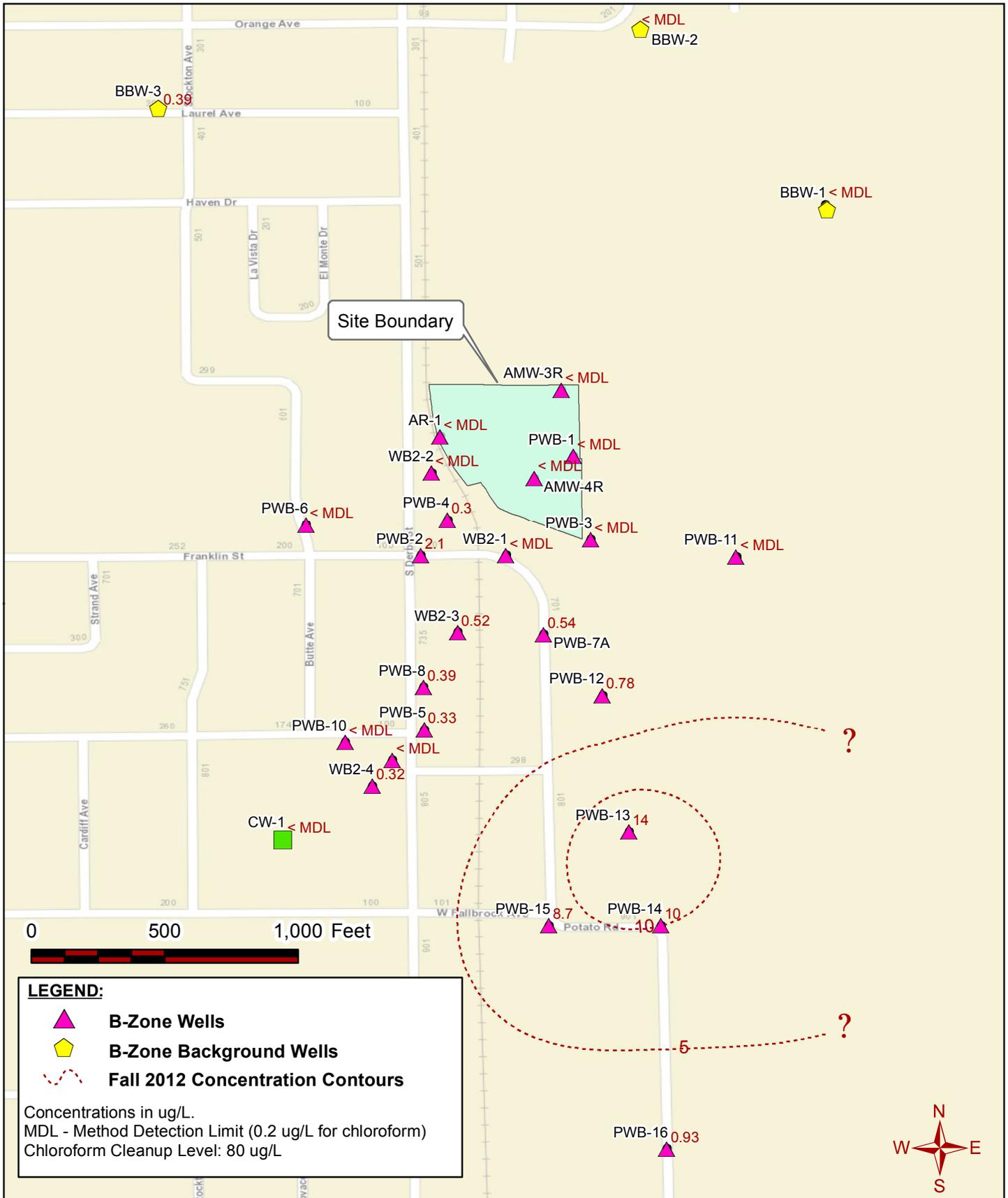
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B-Zone Isoconcentration Map
1,2-DCP
Brown & Bryant Superfund Site
600 South Derby Street, Arvin, CA

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FIGURE
8



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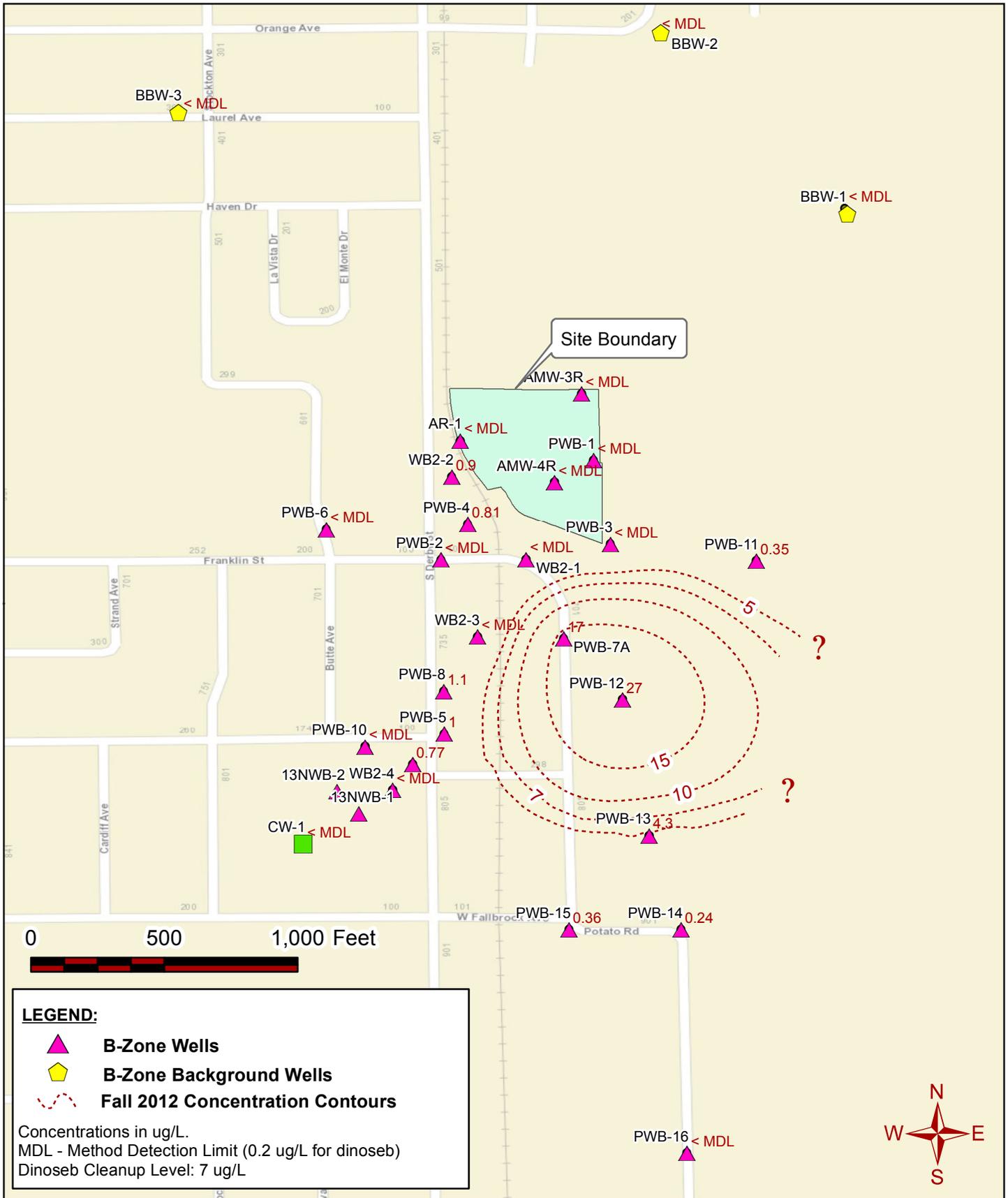
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**B-zone Isoconcentration Map
 Chloroform**
Brown & Bryant Superfund Site
600 South Derby Street, Arvin, CA

Project No. Eco-12-548

Dated: December 2013

FIGURE
9

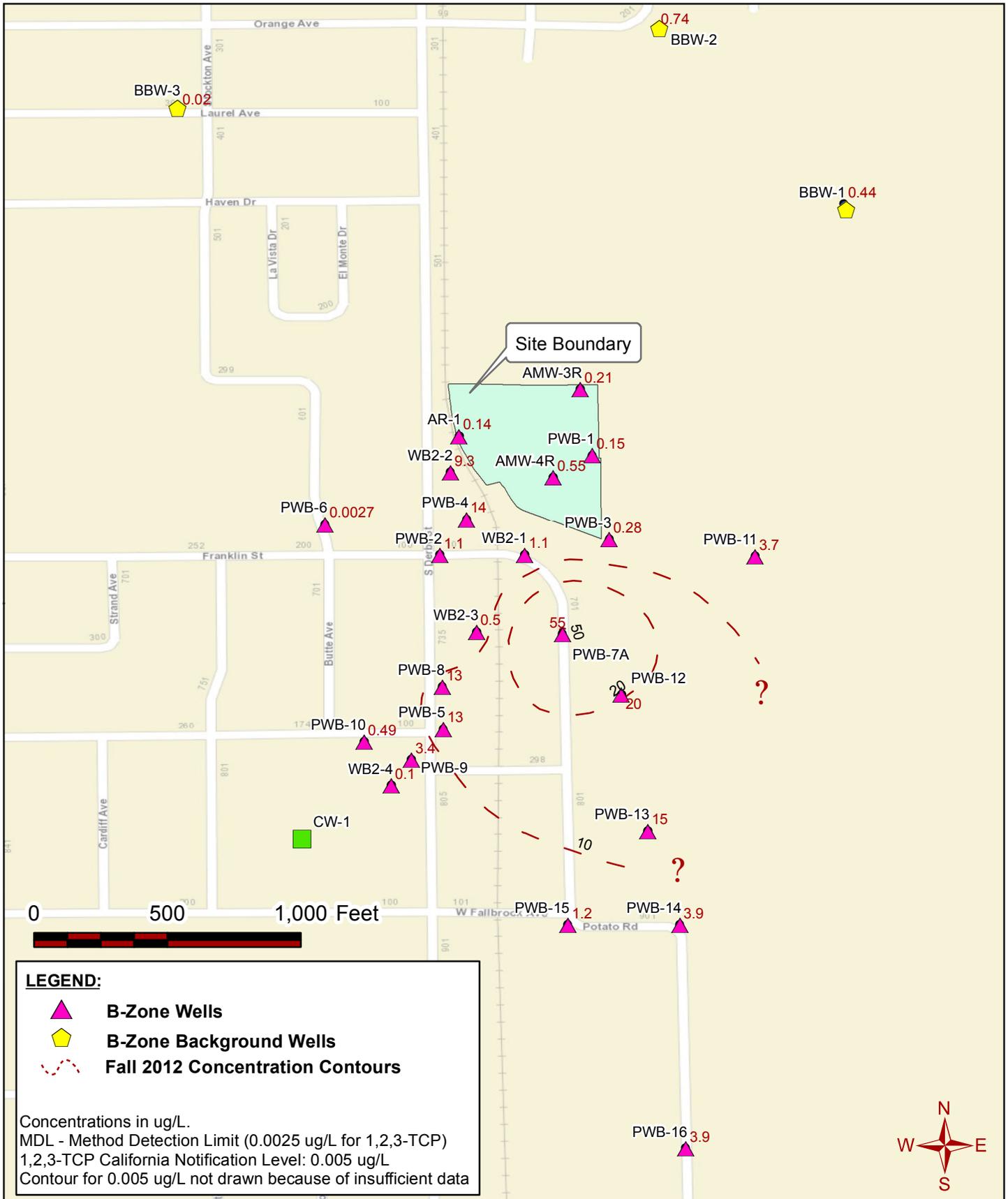


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**B-Zone Isoconcentration Map
 Dinoseb**
Brown & Bryant Superfund Site
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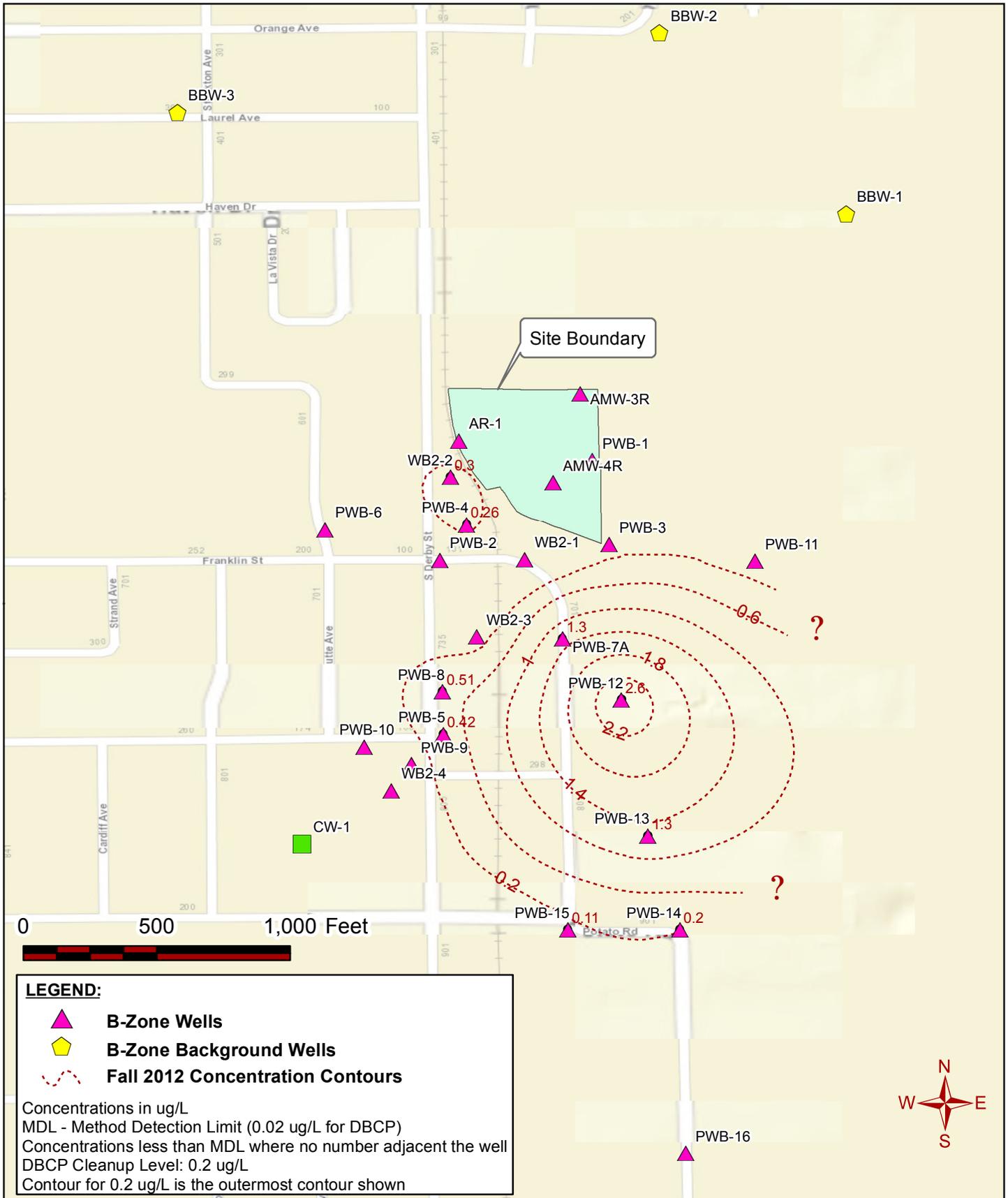
FIGURE
10



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B-Zone Isoconcentration Map
1,2,3-TCP
Brown & Bryant Superfund Site
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FIGURE
11



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**B-Zone Isoconcentration Map
 DBCP
 Brown & Bryant Superfund Site
 600 South Derby Street, Arvin, CA**

Project No. Eco-12-548

Dated: December 2013

FIGURE
12

TABLES

TABLE 1: Groundwater Depths and Elevations for A-Zone and B-Zone Wells
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

Well ID	Coordinates		Boring Depth (ft bgs)	Well Screen Interval (ft bgs)	Well Diameter (inches)	Depth to Groundwater (ft btc)	Depth to Well Base BarCad (ft btc)	Water Column (ft btc)	Casing Elevation (feet)	Groundwater Elevation (feet)
	Northing	Easting								
A-ZONE WELLS										
AMW-1P	2260893.44	6315882.45	72	60.8-70.8	4	nm	73.74	nm	435.78	nm
AMW-2P	2261079.29	6315850.82	73.5	63.6-73.6	4	nm	73.93	nm	433.75	nm
AP-1	2261385.49	6315953.59	69.5	59.5-69.5	4	nm	68.70	nm	434.67	nm
AP-2	2261086.33	6315985.67	71	NR	4	nm	71.25	nm	435.35	nm
AP-4	2260957.31	6315746.09	75	60-70	4	nm	73.29	nm	436.04	nm
EPAS-1	2260895.27	6315614.91	90	77-87	4	87.82	88.56	0.74	433.56	345.74
EPAS-2	2260809.72	6315776.45	90	64-84	4	75.57	83.96	8.39	433.89	358.32
EPAS-3	2260784.95	6315877.67	90	64-84	4	75.21	83.42	8.21	432.39	357.18
EPAS-4	2261856.39	6315978.45	93.5	62-84	4	77.72	78.36	0.64	436.38	358.66
PWA-1	2261012.94	6315413.47	85	65-85	4	83.31	84.05	0.74	430.07	346.76
PWA-2	2260819.52	6316031.56	86.5	64-84	4	77.33	83.76	6.43	430.57	353.24
PWA-3	2260615.98	6315713.47	86.5	64.5-84.5	4	72.14	83.72	11.58	429.42	357.28
PWA-4	2260859.66	6315613.81	86.5	64.5-84.5	4	83.70	83.79	0.09	429.82	346.12
PWA-5	2260779.83	6316580.30	85	64.5-84.5	4	nm	82.54	nm	430.32	nm
PWA-6	2260762.93	6316438.80	86.5	63-83	4	nm	75.74	nm	430.25	nm
PWA-7A	2260497.60	6315885.77	80	58-78	4	70.10	76.39	6.29	429.02	358.92
WA-1	2260677.66	6316067.17	78	63-78	4	70.38	76.37	5.99	429.52	359.14
WA-2	2260488.51	6315620.88	75.5	63-73	4	65.83	70.51	4.68	428.24	362.41
WA-3	2261217.79	6315573.92	79	68-78	4	77.30	78.79	1.49	436.03	358.73
WA-4	2261348.33	6315549.02	76	66-76	4	nm	77.26	nm	436.88	nm
WA-5	2261338.70	6315671.09	78.5	67-77	4	75.86	78.70	2.84	435.81	359.95
WA-6	2261039.80	6315699.83	74	64-74	4	75.74	76.73	0.99	434.90	359.16
WA-7	2261077.87	6315546.76	76	66-76	4	nm	76.25	nm	434.75	nm
WA-8	2260828.38	6316352.78	71	61-71	4	nm	71.64	nm	433.25	nm
WA-9	2260814.30	6315389.85	78	68-78	4	72.45	74.34	1.89	429.25	356.80

TABLE 1: Groundwater Depths and Elevations for A-Zone and B-Zone Wells
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

Well ID	Coordinates		Boring Depth (ft bgs)	Well Screen Interval (ft bgs)	Well Diameter (inches)	Depth to Groundwater (ft btc)	Depth to Well Base BarCad (ft btc)	Water Column (ft btc)	Casing Elevation (feet)	Groundwater Elevation (feet)
	Northing	Easting								
B-ZONE WELLS										
AMW-3R	2261394.61	6315947.18	205	121.5-201.5	4	147.98	194.64	46.66	433.80	285.82
AMW-4R	2261063.95	6315861.00	203	138-198	4	138.19	191.03	52.84	434.92	296.73
AR-1	2261230.70	6315562.90	182	140-186	4	136.90	182.62	45.72	435.24	298.34
BBW-1	2262057.60	6316750.60	154	132.5-152.5	4	135.74	nm	N/A	437.03	301.29
BBW-2	2262740.60	6316184.00	152	130-150	4	135.69	nm	N/A	438.88	303.19
BBW-3	2262457.40	6314701.70	156	135-155	4	136.38	nm	N/A	436.16	299.78
PWB-1	2261145.82	6315982.25	180	166-186	4	135.42	182.39	46.97	433.83	298.41
PWB-2	2260777.08	6315510.81	166	140-160	4	131.95	156.60	24.65	430.52	298.57
PWB-3	2260832.28	6316031.90	166.5	145-165	4	132.45	160.59	28.14	430.67	298.22
PWB-4	2260909.61	6315594.33	166.5	145-165	4	132.81	161.55	28.74	430.78	297.97
PWB-5	2260125.60	6315515.41	166.5	145-165	4	130.54	159.49	28.95	427.47	296.93
PWB-6	2260894.79	6315159.82	161.5	140-160	4	130.10	153.13	23.03	428.48	298.38
PWB-7A	2260479.81	6315884.19	208	140-160	4	130.46	148.67	18.21	429.42	298.96
PWB-8	2260284.35	6315515.10	180	140-160	4	128.97	156.19	27.22	427.40	298.43
PWB-9	2260012.18	6315416.85	161.5	140-160	4	130.32	152.08	21.76	425.93	295.61
PWB-10	2260080.31	6315272.44	161.5	140-160	4	129.04	152.00	22.96	424.44	295.40
PWB-11	2260764.74	6316478.78	226.5	145-165	4	132.50	156.32	23.82	430.47	297.97
PWB-12	2260250.27	6316062.91	163	140-160	4	129.20	149.45	20.25	426.91	297.71
PWB-13A	2259743.28	6316121.24	157	136-156	4	128.88	146.97	18.09	424.83	295.95
PWB-14	2259401.40	6316228.75	162	141-161	4	130.24	151.49	21.25	423.91	293.67
PWB-15	2259410.64	6315875.39	158	137-157	4	127.68	145.42	17.74	424.13	296.45
PWB-16	2258545.89	6316231.16	157	136-156	4	127.71	146.15	18.44	419.61	291.90
WB2-1	2260776.57	6315771.86	211	169.5-179.5	4	134.97	176.16	41.19	432.38	297.41
WB2-2	2261087.40	6315546.23	204	168-178	4	136.98	176.68	39.70	434.94	297.96
WB2-3	2260478.15	6315610.26	190	172-182	4	131.30	160.99	29.69	428.13	296.83
WB2-4	2259915.71	6315354.65	210	168-178	4	150.86	171.08	20.22	425.41	274.55

Notes:

ft btc feet below top of casing; ft bgs feet below ground surface (from well construction diagrams)
nm Not measured—groundwater is lower than BarCad elevation and is not measured for these wells.
Horizontal Datum is NAD83, Zone 5; Vertical Datum is NGVD'29 based on NGS benchmark (PID) FU0078 (H 826) Elev. 418.81

TABLE 3: Summary of COC Results For A-Zone Wells
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

COCs	Wells Sampled	Wells Reported > Detection Limit	Wells Reported > Cleanup Level	Maximum Concentration	Minimum Concentration	Average Concentration	B-zone Cleanup Concentration	Wells in Excess of B-zone Cleanup Level
				µg/L				
1,2-DCP	10	7	4	6600.0	0.21	1591.0	5	EPAS2, EPAS-3, WA-5, & PWA-2. Minimum at PWA-3 & maximum at PWA-2.
1,3-DCP	10	2	2	8.9	5.60	7.3	0.5	EPAS-3 & PWA-2. Minimum at EPAS-3 & maximum at PWA-2.
1,2,3-TCP	10	10	10	1100.0	0.009	212.0	0.005*	All wells sampled. Minimum at WA-2 & maximum at PWA-2
Chloroform	10	9	0	53.0	0.33	9.0	80	None. Minimum at WA-9 & maximum at WA-2.
DBCP	10	4	4	310.0	0.89	138.0	0.2	EPAS2, EPAS-3, WA-3, & PWA-2. Minimum at EPAS-2 & maximum at PWA-2.
Dinoseb	10	5	4	9100.0	0.35	2109.8	7	EPAS-2, EPAS-3, WA-3, & PWA-2. Minimum at WA-1 & maximum at PWA-2.
EDB	10	2	2	81.0	3.00	42.0	0.05	EPAS-3 & PWA-2. Minimum at EPAS-3 & maximum at PWA-2.

Notes:

> greater than
COC chemicals of concern
µg/L micrograms per liter
1,2-DCP 1,2-Dichloropropane
1,3-DCP 1,3-Dichloropropane
1,2,3-TCP 1,2,3-Trichloropropane
DBCP 1,2-Dibromo-3-chloropropane
EDB Ethylene dibromide

- The reported average is for COC results reported in excess of that compound's laboratory detection limits.
- Maximum and minimum concentrations are noted at wells, as applicable.
- * - Notification Limit for 1,2,3-TCP set by California Department of Public Health.

TABLE 5: Summary of COC Results for B-Zone Wells
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

COCs	Wells Sampled	Wells Reported > Detection Limit	Wells Reported > Cleanup Level	Maximum Concentration	Minimum Concentration	Average Concentration	B-zone Cleanup Concentration	B-zone Wells in Excess of Cleanup Level
				µg/L				
1,2-DCP	26	23	6	17.0	0.250	3.886	5	PWB-2, PWB-7A, PWB-13A, PWB-14, PWB-15, & PWB-16. Minimum at PWB-1 & maximum at PWB-14
1,3-DCP	26	0	0	N/A	N/A	N/A	0.5	None.
1,2,3-TCP	26	26	25	55.0	0.003	6.201	0.005*	All except PWB-6. Minimum at WB2-4 & maximum at PWB-7A
Chloroform	26	13	0	14.0	0.300	3.023	80	None. Minimum at PWB-4 & maximum at PWB-13A
DBCP	26	9	7	2.6	0.110	0.778	0.2	WB2-2, PWB-4, PWB-5, PWB-7A, PWB-8, PWB-12, PWB13A, & PWB-14. Minimum at PWB-9 & maximum at PWB-12.
Dinoseb	26	11	2	27.0	0.240	4.894	7	PWB-7A & PWB-12. Minimum at PWB-14 & maximum at PWB-12.
EDB	26	0	0	N/A	N/A	N/A	0.05	None.

Notes:	> greater than							
COC	chemicals of concern							
µg/L	micrograms per liter							
1,2-DCP	1,2-Dichloropropane							
1,3-DCP	1,3-Dichloropropane							
1,2,3-TCP	1,2,3-Trichloropropane							
DBCP	1,2-Dibromo-3-chloropropane							
EDB	Ethylene dibromide							
								<ul style="list-style-type: none"> The reported average is for COC results reported in excess of that compound's laboratory detection limits. Maximum and minimum concentrations are noted at wells, as applicable. * - Notification Level set by California Department of Public Health

TABLE 6: Results of Wet Chemistry Analysis
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

Well No.	Analyte	DATE SAMPLED AND CONCENTRATION (mg/L)					Regulatory Threshold (mg/L)	Source of Standard
		Apr-11	Oct-11	Apr-12	Oct-12	Average		
AR-1	Nitrate-N		23.9	22.4	29.7	25.3	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		155.0	137.0	232	174.7	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.959J	0.966J	0.820J	0.915	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
AMW-3R	Nitrate-N		26.7	31.8	29.2	29.2	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		141.0	162.0	187	163.3	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.982J	0.977J	0.951J	0.970	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
AMW-4R	Nitrate-N	28.6	27.5	28.5	28.2	28.2	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	138.0	131.0	123.0	141	133.3	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.811J	1.080	0.947J	0.739J	0.894	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
WB2-1	Nitrate-N	28.7	28.1	26.7	27.1	27.7	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	137.0	143.0	123.0	124	131.8	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.809J	0.836J	0.864J	0.666J	0.794	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
WB2-2	Nitrate-N	59.3	46.8	49.2	38.6	48.5	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	79.7	92.2	96.1	97.0	91.3	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.853J	0.875J	0.827J	0.798J	0.838	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
WB2-3	Nitrate-N	0.1J	2.7	5.0	5.22	3.3	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	12.0	N/A	1	MCL-USEPA
	Sulfate	84.2	90.7	87.4	95.6	89.5	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.934J	0.903J	0.893J	0.946J	0.919	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		4.5	12.0	0.0088	5.5	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-

TABLE 6: Results of Wet Chemistry Analysis
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

Well No.	Analyte	DATE SAMPLED AND CONCENTRATION (mg/L)					Regulatory Threshold (mg/L)	Source of Standard
		Apr-11	Oct-11	Apr-12	Oct-12	Average		
WB2-4	Nitrate-N		10.5	10.9	10.7	10.7	10	MCL-USEPA
	Nitrite-N		<0.05	0.0535J	< 0.05	N/A	1	MCL-USEPA
	Sulfate		45.1	42.2	43.9	43.7	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.605J	0.536J	< 0.50	0.571	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-1	Nitrate-N		25.5	27.4	27.5	26.8	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		149.0	144.0	162	151.7	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.911J	0.972J	0.794J	0.892	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-2	Nitrate-N	28.1	27.4	30.4	29.6	28.9	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	94.2	94.1	96.1	98.7	95.8	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.630J	0.744J	0.659J	0.735J	0.692	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-3	Nitrate-N	26.6	25.9	25.7	23.8	25.5	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	89.6	92.6	83.6	85.3	87.8	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.728J	0.849J	0.846J	0.683J	0.777	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-4	Nitrate-N	48.7	40.2	42.8	39.0	42.7	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	96.2	105.0	98.5	107	101.7	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.837J	1.030	0.813J	0.721J	0.850	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-5	Nitrate-N		52.2	46.9	43.1	47.4	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		82.9	82.2	97.3	87.5	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.914J	0.825J	0.712J	0.817	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-

TABLE 6: Results of Wet Chemistry Analysis
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

Well No.	Analyte	DATE SAMPLED AND CONCENTRATION (mg/L)					Regulatory Threshold (mg/L)	Source of Standard
		Apr-11	Oct-11	Apr-12	Oct-12	Average		
PWB-6	Nitrate-N		12.3	12.7	11.8	12.3	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		131.0	128.0	136	131.7	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.672J	0.706J	0.564J	0.647	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-7A	Nitrate-N		46.6	55.1	53.6	51.8	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		70.5	61.8	57.4	63.2	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.871J	0.839J	0.959J	0.890	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-8	Nitrate-N		29.7	31.1	30.8	30.5	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		168.0	153.0	160	160.3	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		1.190	0.827J	0.671J	0.896	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-9	Nitrate-N		30.5	29.9	29.1	29.8	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		53.1	48.0	51.2	50.8	250	SMCL-USEPA
	Sulfide		<0.02	0.0970J	0.0380J	0.1	-	-
	TOC		0.705J	0.814J	0.732J	0.750	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-10	Nitrate-N		38.1	36.3	29.4	34.6	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		126.0	128.0	146	133.3	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.860J	1.01	0.772J	0.881	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-11	Nitrate-N		35.9	35.6	34.9	35.5	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		84.8	73.4	78.0	78.7	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.671J	0.691J	0.605J	0.656	-	-
	Ferrous Iron		<0.5	<0.5	0.551J	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-

TABLE 6: Results of Wet Chemistry Analysis
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

Well No.	Analyte	DATE SAMPLED AND CONCENTRATION (mg/L)					Regulatory Threshold (mg/L)	Source of Standard
		Apr-11	Oct-11	Apr-12	Oct-12	Average		
PWB-12	Nitrate-N	53.8	56.0	57.8	61.2	57.2	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	62.8	58.5	58.5	62.8	60.7	250	SMCL-USEPA
	Sulfide		<0.1	0.0235J	< 0.02	N/A	-	-
	TOC	0.820J	1.010	0.891J	0.705J	0.857	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-13A	Nitrate-N	33.2	33.8	35.8	37.0	35.0	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	163.0	151.0	140.0	144	149.5	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.902J	0.944J	0.893J	0.883J	0.906	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<1.0	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<10	N/A	-	-
PWB-14	Nitrate-N		11.4	12.5	11.5	11.8	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate		65.1	69.5	71.7	68.8	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC		0.725J	0.715J	0.570J	0.7	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-15	Nitrate-N	21.1	21.6	25.8	24.6	23.3	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	68.9	74.1	79.5	77.6	75.0	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.578J	0.877J	0.780J	0.740J	0.744	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
PWB-16	Nitrate-N	1.2	1.1	1.1	1.04	1.1	10	MCL-USEPA
	Nitrite-N		<0.05	<0.05	<0.05	N/A	1	MCL-USEPA
	Sulfate	76.8	79.7	78.4	82.6	79.4	250	SMCL-USEPA
	Sulfide		<0.02	<0.02	< 0.02	N/A	-	-
	TOC	0.928J	0.868J	0.882J	0.842J	0.880	-	-
	Ferrous Iron		<0.5	<0.5	<0.5	N/A	-	-
	Dis. Methane		<1.0	<1.0	<0.001	N/A	-	-
	Dis. Hydrogen		<1.0	<1.0	<0.01	N/A	-	-
BBW-1	Nitrate-N				25	N/A	10	MCL-USEPA
	Nitrite-N				<0.05	N/A	1	MCL-USEPA
	Sulfate				73	N/A	250	SMCL-USEPA
	Sulfide				< 0.02	N/A	-	-
	TOC				0.614J	N/A	-	-
	Ferrous Iron				<0.5	N/A	-	-
	Dis. Methane				<0.001	N/A	-	-
	Dis. Hydrogen				<0.01	N/A	-	-

TABLE 6: Results of Wet Chemistry Analysis
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

Well No.	Analyte	DATE SAMPLED AND CONCENTRATION (mg/L)					Regulatory Threshold (mg/L)	Source of Standard
		Apr-11	Oct-11	Apr-12	Oct-12	Average		
BBW-2	Nitrate-N				18.6	N/A	10	MCL-USEPA
	Nitrite-N				<0.05	N/A	1	MCL-USEPA
	Sulfate				152	N/A	250	SMCL-USEPA
	Sulfide				< 0.02	N/A	-	-
	TOC				0.840J	N/A	-	-
	Ferrous Iron				<0.5	N/A	-	-
	Dis. Methane				<0.001	N/A	-	-
	Dis. Hydrogen				<0.01	N/A	-	-
BBW-3	Nitrate-N				35.9	N/A	10	MCL-USEPA
	Nitrite-N				<0.05	N/A	1	MCL-USEPA
	Sulfate				183	N/A	250	SMCL-USEPA
	Sulfide				< 0.02	N/A	-	-
	TOC				0.725J	N/A	-	-
	Ferrous Iron				<0.5	N/A	-	-
	Dis. Methane				<0.001	N/A	-	-
	Dis. Hydrogen				<0.01	N/A	-	-

Notes:

mg/L milligrams per liter
MCL maximum contaminant level
SMCL secondary maximum contaminant level
USEPA United States Environmental Protection Agency
TOC total organic carbons
Dis. dissolved

TABLE 7: Summary of COC Results for B-Zone Wells
Brown and Bryant Superfund Site, 600 S. Derby Street, Arvin, CA

Analyte	Wells Sampled	Wells Reported > Detection Limit	Wells Reported > Cleanup Level	Maximum Concentration	Minimum Concentration	Average Concentration	MCL Concentration	Wells in Excess of MCL
				mg/L				
Nitrate-N	26	26	24	61.20	1.04	28.31	10	All wells except PWB-16 and WA2-3. Minimum at PWB-16 & maximum at PWB-12
Nitrite-N	26	1	1	12.000	12.000	N/A	1	The one well reported is WB2-3.
Sulfate	26	26	0	232.0	43.900	113.312	250	None. Minimum at WB2-4 & maximum at AR-1
Sulfide	26	1	0	0.038	0.038	N/A	-	N/A. Reported only for PWB-9.
TOC	26	25	0	0.959	0.564	0.751	-	N/A. Minimum at PWB-6 & maximum at PWB-7A.
Ferrous Iron	26	1	0	0.551	0.551	N/A	-	N/A. The one reported well is PWB-11.
Dis. Methane	26	1	0	0.009	0.009	N/A	-	N/A. The one well reported is WB2-3.
Dis. Hydrogen	26	0	-	-	-	-	-	N/A

Notes:

mg/L milligrams per liter
MCL maximum contaminant level
TOC total organic carbons
Dis. dissolved
- Not available because there is no MCL for the analyte or no analysis was reported above laboratory detection limits.
The reported average is for COC results reported in excess of that compound's laboratory detection limits. Minimum and maximum concentrations at wells are noted, as

APPENDIX A

DAILY FIELD LOGS

**Eco & Associates, Inc. – QUALITY CONTROL REPORT
- DAILY LOG -**

PROJECT: B&B Superfund GW Monitoring	REPORT NO.: 1 Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-22-12
DESCRIPTION: Water Measurements	CONTRACT NO.:
ON-SITE PERSONNEL: Quin Kinnebrew /Jack Collender	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION: cool & clear

1. ANY DELAYS IN WORK PROGRESS TODAY? No Yes If yes, explain:

2. ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT? No Yes If yes, to whom and explain:

3. ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?
 No Yes If yes, explain:
 ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES? No Yes If yes, explain:

5. SAFETY MEETING/TAILGATE MEETING HELD TODAY? No Yes
 ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Quin Kinnebrew	QK	Eco & Associates	Geologist	0915	1540			
Jack Collender	JC	Eco & Associates	Geologist	0915	1435			

**Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG**

8. VISITOR'S LOG

NAME	INITIAL	COMPANY	IN	OUT	IN	OUT	IN	OUT

9. MAJOR ITEMS OF EQUIPMENT.

TYPE / CAPACITY	NUMBER	STANDBY HOURS	OPERATING HOURS

10. TIME AND ACTIVITY LOG

TIME	DESCRIPTION
0916	Arrive at site and prepare to measure groundwater depths and unload equipment.
0930	Hold site safety meeting and scoping meeting
1004	Begin measuring groundwater wells in A-Zone
1005	Arrive at EPAS-4 and remove well cover and measure well, well appears to be in excellent condition, no repairs required
1014	Replace well cover and leave EPAS-4
1016	Arrive at WA-5 remove well cover and measure well. Well appears to be in excellent condition, no repairs required
1022	Replace well cover and leave WA-5
1024	Arrive at WA-4 and remove well cover. Well appears to be in excellent condition, no repairs required
1029	Replace well cover and leave WA-4
1030	Arrive at WA-3 and remove well cover. Well appears to be in excellent condition, no repairs required
1035	Replace well cover and leave WA-3
1038	Arrive at WA-6 and remove well cover. Well appears to be in excellent condition, no repairs required
1042	Replace well cover and leave WA-6
1044	Arrive at AP-4 and remove well cover. Well appears to be in excellent condition, no repairs required, replaced well cap
1047	Replace well cover and leave AP-4
1049	Arrive at AMW-1P and remove well cover. Well appears to be in excellent condition, no repairs required, replaced well cap. Black widow spider in well.
1053	Replace well cover and leave AMW-1P
1056	Arrive at AMW-2P and remove well cover. Well appears to be in excellent condition
1059	Replace well cover and leave AMW-2P
1107	Arrive at AP-1 and remove well cover. Well appears to be in excellent condition, no repairs needed, well cap replaced
1112	Arrive at A1-2 and remove well cover. Well in excellent condition, no repairs required
1120	Replace well cover and leave A1-2
1125	Arrive at WA-7 and remove well cover. Well in excellent condition, no repairs required

10. TIME AND ACTIVITY LOG (CONT')	
TIME	DESCRIPTION
1130	Replace well cover and leave WA-7
1140	Arrive at PWA-2 and remove well cover. Well in excellent condition, no repairs required
1145	Replace well cover and leave PWA-2
1150	Arrive at EPAS-2 and remove well cover. Well appears in good condition, no repairs required. Black widow in well box
1154	Replace well cover and leave EPAS-2
1155	Arrive at EPAS-3 and remove well cover. Well in good condition, no repairs required. Replace well cap
1200	Replace well cover and leave EPAS-3
1205	Arrive at PWA-6 and remove well cover. Well in good condition, no repairs required.
1210	Replace well cover and leave PWA-6
1220	Break for lunch
1300	Return from lunch
1305	Arrive at PWA-1 and remove well cover. Well appears to be in good condition, no repairs required
1312	Replace well cover and leave PWA-1.
1318	Arrive at WA-9 and remove well cover. Water observed in well box, otherwise well in good condition, no repairs required.
1324	Replace well cover and leave WA-9
1326	Arrive at WA-2 and remove well cover. Well in good condition, no repairs required. Some cracking of the concrete well box.
1331	Replace well cover and leave WA-2
1332	Arrive at PWA-# and remove well cover. Well appears in good condition, no repairs required.
1336	Replace well cover and leave PWA-3
1350	Arrive at WA-1 and remove well cover. Well in good condition, no repairs required.
1354	Replace well cover and leave WA-1
1357	Arrive at WA-8 and remove well cover. Well in excellent condition, no repairs required.
1401	Replace well cover and leave WA-8
1402	Arrive at PWA-5 and remove well cover. Well in good condition, no repairs required.
1407	Replace well cover and leave PWA-5
1410	Arrive at EPAS-1 and remove well cover. Well in good condition, no repairs required.
1416	Replace well cover and leave EPAS-1
1417	Arrive at PWA-4 and remove well cover. Well in good condition, no repairs required.
1422	Replace well cover and leave PWA-4
1435	Return to warehouse and observe warehouse cleaning
1534	Arrive at PWA-7. Cover difficult to remove. Well in good condition. Bolts need to be replaced and well cover threads need to be tapped.
1540	Replace well cover and leave PWA-7

**Eco & Associates, Inc. – QUALITY CONTROL REPORT
- DAILY LOG -**

PROJECT: B&B Superfund Fall 2012 GW Monitoring	REPORT NO.: 2a Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-23-12
DESCRIPTION: GW Sampling	CONTRACT NO.:
ON-SITE PERSONNEL: Jack Collender	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION: warm & sunny

1. ANY DELAYS IN WORK PROGRESS TODAY? No Yes If yes, explain:

2. ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT? No Yes If yes, to whom and explain:

3. ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?
 No Yes If yes, explain:
 ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES? No Yes If yes, explain:

5. SAFETY MEETING/TAILGATE MEETING HELD TODAY? No Yes
 ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Jack Collender	JC	Eco & Associates	Geologist	0720	1630			
Rick Lainhart	RSL	COE	Inspector	0706	1500			

JOBSITE SAFETY INSPECTION CHECKLIST

Project Name/Number:

B&B FALL 2012 GW Monitoring / Eco-12-548

Others:

Location:

Arvin, CA

Date:

10/23/12

Project Manager:

Jack Collender

Inspector:

Note: the following jobsite safety inspection checklist is to be used only at locations where Eco & Associates, Inc. (Eco) controls the work jobsite. It is not to be used at locations where others control the work and/or site.

Check "Yes" For Items Complete	Yes	No	N/A
HOUSEKEEPING			
1 Material storage yard:			
a. Stacked neatly and properly	✓		
b. Aisle, walkways, roads clear	✓		
2 Check work areas for:			
a. Loose and waste materials	✓		
b. Vicinity of ladders, stairs, ramps, and machinery			✓
c. Empty bottles, containers, papers, trash, bands, brick-bats, etc.			✓
d. Trash cans, dumpsters available and emptied regularly			✓
e. Trash chutes and surrounding areas clear			✓
f. Nails, boards, debris removed			✓
g. Trash receptacles provided for drinking cups	✓		
PERSONAL PROTECTIVE EQUIPMENT			
1 Hard hats	✓		
2 Safety shoes/boots	✓		
3 Eye/face protection	✓		
4 Safety belts/lanyards			✓
5 Ear Protection			
a. Noise level areas of 90 dBA and above identified			✓
b. Signs notifying personnel of "Hearing Protection Required" posted as required			✓
6 Specialized Equipment			
a. Gloves	✓		
b. Respirators			✓
c. Chemical-resistant clothing			✓
7 Tools			
a. Handles in good shape	✓		
b. Tool guards in place			✓

**Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG**

8. VISITOR'S LOG

NAME	INITIAL	COMPANY	IN	OUT	IN	OUT	IN	OUT

9. MAJOR ITEMS OF EQUIPMENT.

TYPE / CAPACITY	NUMBER	STANDBY HOURS	OPERATING HOURS

10. TIME AND ACTIVITY LOG

TIME	DESCRIPTION
0720	Arrive at site and organize equipment. Bag Ice
0820	Conduct site safety meeting
0830	Omar and Steve to purge A-Zone wells. Quin to measure Background A-Zone wells PBW-1 through PBW-3.
0840	Mike and Quin sample B-Zone wells
0919	Steve and Omar sample B-Zone wells. Mike and Quin continue to sample 3 rd set of B-Zone wells. Obtain QC Samples.
1209	Break for lunch, pick up bolts at hardware store, get more ice
1300	Resume QC QC Ice Chest 1: 10-23-12 PWB-8 10-23-12 PWB-16 QC Ice Chest 2: 10-23-12 PWB-1 10-23-12 PWB-6 10-23-12 AR-1 QC Ice Chest 3: 10-23-12 AMW-3R – MS/MSD QC Ice Chest 4: 10-23-12 PWB-3 10-23-12 PWB-10 10-23-12 WB2-4 10-23-12 AMW-4R 10-23-12 TB-1 QC Ice Chest 5: 10-23-12 PWB-9 10-23-12 PWB-5 10-23-12 WB2-1 10-23-12 PWB-11
1630	Leave site

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

PROJECT: B&B Superfund Fall 2012 GW Monitoring	REPORT NO.: 2b Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-23-12
DESCRIPTION: GW Sampling	CONTRACT NO.:
ONSITE PERSONNEL: Quin Kinnebrew / Mike Gibbs	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION: cool/clear

1. ANY DELAYS IN WORK PROGRESS TODAY? No Yes If yes, explain:

2. ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT? No Yes If yes, to whom and explain:

3. ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?
 No Yes If yes, explain:

ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES? No Yes If yes, explain:

5. SAFETY MEETING/TAILGATE MEETING HELD TODAY? No Yes

At 07:25 the safety meeting was held

ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Mike Gibbs	MG	Eco & Associates	Tech	0715	1630			
Quin Kinnebrew	QK	Eco & Associates	Geologist	0715	1630			

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

8. VISITOR'S LOG

NAME	INITIAL	COMPANY	IN	OUT	IN	OUT	IN	OUT

9. MAJOR ITEMS OF EQUIPMENT.

TYPE / CAPACITY	NUMBER	STANDBY HOURS	OPERATING HOURS

10. TIME AND ACTIVITY LOG

TIME	DESCRIPTION	pH	COND	TURB	DO	TEMP	SAL	ORP
0903	Arrive @ AMW-3R	--	mS/cm	Ntu	mg/L	°C	ppm	mV
	1st Purge: 6060 mL	7.36	1.89	2.7	104.0	21.26	1.0	117
	2 nd Purge: 5800 mL	7.40	1.76	3.8	92.2	20.44	0.9	140
0936	Start Sampling							
1028	Arrive @ PWB-1	--	mS/cm	Ntu	mg/L	°C	ppm	mV
	1st Purge: 6600 mL	7.16	1.51	1.2	86.3	24.63	0.8	176
1041	2 nd Purge: 4680 mL	7.22	1.77	2.3	85.7	24.82	0.7	187
1050	Start Sampling							

10. TIME AND ACTIVITY LOG CONTINUES								
TIME	DESCRIPTION							
1111	Arrive @ PWB-6							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
1115	1st Purge: 2780 mL	7.54	1.26	46.0	109.8	25.36	0.6	171
1124	2 nd Purge: 2080 mL	7.48	1.24	9.0	7.03	25.01	0.6	173
1132	Start Sampling							
1158	Arrive @ AR-1							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
1200	1st Purge: 6120 mL	7.11	1.86	0.3	8.41	25.76	0.9	198
1210	2 nd Purge: 5800 mL	7.18	1.81	1.1	6.40	25.82	0.9	197
1216	Start Sampling							
1252	Arrive @ PWB-9							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
1305	1st Purge: 1500 mL	7.45	1.34	7.6	8.97	25.38	0.7	33
1309	2 nd Purge: 750 mL	7.58	1.30	866	8.37	24.42	0.6	132
1315	3rd Purge: 400 mL	7.53	1.30	176	6.70	24.50	0.6	139
1320	Start Sampling							
	- Well / groundwater production slows. Water is very murky. ~five minute wait yields ~100 mL water near end of sampling. Total sampling time = 25 minutes.							
	- Stinger to header needs repair.							
1420	Arrive @ PWB-5							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
1424	1st Purge: 2470 mL	7.68	1.40	24.0	110.9	23.80	0.7	112
1428	2 nd Purge: 2800 mL	7.49	1.37	25.4	6.64	23.81	0.7	156
1432	Start Sampling							

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

PROJECT: B&B Superfund Fall 2012 GW Monitoring	REPORT NO.: 2c Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-23-12
DESCRIPTION: GW Sampling	CONTRACT NO.:
ONSITE PERSONNEL: SCS, OA, QK, MG, JC	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION:

1. **ANY DELAYS IN WORK PROGRESS TODAY?** No Yes If yes, explain:

2. **ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT?** No Yes If yes, to whom and explain:

3. **ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?**
 No Yes If yes, explain:

ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. **ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES?** No Yes If yes, explain:

5. **SAFETY MEETING/TAILGATE MEETING HELD TODAY?** No Yes
 At 07:25 the safety meeting was held

ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Steven Saunders	SCS	Eco & Associates	Geologist	0715	1630			
Omar Argueta	OA	Eco & Associates	Tech	0715	1630			
Quin Kinnebrew	QK	Eco & Associates	Geologist	0715	1630			
Mike Gibbs	MG	Eco & Associates	Tech	0715	1630			
Jack Collender	JC	Eco & Associates	Geologist	0715	1630			

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

8. VISITOR'S LOG

NAME	INITIAL	COMPANY	IN	OUT	IN	OUT	IN	OUT

9. MAJOR ITEMS OF EQUIPMENT.

TYPE / CAPACITY	NUMBER	STANDBY HOURS	OPERATING HOURS

10. TIME AND ACTIVITY LOG

TIME	DESCRIPTION								
0715	Arrived onsite. Safety meeting. Set up gear for sampling.								
0825	Arrive @ PWA-1 (missing well cover bolt)								
0830	PWA-1 purged only 240 mL and then 0 mL after 5 minutes.								
1525	Returned to PWA-1 to check purge quantity (75 mL)								
1530	Purge quantity = 0 mL Pulled stinger and measure GW level @83.71 BTC Note: Water outside of Barcad 53.41' BTC								
	PWA-1								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
0830	Purge #1	240 mL & 0 mL	-	-	-	-	-	-	
	Purge #2		-	-	-	-	-	-	
	Purge #3		-	-	-	-	-	-	
0850	Arrived @ PWA-4								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
0852	Purge #1	Dry	-	-	-	-	-	-	

10. TIME AND ACTIVITY LOG CONTINUES									
TIME	DESCRIPTION								
0902	Arrived @ WA-6								
0903	1 st Purge 50 mL, 2 nd purge after 5 min. is dry.	<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
	Purge #1	50 mL	-	-	-	-	-	-	
	Purge #2	dry	-	-	-	-	-	-	
	Purge #3		-	-	-	-	-	-	
1541	Returned to check purge 75 mL, 0 mL after 5 min. Pulled stinger measured GW @ 75.84 BTC								
0928	Arrived @ PWB-3								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
0932	Purge #1	3300 mL	7.92	1.24	9.7	7.55	21.14	0.6	134
0947	Purge #2	2075 mL	6.53	0.701	156	7.15	20.09	0.3	189
0952	Purge #3	2750 mL	6.83	0.698	116	6.86	20.29	0.3	185
0957	Sample time PWB-3								
1020	Arrived @ WB2-4 (Pulling transducer to measure & collect GW)								
	GW level @ 150.86' BTC		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
1040	Purge #1	2700 mL	8.51	0.822	13.5	11.80	22.48	0.4	102
1045	Purge #2	2600 mL	8.41	0.578	102	6.32	22.02	0.3	118
1051	Purge #3	2450 mL	8.34	0.805	47.6	4.75	22.85	0.4	126
1056	Sample time WB2-4								
1128	Arrived @ PWB-10								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
1135	Purge #1	2700 mL	8.02	1.53	12.0	12.95	22.48	0.8	153
1140	Purge #2	2700 mL	7.90	1.64	54.3	6.25	22.67	0.8	158
1145	Purge #3	2700 mL	7.87	1.53	62.3	6.13	22.92	0.8	62.3
1150	Sample time PWB-10								

10. TIME AND ACTIVITY LOG CONTINUES									
TIME	DESCRIPTION								
1220	Arrive @ AMW-4R								
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
1225	Purge #1	3300 + 4000 = 7300 mL	7.87	1.64	33.7	6.02	23.47	0.8	142
1230	Purge #2	3000 + 4000 = 7000 mL	7.91	1.58	7.0	5.54	23.02	0.8	164
1235	Purge #3	4000 + 3000 = 7000 mL	7.99	1.56	29.8	5.92	22.68	0.8	158
1240	Sample time AMW-4R								
1350	Arrive @ PWB-8								
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
1358	Purge #1	3500 mL	8.14	1.60	77.3	17.31	22.33	0.8	64
1310	Purge #2	3450 mL	7.10	1.10	104	6.46	22.07	0.5	125
1315	Purge #3	2800 mL	-	-	-	-	-	-	-
1320	Sample time PWB-8								
1442	Arrive @ PWB-16								
	(Slight leak in BarCad)		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
1446	Purge #1	3550 mL	8.43	0.989	5.6	17.19	21.96	0.5	116
1451	Purge #2	1900 mL	8.25	0.994	12.5	6.24	22.24	0.5	103
1456	Purge #3	3850 mL	8.39	0.842	44.2	6.31	21.79	0.4	100
1501	Sample time PWB-16								
1530	Returned to warehouse to prep. for next days work								
1630	Eco offsite								

**Eco & Associates, Inc. – QUALITY CONTROL REPORT
- DAILY LOG -**

PROJECT: B&B Superfund Fall 2012 GW Monitoring	REPORT NO.: 3a Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-24-12
DESCRIPTION: GW Sampling	CONTRACT NO.:
ON-SITE PERSONNEL: Jack Collender	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION: cool and cloudy

1. ANY DELAYS IN WORK PROGRESS TODAY? No Yes If yes, explain:

2. ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT? No Yes If yes, to whom and explain:

3. ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?
 No Yes If yes, explain:
 ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES? No Yes If yes, explain:

5. SAFETY MEETING/TAILGATE MEETING HELD TODAY? No Yes
 ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Jack Collender	JC	Eco & Associates	Geologist	0700	1715			

**Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG**

8. VISITOR'S LOG

NAME	INITIAL	COMPANY	IN	OUT	IN	OUT	IN	OUT

9. MAJOR ITEMS OF EQUIPMENT.

TYPE / CAPACITY	NUMBER	STANDBY HOURS	OPERATING HOURS

10. TIME AND ACTIVITY LOG

TIME	DESCRIPTION
0700	Purchase ice and drive to site.
0715	Conduct site safety meeting
0720	Omar and Steve mobilize to conduct sampling of BBW-1 through BBW-3. Mike and Quin mobilize to conduct B-Zone sampling
0730	Repack ice chests with fresh ice and prepare for 1000 pick up by lab. FDUP-1 is for well BBW-3 FDUP-2 is for well BBW-4
0845	Nitrogen tank out and needs to be replaced. About 14 wells can be sampled with one large nitrogen tank.
1000	Courier arrives for pick up. Sampling wells BBW-1 through BBW-3 not completed. Courier asked to wait.
1120	QC Ice chest #6: 10-24-12 PWB-14; 10-24-12 BBW-1; 10-24-12 PWB-13A; 10-24-12 PWB-4
1130	QC Ice chest #7: 10-24-12 FDUP-1; 10-24-12 BBW-3; 10-24-12 BBW-2; 10-24-12 PWB-12; 10-24-12 FDUP-2; 10-24-12 TB-1
1132	Courier leaves site with samples
1135	Break for lunch
1240	Return from lunch
1300	Ran out of nitrogen. Omar goes to Bakersfield to get more nitrogen tanks. Steve, Quin, and Mike continue B-Zone sampling. FDUP-3 is for well WB2-2
1540	Begin Sampling A-Zone wells
1550	QC Ice chests
1715	Leave site

**Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES**

PROJECT: B&B Superfund Fall 2012 GW Monitoring	REPORT NO.: 3b Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-24-12
DESCRIPTION: GW Sampling	CONTRACT NO.:
ONSITE PERSONNEL: Steve Saunders / Omar Argueta	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION: cool/clear

1. ANY DELAYS IN WORK PROGRESS TODAY? No Yes If yes, explain:

2. ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT? No Yes If yes, to whom and explain:

3. ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?
 No Yes If yes, explain:

ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES? No Yes If yes, explain:

5. SAFETY MEETING/TAILGATE MEETING HELD TODAY? No Yes
At 07:25 the safety meeting was held

ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Steve Saunders	SS	Eco & Associates	Geologist	0715	1715			
Omar Argueta	OA	Eco & Associates	Tech	0715	1715			

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

8. VISITOR'S LOG

NAME	INITIAL	COMPANY	IN	OUT	IN	OUT	IN	OUT

9. MAJOR ITEMS OF EQUIPMENT.

TYPE / CAPACITY	NUMBER	STANDBY HOURS	OPERATING HOURS

10. TIME AND ACTIVITY LOG

TIME	DESCRIPTION	pH	COND	TURB	DO	TEMP	SAL	ORP
0745	Arrive @ BBW-1 (to sample pump with Bladder)	--	mS/cm	Ntu	mg/L	°C	ppm	mV
0813	1st Purge:	10.13	0.836	64.9	8.33	15.42	0.4	119
0817	2 nd Purge:	8.25	0.997	16.5	6.93	18.64	0.5	108
0820	3rd Purge:	8.19	0.986	13.6	5.78	19.22	0.5	112
0825	Sample time BBW-1							
0905	Arrive @ BBW-2	--	mS/cm	Ntu	mg/L	°C	ppm	mV
0915	1st Purge:	7.93	1.32	46.8	6.64	18.33	0.7	153
0922	2 nd Purge:	7.82	1.34	23.3	5.85	19.54	0.7	150
0930	3rd Purge:	7.80	1.33	20.5	5.64	20.19	0.7	151
0935	Sample time BBW-2							

10. TIME AND ACTIVITY LOG CONTINUES								
TIME	DESCRIPTION							
1015	Arrive @ BBW-3							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
1025	1st Purge:	8.14	1.55	151	5.95	23.06	0.8	149
1035	2 nd Purge:	7.99	1.61	56.5	5.20	22.86	0.8	151
1045	3rd Purge:	8.09	1.58	98.4	5.35	22.91	0.8	150
1050	Sample time BBW-3 (Decon Pump & collected – EB-1 @ 1121)							
1100	Sample time FDUP-1							
1230	Arrive @ PWB-15							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
1250	1st Purge: 3000 mL	7.98	1.28	214	7.27	21.39	0.6	178
1300	2 nd Purge:	7.88	1.26	182	7.06	21.08	0.6	206
1315	Sample time: PWB-15							
1425	Arrive @ WBW2-2							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
1437	1st Purge: 2300 mL	8.60	1.30	15.5	7.06	23.29	0.6	140
1441	2 nd Purge: 700 mL	7.99	0.981	99.1	6.10	23.26	0.5	163
1445	3rd Purge: 700 mL	8.91	1.25	6.5	2.18	23.32	0.6	117
1448	Sample time WBW2-2							
1450	Sample time FDUP-3							
1536	Arrive @ WA-3							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
1540	1st Purge: 220 mL + 200 mL	8.28	1.93	26.0	5.41	22.46	1.0	168
1545	2 nd Purge: 200 mL + 200 mL	8.04	2.02	12.1	4.14	22.20	1.0	168
1600	Sample time WA-3							

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

PROJECT: Fall 2012 GW Monitoring	REPORT NO.: 3c Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-24-12
DESCRIPTION: GW Sampling	CONTRACT NO.:
ONSITE PERSONNEL: Quin Kinnebrew	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION: cool/clear

1. ANY DELAYS IN WORK PROGRESS TODAY? No Yes If yes, explain:

2. ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT? No Yes If yes, to whom and explain:

3. ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?
 No Yes If yes, explain:

ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES? No Yes If yes, explain:

5. SAFETY MEETING/TAILGATE MEETING HELD TODAY? No Yes
 At 07:25 the safety meeting was held

ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Quin Kinnebrew	QK	Eco & Associates	Geologist	0715	1715			
Mike Gibbs	MG	Eco & Associates	Tech	0715	1715			

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

8. VISITOR'S LOG

NAME	INITIAL	COMPANY	IN	OUT	IN	OUT	IN	OUT

9. MAJOR ITEMS OF EQUIPMENT.

TYPE / CAPACITY	NUMBER	STANDBY HOURS	OPERATING HOURS

10. TIME AND ACTIVITY LOG

TIME	DESCRIPTION								
0748	Arrived at WPWB-14								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
0755	1st Purge 3.7 mL	7.70	1.10	2.1	101.0	19.37	0.8	182	
0802	2 nd Purge 3.6 mL	7.62	1.09	1.4	85.6	20.68	0.5	0.5	
0806	Sampling time PWB-14								
0820	Arrived @ PWB-13A								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
0827	1st Purge 3060 mL	8.31	1.34	1.3	11.47	18.87	0.7	191	
0837	2 nd Purge 2680 mL	7.41	1.36	9.7	6.63	20.40	0.7	119	
0844	Sampling time PWB-13A								

10. TIME AND ACTIVITY LOG CONTINUES									
TIME	DESCRIPTION								
0901	Arrived @ PWB-12		* Threads on well Stripped!						
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
0906	1st Purge	2900 mL	7.50	1.17	1.9	7.09	20.55	0.6	178
0920	2 nd Purge	-	7.42	1.19	2.6	6.8	21.67	0.6	183
0922	Sampling time PWB-12								
0944	Arrived @ PWB-4		FDUP-2						
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
0946	1st Purge	3840 mL	7.23	1.54	1.2	7.43	22.29	0.8	198
0953	2 nd Purge	3500 mL	7.21	1.54	1.6	6.65	23.33	0.8	195
1000	Sampling time PWB-4								
1322	Arrived @ WB2-3		- Stinger leaks at top 1/4						
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
1327	1st Purge	3900 mL	8.08	1.33	3.8	6.48	23.37	0.7	166
1330	2nd Purge	3600 mL	8.94	1.29	5.8	6.47	24.20	0.6	132
1334	Sampling time WB2-3								
1430	Arrived @ PWB-7A								
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
1437	1st Purge	2000 mL	7.53	1.17	3.3	8.21	25.39	0.6	195
1442	2 nd Purge	2000 mL	7.62	1.20	2.3	6.51	25.53	0.6	200
1450	Sampling time PWB-7A								

**Eco & Associates, Inc. – QUALITY CONTROL REPORT
- DAILY LOG -**

PROJECT: B&B Superfund GW Monitoring	REPORT NO.: 4-a Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-25-12
DESCRIPTION: Fall 2012 GW Monitoring	CONTRACT NO.:
ON-SITE PERSONNEL: Jack Collender	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION:

1. ANY DELAYS IN WORK PROGRESS TODAY? No Yes If yes, explain:

2. ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT? No Yes If yes, to whom and explain:

3. ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?
 No Yes If yes, explain:
 ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES? No Yes If yes, explain:

5. SAFETY MEETING/TAILGATE MEETING HELD TODAY? No Yes
 ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Jack Collender	JC	Eco & Associates	Geologist	0700	1500			
Steven E. Mendoza	SEM	Belshire	Driver	0705	1130			
Lois Navarro	LN	Belshire	Driver	0830	1130			

JOBSITE SAFETY INSPECTION CHECKLIST

Project Name/Number: B&B GW Monitoring / Eco-12-548 **Others:** _____

Location: Arvin, CA **Date:** 10/25/12

Project Manager: Jack Collender **Inspector:** _____

Note: the following jobsite safety inspection checklist is to be used only at locations where Eco & Associates, Inc. (Eco) controls the work jobsite. It is not to be used at locations where others control the work and/or site.

Check "Yes" For Items Complete	Yes	No	N/A
HOUSEKEEPING			
1 Material storage yard:			
a. Stacked neatly and properly	✓		
b. Aisle, walkways, roads clear	✓		
2 Check work areas for:			
a. Loose and waste materials	✓		
b. Vicinity of ladders, stairs, ramps, and machinery			✓
c. Empty bottles, containers, papers, trash, bands, brick-bats, etc.	✓		
d. Trash cans, dumpsters available and emptied regularly	✓		
e. Trash chutes and surrounding areas clear			✓
f. Nails, boards, debris removed	✓		
g. Trash receptacles provided for drinking cups	✓		
PERSONAL PROTECTIVE EQUIPMENT			
1 Hard hats	✓		
2 Safety shoes/boots	✓		
3 Eye/face protection	✓		
4 Safety belts/lanyards			✓
5 Ear Protection			
a. Noise level areas of 90 dBA and above identified			✓
b. Signs notifying personnel of "Hearing Protection Required" posted as required			✓
6 Specialized Equipment			
a. Gloves	✓		
b. Respirators			✓
c. Chemical-resistant clothing			✓
7 Tools			
a. Handles in good shape	✓		
b. Tool guards in place			✓

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

PROJECT: Fall 2012 GW Monitoring	REPORT NO.: 4-b Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-25-12
DESCRIPTION: GW Sampling	CONTRACT NO.:
ONSITE PERSONNEL: Steve Saunders	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION: cool/clear

1. ANY DELAYS IN WORK PROGRESS TODAY? No Yes If yes, explain:

2. ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT? No Yes If yes, to whom and explain:

3. ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?
 No Yes If yes, explain:

ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES? No Yes If yes, explain:

5. SAFETY MEETING/TAILGATE MEETING HELD TODAY? No Yes

At 07:25 the safety meeting was held

ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Steve Saunders	SS	Eco & Associates	Geologist	0715	1145			
Omar Argueta	OA	Eco & Associates	Tech	0715	1145			

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

8. VISITOR'S LOG

NAME	INITIAL	COMPANY	IN	OUT	IN	OUT	IN	OUT

9. MAJOR ITEMS OF EQUIPMENT.

TYPE / CAPACITY	NUMBER	STANDBY HOURS	OPERATING HOURS

10. TIME AND ACTIVITY LOG

TIME	DESCRIPTION								
0715	Arrive @ site, safety meeting, set up equip. for sampling								
0740	<u>Arrive @ WA-5</u>								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
0744	1st Purge: 1100 mL	8.38	1.98	4.3	8.38	17.06	1.0	133	
0747	2 nd Purge: 800 mL	8.10	2.09	3.0	6.66	18.97	1.0	153	
0750	3rd Purge: 800 mL	8.04	2.05	4.4	6.44	20.11	1.0	152	
0755	Sample time: WA-5								
0820	<u>Arrive @ WA-2</u>								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
0826	1st Purge: 550 mL	8.00	1.44	39.0	15.23	16.21	0.7	157	
0829	2 nd Purge: 500 mL	8.08	1.50	5.1	4.72	20.54	0.8	174	
0831	3rd Purge: 500 mL	8.06	1.49	5.0	3.40	21.18	0.7	171	
0835	Sample time: WA-2								

10. TIME AND ACTIVITY LOG CONTINUES								
TIME	DESCRIPTION							
0858	Arrive @ EPAS-1							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
	1st Purge: 150 mL *	--	--	--	--	--	--	--
	*After 3 min 20 mL, After 5 min. 0 mL	--	--	--	--	--	--	--
		--	--	--	--	--	--	--
1041	Returned to EPAS-1 purged ~ 20 mL, well will not produce an adequate amount of water sampling or parameter measurement.							
0920	Arrive @ EPAS-3							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
0923	1st Purge: 1850 mL	7.51	4.14	6.4	5.07	20.47	2.2	197
0926	2 nd Purge: 1750 mL	7.38	3.80	34.2	6.47	20.82	2.0	187
0929	3rd Purge: 1750 mL	7.68	4.25	3.0	6.01	21.30	2.2	175
0933	Sample time: EPAS-3							
1000	Arrive @ PAW-2							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV
1005	1st Purge: 1700 mL	7.05	7.29	60.6	7.09	20.53	3.9	228
1012	2 nd Purge: 1550 mL	7.03	6.38	121	6.52	21.31	3.4	238
1021	3rd Purge: 1550 mL	7.39	9.45	10.3	5.84	22.45	5.3	209
1026	Sample time: PAW-2							
1045	Finished sampling. Returned to warehouse to pack gear & demob. to office							
1145	Eco offsite							
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
		--	mS/cm	Ntu	mg/L	°C	ppm	mV

Eco & Associates, Inc. – QUALITY CONTROL REPORT
DAILY LOG OF CONSTRUCTION ACTIVITIES

PROJECT: Fall 2012 GW Monitoring	REPORT NO.: 4-c Eco-12-548
PROJECT LOCATION: 600 S. Derby St, Arvin, CA	DATE: 10-25-12
DESCRIPTION: GW Sampling	CONTRACT NO.:
ONSITE PERSONNEL: Quin Kinnebrew	TASK ORDER NO.:
SIGNATURE: 	WEATHER CONDITION: cool/clear

1. ANY DELAYS IN WORK PROGRESS TODAY? No Yes If yes, explain:

2. ANY VERBAL INSTRUCTION GIVEN BY THE GOVERNMENT, REGULATOR, OR CLIENT? No Yes If yes, to whom and explain:

3. ANY CONDITION DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM OR FINDINGS OF FACTS?
 No Yes If yes, explain:

ANY POTENTIAL CHANGE ORDER OR CLAIM MUST BE REPORTED TO THE PROJECT DIRECTOR/MANAGER.

4. ANY DEFICIENCIES, ACTIONS TAKEN TO CORRECT THE DEFICIENCIES? No Yes If yes, explain:

5. SAFETY MEETING/TAILGATE MEETING HELD TODAY? No Yes

At 07:25 the safety meeting was held

ANY LOST TIME ACCIDENT TODAY? No Yes If yes, attach an accident report.

6. PRIME CONTRACTOR AND SUBCONTRACTOR WORK FORCE SIGN IN AND OUT IN THE SPACE BELOW.

NAME	INITIAL	COMPANY	TRADE	IN	OUT	IN	OUT	TOTAL HOURS
Quin Kinnebrew	QK	Eco & Associates	Geologist	0710	1145			
Mike Gibbs	MG	Eco & Associates	Tech	0710	1145			

Eco & Associates, Inc. – QUALITY CONTROL REPORT

DAILY LOG OF CONSTRUCTION ACTIVITIES

8. VISITOR'S LOG

NAME	INITIAL	COMPANY	IN	OUT	IN	OUT	IN	OUT

9. MAJOR ITEMS OF EQUIPMENT.

TYPE / CAPACITY	NUMBER	STANDBY HOURS	OPERATING HOURS

10. TIME AND ACTIVITY LOG

TIME	DESCRIPTION								
0732	Returned to EPAS-4 No water (not a drop)								
0740	Arrived at WA-1 MS/MSD								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
0752	Purged	1560 mL	7.18	1.31	3.4	8.9	17.60	0.7	211
0756		1520 mL	7.01	1.52	24.4	5.30	19.59	0.7	-2
0758		1520 mL	6.83	1.53	17.3	7.14	20.48	0.8	-9
0800	Sampling								
0830	Arrived @ PWA-3								
		<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>	
		--	mS/cm	Ntu	mg/L	°C	ppm	mV	
0832	Purged	2240 mL	7.40	1.22	3.4	87.5	19.38	0.6	119
0840		2020 mL	7.36	1.16	6.1	6.57	22.13	0.6	124
0844		2080 mL	7.39	1.19	2.3	6.75	23.09	0.6	128
0850	Sampling								

10. TIME AND ACTIVITY LOG CONTINUES									
TIME	DESCRIPTION								
0900	Arrived @ PWA-7A Well box needs replacement!								
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
0904	Purged	1530 mL	7.60	0.833	3.0	90.4	22.28	0.4	143
0907		1000 mL	7.52	0.868	3.1	6.53	23.22	0.4	145
0912		1180 mL	7.56	0.885	3.4	6.73	23.20	0.4	144
	Threads stripped/not adhered to concrete								
0916	Sampling								
0920	Returned to PWB-12 / Bolts still stuck								
0928	Arrived @ EPAS-2								
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
0933	Purged	1760 mL	7.13	1.58	1.3	8.91	22.36	0.8	174
0940		1620 mL	7.04	1.63	1.0	78.8	22.96	0.8	172
0944		1530 mL	7.06	1.63	0.7	79.3	23.35	0.8	167
0948	Sampling								
1010	Arrived @ WA-9								
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV
1015	Purged	860 mL	6.63	1.87	1.0	93.50	21.50	1.0	172
1018		300 mL	7.48	1.89	1.4	80.24	21.71	1.0	175
1025		360 mL	7.34	1.87	1.0	6.77	23.76	0.9	175
1030	Sampling								
1043	Finished WA-9								
			<u>pH</u>	<u>COND</u>	<u>TURB</u>	<u>DO</u>	<u>TEMP</u>	<u>SAL</u>	<u>ORP</u>
			--	mS/cm	Ntu	mg/L	°C	ppm	mV

APPENDIX B

LABORATORY REPORTS

THE LABORATORY REPORTS ARE PROVIDED ON
CD-ROM WITH THIS HARD COPY.

APPENDIX C

DATA VALIDATION AND AUTOMATED DATA REVIEW REPORTS

*THE AUTOMATED DATA REVIEW REPORT IS PROVIDED
ON CD-ROM WITH THIS HARD COPY.*

Data Validation Report

Groundwater Monitoring Data

for

Brown & Bryant

Arvin, CA

Project No.: Eco-12-548

SDG#: 12J162

LEVEL III & IV

Prepared for:

Eco & Associate, Inc.

1855 W. Katella Ave, Suite 340

Orange, CA, 92867

By

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Moorpark, California

October 2012

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1.0 INTRODUCTION	
1.1 Objectives and Scope of the Data Validation	5
1.2 Organization of the Report	5
2.0 DATA REVIEW AND VALIDATION	
2.1 Data Reporting	6
2.2 Data Evaluation	7
2.2.1 Holding Times	10
2.2.2 Laboratory and Field Blanks	11
3.0 QUALITY ASSURANCE OBJECTIVES	
3.1 Qualitative QA Objectives	12
3.1.1 Comparability	12
3.1.2 Representativeness	12
3.2 Quantitative QA Objectives	12
3.2.1 Precision	13
3.2.2 Accuracy	13
3.2.3 Completeness	14
4.0 DATA VALIDATION	
4.0 Results of Data Validation	15
4.1 Volatile Organic Compounds (EPA 8260B)	16
4.2 Fumigants by EPA Method EPA 8260B (SIM)	20
4.3 Herbicides by (EPA Method 8151A)	23
4.4 Anions, EPA Method 300.0	25
4.5 (Total Organic Carbon) St Method 415.1	26
4.6 (Ferrous Iron) SM3500	28
4.7 (Sulfide) SM4500S2D	29
4.8 (Methane & dissolved Hydrogen) EPA Method RSK175	30
5.0 Conclusion	32
6.0 REFERENCES	33
7.0 APPENDIX A: Sample results tables	34

EXECUTIVE SUMMARY

This data validation report presents the evaluation and validation of the analytical data for ten ground water samples collected on 10-23-12 and 10-24-12 as part of biannually groundwater monitoring at Brown and Bryant, Arvin, California (CA). EMAX Laboratory in Torrance, California performed the chemical analysis of the samples. The United States Army Corps of Engineers and the State of California have certified EMAX Laboratory to perform the analysis described within this project. (Eco & Associates Inc., April 2011).

Ten (10) ground water samples, which included one field duplicate sample, were collected on 10-23-12 and 10-24-12. EMAX Laboratory received the samples on 10-24-12. The data was delivered in one package as Level III and Level IV deliverables. 10% of the data was subjected to validation equivalent to EPA Level IV data validation. Raw data for one sample from this sample group (10-23-12- PWB-6) was submitted as level IV deliverable for all the requested analytical methods. Raw data for designated sample as MS/MSD (10-23-12-AMW-3R) together with all other QC samples were also submitted.

Level III data validation examined quality assurance/quality control (QA/QC) elements such as holding time, (both extraction and analysis), critical quality control measures, completeness of the results, extraction logs, instrument injection logs and summaries of initial and continuing calibrations for the following EPA methods of analysis:

Volatile Organic Compounds by EPA Method **8260B**

Fumigants (EDB, DBCP and 1, 2, 3-Trichloropropane) by EPA Method **8260B SIM**

Dinoseb by EPA Method **8151A**

Anions (Nitrite-N, Nitrate-N and Sulfate) by IC, EPA Method **300.0**

Total Organic Carbon by Method **415.1**

Ferrous Iron by Standard Method **3500**

Total Sulfide by Standard Method **4500-S2D**

Methane and dissolved Hydrogen by EPA Method **RSK175**

The analytical results, QC results, initial calibration and related continuing calibration raw data were comprehensively compared with the corresponding raw data and chromatograms presented for Level IV data validation.

All samples were analyzed for each of the components listed in the corresponding EPA Methods. The evaluation indicated that all the analytical work was performed as requested on the chain of custody. The extraction and analytical holding times were met for all samples in each method and subsequent dilutions.

Generally, data presented with this data package was considered acceptable and met quality control acceptance limits for each EPA Method, with some technical variations. The deviations are discussed in section 4.0 for each method. The results of sample analysis are tabulated in Appendix A.

1.0 INTRODUCTION

This report presents the evaluation and validation of analytical data collected as part of biannually groundwater monitoring at Brown and Bryant Superfund Site at Arvin, California.

1.1 Objectives and Scope of Data Validation

The main objective of this report is to evaluate the acceptability of groundwater data. The data validation was performed according to the analytical requirements of the method in the *Quality Assurance Project Plan, final Draft, Brown and Bryant, Arvin, CA*, (Project No: Eco-12-548, Eco & Associates Inc. April 2012), EM 200-1-10 Guidance for Evaluation Performance-based Chemical Data, US Army Corps of Engineers (USACE), June 2005, *USEPA Analytical Operations/Data Quality Center (AOC) National Functional Guidelines for Organic Data Review* (USEPA, August 2002) and Department of Defense Quality Systems Manual (DoD QSM) Version 4.2, 2010 .

1.2 Organization of the Report

Section 2.0 describes the components of the data review. Section 3.0 provides the qualitative quality assurance objectives. Section 4.0 summarizes the findings and conclusions of the data validation.

2.0 DATA REVIEW AND VALIDATION

Data validation is a systematic method for reviewing and qualifying the presented analytical data for their intended use. The objective of this data validation report is to identify any unacceptable or faulty measurements if any, as reported by the laboratory.

EMAX Laboratory in Torrance, California performed the chemical analysis of the samples. Army Corps of Engineers and the State of California have certified EMAX laboratory to perform the EPA Methods of analysis described within this report.

Ten (10) ground water samples, which included one field duplicate sample, were collected on 10-23-12 and 10-24-12. EMAX Laboratory received the samples on 10-24-12.

2.1 Data Reporting

The data was delivered in one package as Level III and Level IV deliverables. Ten percent of the data was subjected to validation equivalent to EPA Level IV data validation. EMAX Laboratory provided the following information in one data package for both LEVEL III and LEVEL IV deliverable.

- Sample identification number;
- Date of sample collection;
- Sample matrix type;
- Analysis method;
- Target lists and results of analysis;
- Quantitation limits and/or Reporting Limits;
- Laboratory qualifiers and qualifier definitions;
- Copies of sample logs and chain-of-custody logs;
- Sample preparation log (with the sample extraction date)
- Sample Analysis log (Instrument injection log)
- Summary of initial and continuing calibrations;
- Quality control results.
- Case narrative for each method.

- Raw data for all the initial calibration standards, Initial calibration verification standards (ICV), continuing calibration standards (CCV), ion fragments for positive hits, internal standard area counts and retention time window width, where applicable. Raw data for one sample (10-23-12- PWB-6) marked as level IV in the chain of custody as well as MS/MSD (10-23-12-AMW-3R); together with the associated QC samples were also included.

Data validation was performed in three stages: first an initial review of the analytical reports and QA/QC information was performed using summary results and summary tables only. Then, a full review of all analytical reports, QA/QC information, as well as the corresponding raw and analytical data was carried out. Finally summary tables and corresponding raw data of initial and continuing calibration standards, the extraction log, and injection (sequence) log were fully reviewed. Overall review assessed the effects of QA/QC results on the data usability. The review included such parameters as holding times, initial and continuing calibration method requirements, equipment performance check standards (tune check and degradation standards), surrogate recoveries, method blank results, lab control sample (LCS) and matrix spike/matrix spike duplicate (MS/MSD) for accuracy and precision.

Level IV review compared the reported analytical results with those obtained from the raw data. Raw data was submitted for one sample at Level IV data deliverable for all the analytical methods requested on the chain of custody. Calculations and corresponding equations, as well as analyte identification criteria were all verified.

2.2 Data Evaluation

The following parameters were evaluated in the preliminary data review:

- Analysis performed and sample identifications were verified to be in accordance with the information provided on the chain-of-custody (COC);
- Technical holding times were confirmed for all samples with regard to the requested method of analysis (collection to extraction and extraction to analysis);

- Reported quantitation limits were compared with the project measurement objectives;
- Initial and continuing calibrations were evaluated;
- Equipment performance standards (tuning check standard) was evaluated
- Field and laboratory blank results were evaluated;
- LCS/LCSD and MS/MSD results were evaluated; and
- Field and laboratory matrix duplicate results, trip blank results as well as surrogate recoveries, internal standards and instrument performance check compounds were evaluated.
- Chromatograms and mass spectrum results as well as ion fragments for positive hits were evaluated

The following is a list of sample identifications and corresponding laboratory sample identification numbers:

CLIENT ID	EMAX ID#
10-24-12BBW-1	J162.01
10-24-12BBW-2	J162.02
10-24-12BBW-3	J162.03
10-24-12-FDUP-1	J162.04
10-23-12-PWB-6	J162.05
10-23-12-AR-1	J162.06
10-23-12-PWB-1	J162.07
10-23-12-AMW-3R	J162.08
10-23-12-PWB-3	J162.09
10-23-12- PWB-10	J162.10
10-23-12-AMW-3RMS	J162.08MS
10-23-12-AMW-3RMSD	J162.08MSD
10-23-12-AMW-3RDUP	J162.08DUP

Field duplicate and associated sample	
10-24-12-FDUP-2	10-24-12- BBW-3

Table 2-1 below shows the specified analysis for constituents in the water samples, the corresponding Environmental Protection Agency (EPA) analytical method, the corresponding practical quantitation limits (PQL/RL), regulatory levels, and the effluent discharge limits of specific constituents if available.

TABLE 2-1
Summary of Analytical Parameters
Brown & Bryant, Arvin, California

MATRIX	CONSTITUENT	EPA METHOD	RLs (µg/L)	REGULATORY LEVEL (µg/L)	EFFLUENT DISCHARGE LIMITS (µg/L)	
Water	Volatile Organic Compounds	8260B	1	NA	NA	
	Fumigants (EDB, DBCP and 1,2,3-Trichloropropane)	8260B SIM	0.05-0.05 0.005(1,2,3-TCP)	NA	NA	
	Herbicides (Dinoseb)	8151A	0.40	NA	NA	
	Fixed gases	Dissolved Hydrogen	RSK175	10.0	NA	NA
		Methane	RSK175	1.0	NA	NA
	Ferrous Iron	SM3500	2.0mg/L	NA	NA	
	Sulfide	SM4500S2D	0.1mg/L	NA	NA	
	Anions By IC	Nitrite-N	300.0	0.100(mg/L)	NA	NA
		Nitrate-N	300.0	0.100(mg/L)	NA	NA
		Sulfate	300.0	0.500(mg/L)	NA	NA
Total Organic Carbon	415.1	1.0mg/L	NA	NA		

Notes:

RL = Reporting Limit,

NA = Not Available

µg/L = microgram/Liter

mg/L= milligram/Liter

2.2.1 Holding Times

Technical holding times are defined as the maximum time allowed between sample collection, extraction and analysis. A 14-day collection-to-analysis holding time was used for EPA Method 8260B and 8260B SIM. A 7-day holding time from collection to extraction, and 40-day holding time from extraction-to-analysis was met, for EPA Method 8151A. Holding time of 48-Hours from collection to analysis was met for analysis of Anions.

TABLE 2-2
Summary of Analytical Methods and Holding Time Requirements
Brown & Bryant, Arvin, California

ANALYSIS Method	MATRIX	HOLDING TIME REQUIREMENT	DATA QUALIFIED AS "J"	DATA QUALIFIED AS "R"
EPA Method 8260B	Water	14 days to analysis	None. Holding times were met	None. Holding times were met
EPA Method 8260B SIM	Water	14 days to analysis	None. Holding times were met	None. Holding times were met
EPA Method 8151A	Water	7 days to extraction, 40 days to analysis	None. Holding times were met	None. Holding times were met
Nitrate, Nitrite & by EPA Method 300.0	Water	48 hours to extraction and analysis	None. Holding times were met	None. Holding times were met
Sulfate by EPA Method 300.0	Water	28 days from collection to analysis	None. Holding times were met	None. Holding times were met
Sulfide by SM4500S2D	Water	7 days from collection to analysis	None. Holding times were met	None. Holding times were met
Ferrous Iron by SM3500	Water	24 hours from collection to analysis	None. Holding times were met	None. Holding times were met
TOC by Method 415.1	Water	28 days to analysis	None. Holding times were met	None. Holding times were met
Dissolved Hydrogen and Methane by RSK175	Water	14 days from collection to analysis	None. Holding times were met	None. Holding times were met

2.2.2 Laboratory and Field Blanks

The objective of laboratory and field blanks is to determine the presence and extent of contamination resulting from laboratory or field activities. Blanks reported here included method and/or extraction blanks. The result of analysis of method blank is discussed in section 4.0 for each method. All samples were transported in five ice preserved coolers and were stored in a refrigerator upon arrival to the laboratory. The temperatures of the coolers were recorded as 3.0°C to 4.4°C for each upon arrival. All samples were received intact and in good condition.

3.0 QUALITY ASSURANCE OBJECTIVES

Quality assurance (QA) objectives define analytical parameters that validate the conclusions drawn from the results. Quality assurance was assessed through the following means: precision, accuracy, representativeness, completeness, and comparability (PARCC).

3.1 Qualitative QA Objectives

Qualitative aspects of QA for analytical data are characterized by completeness and representativeness.

3.1.1 Comparability

Comparability defines the level of confidence with which one data set can be compared with another. Comparability is related to accuracy and precision. It is also a measure of the data's reliability. All units for comparability are in accordance with standard procedures so that the results could be compared with other laboratories if necessary.

3.1.2 Representativeness

Representativeness is a quantity, which presents whether the results of analysis accurately portray the actual site conditions. Representativeness is a qualitative parameter, which signifies the extent of accuracy and precision, to which the data represent a characteristic population, parameter variations at a sampling point, process condition, or environmental conditions. The sampling procedures described within the approved QAPP (Eco & Associates, Inc., final version, April 2011) are designed to provide samples representative of the site conditions.

3.2 Quantitative QA Objectives

Quantitative QA Objectives for analytical data are defined as precision, accuracy, completeness, and method quantitation limits. These quantitative parameters are established in order to monitor the overall quality of analytical data produced by the laboratory. The laboratory performing the analytical methods specified in Table 2-1, and the case narratives, which is included in the data package from the laboratory, ensures the quality of the analytical data.

3.2.1 Precision

Precision is a measure of the closeness with which multiple analyses of a given sample agree with each other. It describes the agreement between two or more measurements that have been made in exactly the same way. Precision is measured through matrix spike/matrix spike duplicate samples, surrogate standards, and laboratory control samples. The relative percent difference (RPD) is calculated as a means of quantifying precision. The following equation is used for this purpose:

$$\text{RPD} = \frac{R_1 - R_2}{(R_1 + R_2)/2} \times 100$$

Where:

RPD = Relative percent difference

R₁ = Result of the first duplicate or measured sample concentration

R₂ = Result of the second duplicate or known sample or duplicate concentration

When analytes are present at concentrations below or near the quantitation limit, precision is measured, using MS/MSD, and/or LCS/LCSD results.

Precision results are discussed in Section 4.0 of this report.

3.2.2 Accuracy

Accuracy indicates the closeness of the measurement to its true or accepted value. Accuracy measures agreement between a result and its true value. Method-specific QA objectives for precision and accuracy were based on the quality control limits developed by the laboratory for the analytical methods, specified in Table 2-1. These procedures may affect the accuracy of the data presented. Additionally, initial and continuing calibrations were used to verify that the analytical instrument accurately measured the compound concentrations. Calculations were independently verified for the response factors and percent differences (%Ds).

3.2.3 Completeness

Completeness is defined as the percentage of total measurements, which are judged to be valid. The completeness objective is to obtain a sufficient amount of valid data to enable the goals and objectives of the project to be achieved.

Completeness is quantified by computing the fraction of reports, which remained valid after the sampling procedures were reviewed and the results conformed to QA/QC protocols. The following equation was used to calculate completeness:

$$\text{Completeness} = \frac{\text{No. of valid field samples analyzed}}{\text{No. of valid field samples collected}} \times 100$$

Completeness is affected by anything that reduces the number of samples analyzed (such as a sample bottle breaking), as well as acceptance or non-acceptance of analytical results.

4.0 DATA VALIDATION

This data review covers ten (10) water samples listed on page 8 including dilutions and reanalysis if applicable. The analyses were according to the following EPA Methods:

EPA Method 8260B for volatile organic compounds

EPA Method 8260B SIM for fumigants (EDB, DBCP and 1, 2, 3-Trichloropropane)

EPA Method 8151A for Chlorinated Herbicides (Dinoseb)

Anions (Nitrite-N, Nitrate-N and Sulfate) by IC, EPA Method 300.0

Total Organic Carbon; Method 415.1

Ferrous Iron by Standard Method 3500

Total Sulfide by Standard Method 4500-S2D

Methane and dissolved Hydrogen by EPA Method RSK175

This review follows USEPA Analytical Operations/Data Quality Center (AOC) *National Functional Guidelines for Organic Data Review* (USEPA, August 2002); and EM 200-1-10 *Guidance for Evaluating Performance-based Chemical Data*, US Army Corps of Engineers (USACE), June 2005. The following subsections correlate to the above guidelines.

A summary table summarizing all data and qualification, if any is provided at the end of this report. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

The following are definitions of the data qualifiers:

- U Indicates the compound was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None indicates the finding did not significantly impact the data; therefore qualification was not required.

4.1. VOC (EPA Method 5030B/8260B)

Technical Holding Times

A 14-day technical holding time requirement was met for all the samples. A total of ten (10) ground water samples were collected on 10-23-12 and 10-24-12. All samples and sample dilutions were analyzed on 10-26-12. Samples, QC samples and sample dilutions were analyzed with reference to one analytical batch (preparation batch: VO67J20).

The chain-of-custody was reviewed for documentation of sample information and method of analysis.

Table 1 in appendix A summarizes the list of samples with the results and qualification notations.

Tuning criteria

The performance of the instrument was checked by injection of a single component tune check standard (BFB: Bromofluorobenzene) prior to initial calibration on 10-02-12. At the start of analytical batch on 10-26-12, the tune check standard was also injected. All the mass ratio requirements were within the assigned criteria.

Initial Calibration

Ground water samples were analyzed with reference to one set of initial calibration using GC/MSD with instrument ID #s TO-67. Initial calibration curve was generated on 10-02-12. A multilevel calibration curve ranging from 0.3µg/L to 100µg/L was used for this purpose. Internal standard curve type was used for initial calibration. Minimum response factor for system performance check compounds (SPCCs) were within the method acceptable limits. Response factors at each level were randomly recalculated and all agreed with the response factors presented in the initial calibration summary table.

Minimum average response factors for the system performance check compounds (SPCCs) for each instrument were recognized according to the following tables:

Table 4.1.1: System Performance Check Compounds (Initial calibration)

System Performance check compounds (SPCCs)	Min. Ave. Response Factor (Method limits)	Ave. Res. Factor 10-02-12 (Calculated) Instrument ID#: T-O67
Chloromethane	≥ 0.10	0.532
1,1 -dichloroethane	≥ 0.10	0.616
Bromoform	≥ 0.10	0.357
Chlorobenzene	≥ 0.30	0.988
1,1,2,2-Tetrachloroethane	≥ 0.30	0.534

Average response factor curve fit was mainly used to show linearity within standard levels in initial calibration. Maximum 15% RSD limit was met for all the target compounds.

Calibration check compounds (CCCs) met the acceptance criteria for %RSD among the response factors calculated for each level. Table 4.1.2 lists the CCCs with the method requirement limits and the calculated %RSD among the response factors for each initial calibration.

Table 4.1.2 Calibration Check Compounds (CCCs): Initial Calibration

Calibration Check Compounds (CCCs)	Response Factors %RSD (Limit)	Response Factors %RSD 10-02-12 Instrument ID#: T-O67
1,1-Dichloroethene	≤ 30%	4.27
Chloroform	≤ 30%	4.50
1,2-Dichloropropane	≤ 30%	5.20
Toluene	≤ 30%	4.73
Ethyl benzene	≤ 30%	5.0
Vinyl chloride	≤ 30%	12.8

Initial Calibration Verification and Continuing Calibration verification (Daily Calibration)

Initial calibration was verified by a second source standard at the end of calibration and before sample analysis on 10-03-12. Percent differences (%D) between initial calibration average response factors (RRFs) and the initial calibration verification response factors (RFs) were less than or equal to 20% for all target compounds.

One continuing calibration check standard was analyzed at the beginning of analytical shift on 10-26-12. Prior to continuing calibration standard analysis, **instrument performance check standard** (BFB tune check) was carried out. It passed all the method tuning criteria.

The minimum average response factors for the system performance check compounds (SPCCs) for continuing calibration standards were all within the method limits. The following table list average response factors for system performance check compounds.

Table 4.1.3: System Performance Check Compounds: (Daily calibration)

System Performance Check compounds (SPCCs)	Minimum response factor (Method limits)	Second source St. Response factors CCRF 10-03-12	Continuing cal. Response factors CCRF 10-26-12
Chloromethane	≥ 0.10	0.535	0.538
1,1-Dichloroethane	≥ 0.10	0.626	0.676
Chlorobenzene	≥ 0.10	0.1.01	1.087
Bromoform	≥ 0.30	0.367	0.412
1,1,2,2-Tetrachloroethane	≥ 0.30	0.559	0.610

Calculated percent differences (%drift) between initial calibration RRFs (average response factors) and the continuing calibration response factors (CCRF) were less than or equal to 20% for all the Calibration Check Compounds (CCCs) and less than or equal to 20% for all other target analytes. The area counts for all internal standards were within ± 50-150 percent of the same level in the initial calibration. The calculated % difference between RFs from continuing calibration and average response factors from initial calibration is summarized in Table 4.1.4 for continuing calibration compounds as follows:

Table 4.1.4 Calibration Check Compounds (CCCs): ICV and Daily Calibration

Calibration Check Compounds (CCCs)	%Deviation From Initial calibration (Acceptance Limit)	Deviation from Initial calibration 2nd source (10-03-12)	Deviation from Initial calibration Daily calibration (10-26-12)
Vinyl chloride	≤ 20%	5.7%	9.9%
1,1-Dichloroethene	≤ 20%	1.0%	1.2%
Chloroform	≤ 20%	6.2%	13.0%
1,2-Dichloropropane	≤ 20%	1.9%	8.2%
Toluene	≤ 20%	3.0%	8.9%
Ethyl benzene	≤ 20%	0.70%	11.3%

Deviation from the initial calibration was less than 20 percent for the rest of target list (Non-CC compounds).

Quality Control: The QC samples reported consisted of one method blank, one set of LCS/LCSD and MS/MSD. Client's designated sample (10-23-12-AMW-3R) was spiked for precision as MS/MSD. The full list of target compounds were spiked and reported for LCS/LCSD and MS/MSD. Percent recoveries and percent RPDs for all the QC samples reported were within the project acceptance limits for all reported compounds.

The results, percent recoveries and RPDs were recalculated randomly and all agreed with the reported QC summary table.

Method blank: One method blank was presented with the data package, analyzed on 10-26-12. Method blank was reported as non-detected for all the analytes in the target list. Only a trace of Methylene chloride (0.73ug/L) was detected in method blank (Batch #VO67J20); however, no Methylene chloride was detected in any of the field samples.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-1 was identified as field duplicate of sample 10-24-12-BBW-3. Results of positive hits for each sample and corresponding sample duplicate are shown in the following table:

Analyte	10-24-12 FDUP-1 µg/L	10-24-12 BBW-3 µg/L	%RPD
Acetone	5.6J	ND	200%
Carbon tetrachloride	3.2	2.6	20.7%
Chloroform	0.41J	0.39J	5.0%
Toluene	0.24J	0.25J	4.08%

Surrogate recoveries were all within the method's acceptance limits. The reported results for each sample are incorporated in table 1 in appendix A.

Raw data for one sample, 10-23-12- PWB-6, was submitted as level IV data deliverable. Raw data for all associated QC samples were also included as Level IV data deliverable. The

results calculated from the raw data, agreed with all the results reported in data summary reports. The sample results together with the surrogate recoveries are tabulated in table 1 appendix A.

4.2. EPA Method 5030B/8260B SIM (FUMIGANTS)

Technical Holding Times

A 14-day technical holding time requirement was met for all the samples. A total of ten (10) ground water samples were collected on 10-23-12 and 10-24-12. All samples and QC samples were analyzed on 10-29-12. Samples and QC samples were analyzed with reference to one preparation batch (VO05J21).

The chain-of-custody was reviewed for documentation of sample information and method of analysis. Samples were analyzed for three fumigants: 1,2-Dibromomethane (EDB), 1,2,3-Trichloropropane (TCP), and 1,2-Dibromo-3-chloropropane (DBCP). A Mass detector at Selected Ion Monitoring mode (SIM) was used to achieve low detection limits required for the target compounds.

Table 2 in appendix A summarizes the list of samples with the results and qualification notations.

Tuning criteria

The performance of the instrument was checked by injection of a single component tune check standard (BFB: Bromofluorobenzene) prior to initial calibration and at the start of each analytical batch. All mass ratios were within the method assigned criteria.

Initial Calibration

Ground water samples were analyzed with reference to one set of initial calibration using purge and trap together with GC/MSD at selected ion monitoring mode. Instrument ID # T-O05 was used for the analysis. Initial calibration curve was generated on 10-09-12. A multilevel calibration curve ranging from 5ng/L (ppt) to 1000ng/L (ppt) was used for this purpose. Instrument performance check standard (BFB) was analyzed prior to initial calibration. It passed all the tuning criteria. Modified version of SW-846 8260B (SIM) was used for generation of calibration curve and data. Internal standard curve type was used for initial calibration.

Minimum response factor for all the target compounds were within the method acceptable limits. Average response factor curve fit was used to show linearity. Percent relative standard deviation (%RSD) among response factors was less than 15% for all target analytes. Using results from raw data, response factors at each level were randomly recalculated and all agreed with the response factors submitted in the initial calibration summary table.

Initial Calibration Verification and Continuing Calibration (Daily calibration)

The initial calibration curve was verified by a second source standard (ICV) at the end of calibration and before sample analysis on 10-10-12. Quality control criteria regarding minimum response factors were within methods, acceptance limits. Percent differences (%D) between initial calibration average response factors (RRFs) and the initial calibration verification response factors (RFs) were less than or equal to 20% for all target compounds.

Continuing calibration check standard was analyzed at the beginning of analytical shift on 10-29-12. Prior to analysis of continuing calibration, instrument performance check was carried out by injection of BFB tune check standard. Instrument mass ratios were all within specification of the method.

The calculated % difference (%D) between RFs from continuing calibration and average response factors from initial calibration is summarized in Table 4.2.1 for the targets of interest in this method as follows:

Table 4.2.1: Percent difference from initial calibration: (Daily calibration)

Target Compounds	% Deviation From Initial Calibration Method Criteria	% Deviation From Initial Calibration 2 nd Source St. (Calculated) (10-10-12)	% Deviation From Initial Calibration Daily St. (Calculated) (10-29-12)
1,2-Dibromomethane (EDB)	≤ 20%	5.7%	13.9%
1,2,3-Trichloropropane(TCP)	≤ 20%	7.5%	0.8%
1,2-Dibromo-3-chloropropane (DBCP)	≤ 20%	8.8%	3.4%

Calculated percent differences (%drift) between initial calibration RRFs (average response factors) and the continuing calibration response factors (CCRF) were less than or equal to 20% for all target analytes. The area counts for all internal standards were within \pm 50-150 percent of the same level in the initial calibration.

Quality Control: The QC samples reported consisted of one method blank, one set of LCS/LCSD and MS/MSD. Client's designated sample (10-23-12-AMW-3R) was spiked for precision as MS/MSD. All three target compounds were spiked and reported for LCS/LCSD and MS/MSD. Percent recoveries and percent RPDs for LCS/LCSD and MS/MSD were within the project acceptance limits for all reported compounds.

The results, percent recoveries and RPDs were recalculated randomly and all agreed with the reported QC summary tables.

Method blank: One method blank was presented with the data package (analyzed on 10-29-12,). Method blank was reported as non-detected for all analytes in the target list.

Surrogate recoveries were all within the method's acceptance limits. The reported results for each sample are incorporated in table 1 in appendix A.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-1 was identified as field duplicate of sample 10-24-12-BBW-3. Results of positive hits for each sample and corresponding sample duplicate are shown in the following table:

Analyte	10-24-12 FDUP-1 $\mu\text{g/L}$	10-24-12 BBW-3 $\mu\text{g/L}$	%RPD
1,2-Dibromoethane (EDB)	ND	ND	NA
1,2-Dibromo-3-chloropropane	ND	ND	NA
1, 2,3-Trichloropropane	0.018	0.020	10.5%

Raw data for one sample, 10-23-12- PWB-6, together with all further dilutions was submitted as level IV data deliverable. Raw data for all associated QC samples were also

included as Level IV data deliverable. The results calculated from the raw data, agreed with all the results reported in data summary reports. The sample results together with the surrogate recoveries are tabulated in table 2 Appendix A.

4.3 DINOSEB BY GC/ECD (EPA Method 8151A)

Technical Holding Times

A 7-day technical holding time from sample collection to extraction and 40-day from extraction to analysis was met for all samples. A total of ten (10) ground water samples were collected on 10-23-12 and 10-24-12. Samples were extracted with one preparation batch on 10-27-12 (preparation batch # HEJ008W). Sample extracts were all analyzed within 40-day holding time on 10-29-12.

EPA Method 8151A uses GC equipped with two Electron Capture Detectors (ECDs) and two columns connected to the same injection port for analysis. Results and raw data generated from both columns were submitted. Chlorinated Herbicides (Dinoseb) was determined by this method.

Initial Calibration

Samples were analyzed with reference to one initial calibration generated on 10-09-12. Seven calibration levels (20-200 $\mu\text{g/L}$) were used in initial calibration. Channel A and B were both calibrated. External standard curve type was used for calibration. Calibration factor (area for each compound versus concentration) was used for calculation. Average response factor was used to show linearity for each channel. Percent relative standard deviation (%RSD) among calibration factors (CFs) for both channel A and B were less than 20%. Retention time window width was established by using initial calibration standards at each level. All further sample and QC analysis identification were based on the assigned retention time windows set by initial calibration for each peak. The instrument was calibrated for the full list of Herbicides, both for initial calibration and continuing (daily calibration), but the result of analysis was reported only for Dinoseb.

Initial Calibration Verification (ICV) and Continuing (Daily) Calibration

Initial calibration curve was verified by a second source standard at the end of calibration and prior to sample analysis on 10-09-12. Percent difference between mean calibration factors from initial calibration and calibration factors calculated from the second source were less than 15% for both Dinoseb and MCP (used as surrogate).

Four continuing calibration standards with intervals of 10 sample injections were analyzed with samples, and QC samples. Samples were all analyzed on 10-29-12. Percent difference between initial calibration average response factors and the response factors calculated for Dinoseb from continuing calibrations were less than 20% for all standards. Results for surrogate recoveries and QC samples were reported from both channel A and B.

Quality Control samples consisted of method blank, one set of LCS/LCSD and MS/MSD for preparation batch #HEJ008W. Client designated sample 10-23-12-AMW-3R was spiked for accuracy and precision. Full Herbicide list was spiked for LCS/LCSD and MS/MSD, but only Dinoseb and MCP (as surrogate) were reported for precision and accuracy. Percent recoveries (%R) were within the project established QC limits for LCS and MS/MSD. Calculated %RPD was less than 30% acceptance limit

Method blank was reviewed for each component and no herbicide was found in the method blank for the extraction batch # HEJ008W.

Surrogate recoveries were all within the method's acceptable limits for all initial analyses. The calculated result for each sample is incorporated in table 3 in Appendix A.

Field duplicate samples and its associated samples: Sample 10-24-12-FDUP-1 was recognized as field duplicate of sample 10-24-12-BBW-3 Results of analysis for each sample and corresponding sample duplicates are shown in the following table:

Analyte	10-24-12 FDUP-1 µg/L	10-24-12 BBW-3 µg/L	%RPD
Dinoseb	ND	ND	NA

Raw data for one sample, 10-23-12- PWB-6, with related QC samples and dilutions were submitted at level IV deliverable. Raw data responses were used in recalculation and all verified the reported values.

4.4 Method 300.0: Anions

A total of ten (10) ground water samples were collected on 10-23-12 and 10-24-12. Samples were analyzed for Nitrate-N, Nitrite-N and Sulfate using Ion Chromatography (IC) on 10-24-12 and 10-25-12. All the field samples and dilutions were analyzed within 48-hour holding time requirement.

Anions such as Nitrate-N, Nitrite-N and Sulfate were separated from water samples by Ion chromatography. The separated anions in their acid form (very conductive) were measured by conductivity. They were identified on the basis of retention time as compared to previously established time window set by reference standards.

One set of initial calibration curve (ranging from 0.05 to 20 mg/L) was generated on 10-24-12. Instrument was initially calibrated with nine calibration levels. Linear curve type with correlation coefficients of at least 0.999 was used for each anion throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (concentration of each anion versus area count of each anion) was presented for each target compound. Area for each level was randomly checked with the values and equations presented with each calibration curve. All agreed with the raw data. A second source standard mixture at mid-point (1.0mg/L) was used to verify the linearity of initial calibration for each anion on 10-24-12. Recoveries were all within 90-110% of initial value.

Daily (Continuing) Calibrations:

Six continuing calibration standards were analyzed on 10-24-12 and 10-25-12 with 10-injections interval. Continuing calibration standards were analyzed with samples, sample dilutions and QC samples. The recoveries of target anions were within 90-110% of the expected values in all submitted continuing calibration standards. After each continuing calibration

standard, one calibration blank was injected. All the blanks were reported as non-detected regarding all the target anions.

Quality Control Samples consisted of two method blanks, two sets of LCS/LCSD, MS/MSD and sample duplicate for each requested anion. Sample 10-23-12-AMW-3R was spiked for MS/MSD and also analyzed as sample duplicate. Recoveries of LCS/LCSD were within 90-110 % of spiked values and that of MS/MSD was within 80-120%, all covering the QC limits requirements. Percent RPDs were less than 20% for LCS/LCSD and MS/MSD. Each QC set was analyzed with the same dilution factor as the one used for reporting the corresponding anion.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-1 was identified as field duplicate of sample 10-24-12-BBW-3. Results of analysis for sample and corresponding sample duplicate are shown in the following table:

Analyte	10-24-12 FDUP-1 µg/L	10-24-12 BBW-3 µg/L	%RPD
Nitrate-N	35.7	35.9	<1%
Nitrite-N	ND	ND	NA
Sulfate	181	183	1.10%

Raw data for one sample (10-23-12- PWB-6) with corresponding dilutions and all related QC samples were submitted for level IV data review. Raw data for level IV sample with all QC samples and dilutions was reviewed comprehensively. The recalculated values from raw data agreed with the result submitted.

4.5 Total Organic Carbon (TOC) by EPA Method 415.1

A total of ten (10) ground water samples were collected on 10-23-12 and 10-24-12. Samples were analyzed for Total Organic Carbon (TOC) on 10-26-12, within 28-days holding time requirement. Organically bound carbons in water are measured by oxidation or combustion of organic molecules to single smaller molecules. TOC analyzers utilize high temperature

combustion to convert Organic Carbon to carbon dioxide, which is measured by the analyzer. Non-Purgable Organic Carbon (NPOC) is the target of interest.

One set of initial calibration curve with at least 5 calibration levels (ranging from 1.0mg/L to 80 mg/L) was generated on 10-26-12. Linear curve type with correlation coefficients of at least 0.999933 was used throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (area versus concentration) was presented for Non-purgable Organic Carbon. Results for each level was randomly checked with the values and equations presented with the calibration curve. All agreed with the raw data.

A second source standard mixture at mid-point of the calibration curve (25mg/L) was used to verify the linearity of initial calibration on 10-26-12. Recoveries were all within 90-110% of initial value. Continuing calibration standards, together with continuing calibration blanks were analyzed at 10-injection intervals on 10-26-12. They all passed the assigned calibration criteria.

Quality Control Samples consisted of method blank, one set of LCS/LCSD and MS/MSD. Sample 10-23-12-AMW-3R was spiked for MS/MSD. Recoveries of LCS/LCSD were within 80-120 % of spiked values and that of MS/MSD was within 75-125%, all covering the QC limits requirements. Percent RPDs were less than 20% for LCS/LCSD and MS/MSD.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-1 was identified as field duplicate of sample 10-24-12-BBW-3. Results of TOC analysis for each sample and corresponding sample duplicates are shown in the following table:

Analyte	10-24-12 FDUP-1 mg/L	10-24-12 BBW-3 mg/L	%RPD
TOC	0.567J	0.725J	24.5%

Raw data and corresponding chromatogram for all ten samples with QC samples were presented with the data package. Four readings were recorded for each sample. Final reported results were average of the four readings for each sample. The sample results are tabulated in table 5 Appendix A.

4.6 Ferrous Iron by Standard Method 3500

A total of ten (10) ground water samples were collected on 10-23-12 and 10-24-12. Samples were analyzed for Ferrous Iron on 10-24-12, within 24-hour holding time. Ferrous Iron (in reduced form) reacts with an oxidation-reduction indicator (o-Phenanthroline), resulting in a colored complex. The intensity of color formed due to reaction, is proportional to the amount of ferrous iron in the solution and can be detected and measured by a spectrophotometer.

One set of initial calibration curve with at least 5 calibration levels (ranging from 2.0mg/L to 25 mg/L) was generated on 10-24-12. Linear curve type with correlation coefficients of at least 0.999905 was used throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (Absorbance versus concentration) was presented for initial calibration standards. Results for each level was randomly checked with the values and equations presented with the calibration curve. All agreed with the raw data.

A second source standard (ICV) mixture at mid-point (15mg/L) was used to verify the linearity of initial calibration on 10-24-12. Recoveries were all within 90-110% of initial value. Two continuing calibration standards (CCV), together with continuing calibration blanks were analyzed with samples and QC samples on 10-24-12. They passed the calibration criteria.

Quality Control Samples consisted of method blank, LCS/LCSD, MS/MSD and sample/sample duplicate. Sample 10-23-12-AMW-3R was spiked for MS/MSD. It was also analyzed as sample duplicate. Recoveries of LCS/LCSD and MS/MSD were within the acceptance limit of 80-120 % of spiked value. Percent RPDs were less than 20% for LCS/LCSD and MS/MSD.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-1 was recognized as field duplicate of sample 10-24-12-BBW-3. Both sample and the corresponding associated sample duplicate were reported as non-detected for Ferrous Iron.

Raw data that included results of analysis and calibration curve was presented for all ten samples together with QC samples. The sample results are tabulated in table 6 Appendix A.

4.7 Sulfide by Standard Method SM4500-S2D

A total of ten (10) ground water samples were collected on 10-23-12 and 10-24-12. Samples were analyzed for Total Sulfide on 10-29-12, within seven-day holding time.

The method is based on reaction of Sulfide, Ferric chloride and Amine-sulfuric acid to produce Methylene blue. The intensity of color is proportional to the sulfide concentration in water. The intensity of color resulting from reaction can be detected and measured by a spectrophotometer.

One set of initial calibration curve with at least 5 calibration levels (ranging from 0.1mg/L to 1 mg/L) was generated on 10-29-12. Linear curve type with correlation coefficient of at least 0.999513 was used throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (Absorbance versus concentration of standard solutions), together with related equations was presented. Results for each level was randomly checked with the values and equations presented with the calibration curve. All agreed with the raw data.

A second source standard mixture at mid-point (0.5mg/L) was used to verify the linearity of initial calibration on 10-29-12. Recoveries were all within 90-110% of initial value. Two continuing calibration standards, together with continuing calibration blanks were analyzed with samples and QC samples on 10-29-12. They passed the calibration criteria.

Quality Control Samples consisted of one method blank, one set of LCS/LCSD, one MS and a sample duplicate analysis. Sample 10-23-12-AMW-3R was spiked for MS and analyzed as sample duplicate as well. Recoveries of LCS/LCSD were within 80-120 %, covering the QC limits requirements of spiked values. Percent RPDs were less than 20% for both sets of LCS/LCSD. Sample and sample duplicate results were reported as non-detected.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-1 was recognized as field duplicate of sample 10-24-12-BBW-3. Both field sample and associated field duplicate sample were reported as non-detected for total Sulfide.

Raw data (results of analysis together with the calibration curve) for all ten samples together with QC samples were presented with the data package. The sample results are tabulated in table 7 Appendix A.

4.8. METHANE and DISSOVED HYDROGEN by EPA Method RSK175

Technical Holding Times

A 14-day technical holding time from sample collection to analysis was met for all samples. A total of ten (10) ground water samples were collected on 10-23-12 and 10-24-12. Samples were all analyzed within the 14-day holding time on 11-05-12 and 11-06-12.

EPA Method RSK175 uses GC equipped with a thermal conductivity detector (TCD) and a flame ionization detector (FID). Sample from headspace is injected into a GC with a single column connected to two detectors in series. GC/FID response was used for Methane and GC/TCD response was used for Hydrogen.

Results and raw data generated from both detectors were submitted. Methane and dissolved hydrogen were determined by this method.

Initial Calibration

Samples were analyzed with reference to one initial calibration for each gas. GC/TCD was calibrated with five calibration levels (1000-50000 ppmv for Hydrogen) on 11-03-2011 and GC/FID was calibrated with five calibration levels (3-10000ppmv for Methane) on 02-27-12. The same instrument was used (instrument ID#GC8A) for both detectors but samples were injected separately for each calibration/detector. Both detectors were calibrated. External standard curve type was used for calibration. Calibration factor (area for each compound versus concentration) was used for calculation. Average response factor was used to show linearity for each channel.

Percent relative standard deviation (%RSD) among calibration factors (CFs) for both detectors (TCD) and (FID) were less than 20% with correlation coefficient of 0.999818 for

Hydrogen and 0.999989 for Methane. Retention time window width was established by using initial calibration standards at each level. All further sample and QC analysis identification were based on the assigned time windows set by initial calibration for each peak. The instrument was calibrated for methane at least eighteen month prior to sample analysis.

Initial Calibration Verification (ICV) and Continuing (Daily) Calibration

Initial calibration verification standard (ICV) was submitted for Hydrogen (TCD detector). Raw data for initial calibration verification standard (ICV) was missing from the data package for Methane (FID detector). EMAX Laboratory was informed to provide the missing data. Percent difference was less than 20% for both detectors. Two continuing calibration standards with intervals of 10 sample injections were analyzed with samples and all the QC samples. All samples and QC samples were analyzed on 11-05-12 and 11-06-12. Percent difference between initial calibration average response factors and the response factors calculated for each analyte from continuing calibrations were less than 20% for all standards.

Quality Control samples consisted of one method blank, one set of LCS/LCSD and MS/MSD. Client designated sample 10-23-12-AMW-3R was spiked for accuracy and precision. Both Hydrogen and Methane were spiked and reported for LCS/LCSD and MS/MSD. Percent recoveries (%R) were within the project established QC limits for LCS/LCSD and MS/MSD. Calculated %RPD was less than 30% acceptance limit.

Method blank was reviewed for each component and no target analyte was found in the method blank for each detector.

Surrogate: No surrogate is used in this method.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-1 was recognized as field duplicate of sample 10-24-12-BBW-3. Both field samples and associated field duplicate samples were reported as non-detected for Hydrogen and Methane.

Raw data for all ten samples, with related QC samples were submitted at level IV deliverable. Raw data for samples and QC samples were submitted for both detectors (FID for Methane, and TCD for Hydrogen). Raw data responses were used in recalculation and all verified the reported values.

5.0 Conclusion

Overall, the data presented is generally regarded as acceptable for all the EPA methods listed in the chain of custody. The data can reliably be used for the purpose of this project.

6.0 References

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5. Department of Defense Quality System Manual (DOD QSM), Version 4.2, 2010
6. EPA Methods for Chemical Analysis of Water and Wastes. EPA -600-4-79-020. Revised; March 1983.
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7.0 APPENDIX A

Table 1-Volatile Organic Compounds component List: EPA Method 8260B

ANALYTE	RLs	10-24-12- BBW-1	10-24-12- BBW-2	10-24-12- BBW-3	10-24-12- FDUP-1	10-23-12- PWB-6	10-23-12- AR-1
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Acetone	10	U	6.0J	U	5.6J	U	U
Benzene	1.0	U	U	U	U	U	U
Bromobenzene	1.0	U	U	U	U	U	U
Bromochloromethane	1.0	U	U	U	U	U	U
Bromodichloromethane	1.0	U	U	U	U	U	U
Bromoform	1.0	U	U	U	U	U	U
Bromomethane	1.0	U	U	U	U	U	U
2-Butanone	10	U	U	U	U	U	U
n-Butylbenzene	1.0	U	U	U	U	U	U
sec-Butylbenzene	1.0	U	U	U	U	U	U
tert-Butylbenzene	1.0	U	U	U	U	U	U
Carbon Disulfide	1.0	U	U	U	U	U	U
Carbon Tetrachloride	1.0	U	U	2.6	3.2	U	U
Chlorobenzene	1.0	U	U	U	U	U	U
Chloroethane	1.0	U	U	U	U	U	U
2-ChloroethylVinylether	1.0	U	U	U	U	U	U
Chloroform	1.0	U	U	0.39J	0.41J	U	U
Chloromethane	1.0	U	U	U	U	U	U
2-Chlorotoluene	1.0	U	U	U	U	U	U
4-Chlorotoluene	1.0	U	U	U	U	U	U
1,2Dibromo3Chloropropane	1.0	U	U	U	U	U	U
Dibromochloromethane	1.0	U	U	U	U	U	U
1,2-Dibromoethane(EDB)	1.0	U	U	U	U	U	U
Dibromomethane	1.0	U	U	U	U	U	U
1,2-Dichlorobenzene	1.0	U	U	U	U	U	U
1,3-Dichlorobenzene	1.0	U	U	U	U	U	U
1,4-Dichlorobenzene	1.0	U	U	U	U	U	U
Dichlorodifluoromethan	1.0	U	U	U	U	U	U
1,1-Dichloroethane	1.0	U	U	U	U	U	U
1,2-Dichloroethane	1.0	U	U	U	U	U	U
1,1-Dichloroethene	1.0	U	U	U	U	U	U
Cis-1,2-Dichloroethene	1.0	U	U	U	U	U	U
trans-1,2-Dichloroethene	1.0	U	U	U	U	U	U
1,2-Dichloropropane	1.0	0.51J	0.67J	U	U	U	U
1,3-Dichloropropane	0.5	U	U	U	U	U	U
2,2-Dichloropropane	1.0	U	U	U	U	U	U
1,1-Dichloropropene	1.0	U	U	U	U	U	U
cis-1,3-Dichloropropene	1.0	U	U	U	U	U	U
trans-1,3-Dichloropropene	1.0	U	U	U	U	U	U
Ethylbenzene	1.0	U	U	U	U	U	U
Hexachlorobutadiene	1.0	U	U	U	U	U	U
2-Hexanone	10	U	U	U	U	U	U
Isopropylbenzene	1.0	U	U	U	U	U	U
p-Isopropyltoluene	1.0	U	U	U	U	U	U
MTBE	1.0	U	U	U	U	U	U

ANALYTE	RLs µg/L	10-24-12- BBW-1	10-24-12- BBW-2	10-24-12- BBW-3	10-24-12- FDUP-1	10-23-12- PWB-6	10-23-12- AR-1
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
4-Methyl-2-Pentanone	10.0	U	U	U	U	U	U
Methylene chloride	1.0	U	U	U	U	U	U
Naphthalene	1.0	U	U	U	U	U	U
n- Propylbenzene	1.0	U	U	U	U	U	U
Styrene	1.0	U	U	U	U	U	U
1,1,1,2-Tetrachloroethane	1.0	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	1.0	U	U	U	U	U	U
Tetrachloroethene	1.0	U	U	U	U	U	U
Toluene	1.0	U	U	0.25J	0.24J	U	U
1,2,3-Trichlorobenzene	1.0	U	U	U	U	U	U
1,2,4-Trichlorobenzene	1.0	U	U	U	U	U	U
1,1,1-Trichloroethane	1.0	U	U	U	U	U	U
1,1,2-Trichloroethane	1.0	U	U	U	U	U	U
Trichloroethene	1.0	U	U	U	U	U	U
Trichlorofluoromethane	1.0	U	U	U	U	U	U
1,2,3-Trichloropropane	1.0	U	0.51J	U	U	U	U
1,2,4-Trimethylbenzene	1.0	U	U	U	U	U	U
1,3,5-Trimethylbenzene	1.0	U	U	U	U	U	U
Vinyl Chloride	1.0	U	U	U	U	U	U
o-Xylene	1.0	U	U	U	U	U	U
m- & p-Xylenes	1.0	U	U	U	U	U	U
Surrogate (Limits)	(Limits)	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
1,2Dichloroeth-d4	70-120	93.2	94.6	90.9	92.1	89.8	91.3
4-Bromofluorbenze	75-120	96.0	94.0	94.3	91.5	89.0	94.2
Toluene-d8	85-120	100	98.7	99.2	97.4	98.0	98.8
Dibromofluoromethane	85-115	102	104	103	103	104	105

Table 1-Volatile Organic Compounds component List: EPA Method 8260B

ANALYTE	RLs µg/L	10-23-12- PWB-1 µg/L	10-23-12- AMW-3R µg/L	10-23-12- PWB-3 µg/L	10-23-12- PWB-10 µg/L		
Acetone	10	U	U	U	U		
Benzene	1.0	U	U	U	U		
Bromobenzene	1.0	U	U	U	U		
Bromochloromethane	1.0	U	U	U	U		
Bromodichloromethane	1.0	U	U	U	U		
Bromoform	1.0	U	U	U	U		
Bromomethane	1.0	U	U	U	U		
2-Butanone	10	U	U	U	U		
n-Butylbenzene	1.0	U	U	U	U		
sec-Butylbenzene	1.0	U	U	U	U		
tert-Butylbenzene	1.0	U	U	U	U		
Carbon Disulfide	1.0	U	U	U	U		
Carbon Tetrachloride	1.0	U	1.3	U	0.64J		
Chlorobenzene	1.0	U	U	U	U		
Chloroethane	1.0	U	U	U	U		
2-ChloroethylVinylether	1.0	U	U	U	U		
Chloroform	1.0	U	U	U	U		
Chloromethane	1.0	U	U	U	U		
2-Chlorotoluene	1.0	U	U	U	U		
4-Chlorotoluene	1.0	U	U	U	U		
1,2Dibromo3Chloropropane	1.0	U	U	U	U		
Dibromochloromethane	1.0	U	U	U	U		
1,2-Dibromoethane(EDB)	1.0	U	U	U	U		
Dibromomethane	1.0	U	U	U	U		
1,2-Dichlorobenzene	1.0	U	U	U	U		
1,3-Dichlorobenzene	1.0	U	U	U	U		
1,4-Dichlorobenzene	1.0	U	U	U	U		
Dichlorodifluoromethan	1.0	U	U	U	U		
1,1-Dichloroethane	1.0	U	U	U	U		
1,2-Dichloroethane	1.0	U	U	U	U		
1,1-Dichloroethene	1.0	U	U	U	U		
Cis-1,2-Dichloroethene	1.0	U	U	U	U		
trans-1,2-Dichloroethene	1.0	U	U	U	U		
1,2-Dichloropropane	1.0	0.25J	0.32J	0.25J	0.41J		
1,3-Dichloropropane	0.5	U	U	U	U		
2,2-Dichloropropane	1.0	U	U	U	U		
1,1-Dichloropropene	1.0	U	U	U	U		
cis-1,3-Dichloropropene	1.0	U	U	U	U		
trans-1,3-Dichloropropene	1.0	U	U	U	U		
Ethylbenzene	1.0	U	U	U	U		

ANALYTE	RLs	10-23-12- PWB-1	10-23-12- AMW-3R	10-23-12- PWB-3	10-23-12- PWB-10		
	µg/L	µg/L	µg/L	µg/L	µg/L		
Hexachlorobutadiene	1.0	U	U	U	U		
2-Hexanone	10	U	U	U	U		
Isopropylbenzene	1.0	U	U	U	U		
p-Isopropyltoluene	1.0	U	U	U	U		
MTBE	1.0	U	U	U	U		
4-Methyl-2-Pentanone	10.0	U	U	U	U		
Methylene chloride	1.0	U	U	U	U		
Naphthalene	1.0	U	U	U	U		
n- Propylbenzene	1.0	U	U	U	U		
Styrene	1.0	U	U	U	U		
1,1,1,2-Tetrachloroethane	1.0	U	U	U	U		
1,1,2,2-Tetrachloroethane	1.0	U	U	U	U		
Tetrachloroethene	1.0	U	U	U	U		
Toluene	1.0	U	U	U	U		
1,2,3-Trichlorobenzene	1.0	U	U	U	U		
1,2,4-Trichlorobenzene	1.0	U	U	U	U		
1,1,1-Trichloroethane	1.0	U	U	U	U		
1,1,2-Trichloroethane	1.0	U	U	U	U		
Trichloroethene	1.0	U	U	U	U		
Trichlorofluoromethane	1.0	U	U	U	U		
1,2,3-Trichloropropane	1.0	U	U	U	U		
1,2,4-Trimethylbenzene	1.0	U	U	U	U		
1,3,5-Trimethylbenzene	1.0	U	U	U	U		
Vinyl Chloride	1.0	U	U	U	U		
o-Xylene	1.0	U	U	U	U		
m-& p-Xylenes	1.0	U	U	U	U		
Surrogate (Limits)		% Recovery	% Recovery	% Recovery	% Recovery		
1,2Dichloroeth-d4	70-120	92.6	82.9	92.1	90.5		
4-Bromofluorbenze	75-120	95.0	98.1	96.1	96.2		
Toluene-d8	85-120	97.5	103	98.1	100		
Dibromofluoromethane	85-115	104	99.0	103	105		

Table 2-Fumigants (EDB, DBCP & 1, 2, 3-Trichloropropane): EPA Method 8260B (SIM)

ANALYTE	RLs µg/L	10-24-12- BBW-1 µg/L	10-24-12- BBW-2 µg/L	10-24-12- BBW-3 µg/L	10-24-12- FDUP-1 µg/L	10-23-12- PWB-6 µg/L	10-23-12- AR-1 µg/L
EDB	0.05	ND	ND	ND	ND	ND	ND
DBCP	0.05	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	0.005	0.44	0.74	0.020	0.018	0.0027J	0.14
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
Toluene d8	80-120	118	108	99.0	101	90.6	99.6

Table 2-Fumigants (EDB, DBCP & 1, 2, 3-Trichloropropane): EPA Method 8260B (SIM)

ANALYTE	RLs µg/L	10-23-12- PWB-1 µg/L	10-23-12- AMW-3R µg/L	10-23-12- PWB-3 µg/L	10-23-12- PWB-10 µg/L		
EDB	0.05	ND	ND	ND	ND		
DBCP	0.05	ND	ND	ND	ND		
1,2,3-Trichloropropane	0.005	0.15	0.21	0.28	0.49		
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery		
1,3-DBP (Surrogate)	80-120	98.5	102	107	106		

Table 3-Herbicides (Dinoseb): EPA Method 8151A

ANALYTE	RLs µg/L	10-24-12- BBW-1 µg/L	10-24-12- BBW-2 µg/L	10-24-12- BBW-3 µg/L	10-24-12- FDUP-1 µg/L	10-23-12- PWB-6 µg/L	10-23-12- AR-1 µg/L
Dinoseb	0.4	ND	ND	ND	ND	ND	ND
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
MCP (Surrogate)	40-140	90.5	84.9	85.3	93.1	81.1	84.1

Table 3-Herbicides (Dinoseb): EPA Method 8151A

ANALYTE	RLs µg/L	10-23-12- PWB-1 µg/L	10-23-12- AMW-3R µg/L	10-23-12- PWB-3 µg/L	10-23-12- PWB-10 µg/L		
Dinoseb	0.4	ND	ND	ND	ND		
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery		
MCP (Surrogate)	60-125	77.2	64.1	89.1	89.4		

Table 4-Anions (Nitrate-N, Nitrite-N and Sulfate): EPA Method 300.0

ANALYTE	RLs mg/L	10-24-12- BBW-1 mg/L	10-24-12- BBW-2 mg/L	10-24-12- BBW-3 mg/L	10-24-12- FDUP-1 mg/L	10-23-12- PWB-6 mg/L	10-23-12- AR-1 mg/L
Anions							
Nitrate-N	0.1	25.0	18.6	35.9	35.7	11.8	29.7
Nitrite-N	0.1	ND	ND	ND	ND	ND	ND
Sulfate	0.5	73.0	152	183	181	136	232

Table 4-Anions (Nitrate-N, Nitrite-N and Sulfate): EPA Method 300.0

ANALYTE	RLs mg/L	10-23-12- PWB-1 mg/L	10-23-12- AMW-3R mg/L	10-23-12- PWB-3 mg/L	10-23-12- PWB-10 mg/L		
Anions							
Nitrate-N	0.1	27.5	29.2	23.8	29.4		
Nitrite-N	0.1	ND	ND	ND	ND		
Sulfate	0.5	162	187	85.3	146		

Table 5-Total Organic Carbon: EPA Method 415.1

ANALYTE	RLs mg/L	10-24-12- BBW-1 mg/L	10-24-12- BBW-2 mg/L	10-24-12- BBW-3 mg/L	10-24-12- FDUP-1 mg/L	10-23-12- PWB-6 mg/L	10-23-12- AR-1 mg/L
TOC	1.0	0.614J	0.840J	0.725J	0.567J	0.564J	0.820J

Table 5-Total Organic Carbon: EPA Method 415.1

ANALYTE	RLs mg/L	10-23-12- PWB-1 mg/L	10-23-12- AMW-3R mg/L	10-23-12- PWB-3 mg/L	10-23-12- PWB-10 mg/L		
TOC	1.0	0.794J	0.951J	0.683J	0.772J		

Table 6-Ferrous Iron: Standard Method 3500

ANALYTE	RLs mg/L	10-24-12- BBW-1 mg/L	10-24-12- BBW-2 mg/L	10-24-12- BBW-3 mg/L	10-24-12- FDUP-1 mg/L	10-23-12- PWB-6 mg/L	10-23-12- AR-1 mg/L
Ferrous Iron	2.0	ND	ND	ND	ND	ND	ND

Table 6-Ferrous Iron: Standard Method 3500

ANALYTE	RLs mg/L	10-23-12- PWB-1 mg/L	10-23-12- AMW-3R mg/L	10-23-12- PWB-3 mg/L	10-23-12- PWB-10 mg/L		
Ferrous Iron	2.0	ND	ND	ND	ND		

Table 7-Sulfide: Standard Method 4500S2D

ANALYTE	RLs mg/L	10-24-12- BBW-1 mg/L	10-24-12- BBW-2 mg/L	10-24-12- BBW-3 mg/L	10-24-12- FDUP-1 mg/L	10-23-12- PWB-6 mg/L	10-23-12- AR-1 mg/L
Sulfide	0.1	ND	ND	ND	ND	ND	ND

Table 7-Sulfide: Standard Method 4500S2D

ANALYTE	RLs mg/L	10-23-12- PWB-1 mg/L	10-23-12- AMW-3R mg/L	10-23-12- PWB-3 mg/L	10-23-12- PWB-10 mg/L		
Sulfide	0.1	ND	ND	ND	ND		

Table 8- Methane and Dissolved Hydrogen: RSK175

ANALYTE	RLs µg/L	10-24-12- BBW-1 µg/L	10-24-12- BBW-2 µg/L	10-24-12- BBW-3 µg/L	10-24-12- FDUP-1 µg/L	10-23-12- PWB-6 µg/L	10-23-12- AR-1 µg/L
Hydrogen	1.0	ND	ND	ND	ND	ND	ND
Methane	10	ND	ND	ND	ND	ND	ND

Table 8- Methane and Dissolved Hydrogen: RSK175

ANALYTE	RLs µg/L	10-23-12- PWB-1 µg/L	10-23-12- AMW-3R µg/L	10-23-12- PWB-3 µg/L	10-23-12- PWB-10 µg/L		
Hydrogen	1.0	ND	ND	ND	ND		
Methane	10	ND	ND	ND	ND		

Data Validation Report

Groundwater Monitoring Data

for

Brown & Bryant

Arvin, CA

Project No.: Eco-12-548

SDG#: 12J163

LEVEL III & IV

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1.0 INTRODUCTION	
1.1 Objectives and Scope of the Data Validation	5
1.2 Organization of the Report	5
2.0 DATA REVIEW AND VALIDATION	
2.1 Data Reporting	6
2.2 Data Evaluation	7
2.2.1 Holding Times	10
2.2.2 Laboratory and Field Blanks	11
3.0 QUALITY ASSURANCE OBJECTIVES	
3.1 Qualitative QA Objectives	12
3.1.1 Comparability	12
3.1.2 Representativeness	12
3.2 Quantitative QA Objectives	12
3.2.1 Precision	13
3.2.2 Accuracy	13
3.2.3 Completeness	14
4.0 DATA VALIDATION	
4.0 Results of Data Validation	15
4.1 Volatile Organic Compounds (EPA 8260B)	16
4.2 Fumigants by EPA Method EPA 8260B(SIM)	20
4.3 Herbicides by (EPA Method 8151A)	23
4.4 Anions, EPA Method 300.0	25
4.5 (Total Organic Carbon) St Method 415.1	27
4.6 (Ferrous Iron) SM3500	28
4.7 (Sulfide) SM4500S2D	29
4.8 (Methane & dissolved Hydrogen) EPA Method RSK175	30
5.0 Conclusion	32
6.0 REFERENCES	33
7.0 APPENDIX A: Table of sample results	34

EXECUTIVE SUMMARY

This data validation report presents the evaluation and validation of the analytical data for fifteen ground water samples collected on 10-23-12 and 10-24-12 as part of biannually groundwater monitoring at Brown and Bryant, Arvin, California (CA). EMAX Laboratory in Torrance, California performed the chemical analysis of the samples. The United States Army Corps of Engineers and the State of California have certified EMAX Laboratory to perform the analysis described within this project. (Eco & Associates Inc., April 2011).

Fifteen (15) ground water samples, which included one trip blank sample, one equipment blank sample and one field duplicate sample, were collected on 10-23-12 and 10-24-12. EMAX Laboratory received the samples on 10-24-12. Trip blank sample accompanied the samples for volatile organic compounds and was analyzed for EPA Method 8260B only. Equipment blank sample was also analyzed for EPA Method 8260B only. The data was delivered in one package as Level III and Level IV deliverables. 10% of the data was subjected to validation to equivalent of EPA Level IV data validation. Raw data for one sample from this sample group (10-23-12-AMW-4R) was submitted as level IV deliverable for all the requested analytical methods. No sample was designated as MS/MSD in the chain of custody; therefore the result and %recoveries of LCS/LCSD was evaluated for both precision and accuracy.

Level III data validation examined quality assurance/quality control (QA/QC) elements such as holding time, (both extraction and analysis), critical quality control measures, completeness of the results, extraction logs, instrument injection logs and summaries of initial and continuing calibrations for the following EPA methods of analysis:

Volatile Organic Compounds by EPA Method **8260B**

Fumigants (EDB, DBCP and 1, 2, 3-Trichloropropane) by EPA Method **8260B SIM**

Dinoseb by EPA Method **8151A**

Anions (Nitrite-N, Nitrate-N and Sulfate) by IC, EPA Method **300.0**

Total Organic Carbon by Method **415.1**

Ferrous Iron by Standard Method **3500**

Total Sulfide by Standard Method **4500-S2D**

Methane and dissolved Hydrogen by EPA Method **RSK175**

The analytical results, QC results, initial calibration and related continuing calibration data were comprehensively compared with the corresponding raw data and chromatograms presented for Level IV data validation.

All samples were analyzed for each of the components listed in the corresponding EPA Methods. The evaluation indicated that all the analytical work was performed as requested on the chain of custody. The extraction and analytical holding times were met for all samples in each method and subsequent dilutions.

Generally, data presented with this data package was considered acceptable and met quality control acceptance limits for each EPA Method, with some technical variations. The deviations are discussed in section 4.0 for each method. The results of sample analysis are tabulated in Appendix A.

1.0 INTRODUCTION

This report presents the evaluation and validation of analytical data collected as part of biannually groundwater monitoring at Brown and Bryant Superfund Site at Arvin, California.

1.1 Objectives and Scope of Data Validation

The main objective of this report is to evaluate the acceptability of groundwater data. The data validation was performed according to the analytical requirements of the method in the *Quality Assurance Project Plan, final Draft, Brown and Bryant, Arvin, CA*, (Project No: Eco-12-548, Eco & Associates Inc. April 2012), EM 200-1-10 Guidance for Evaluation Performance-based Chemical Data, US Army Corps of Engineers (USACE), June 2005, *USEPA Analytical Operations/Data Quality Center (AOC) National Functional Guidelines for Organic Data Review* (USEPA, August 2002) and Department of Defense Quality Systems Manual (DoD QSM) Version 4.2, 2010 .

1.2 Organization of the Report

Section 2.0 describes the components of the data review. Section 3.0 provides the qualitative quality assurance objectives. Section 4.0 summarizes the findings and conclusions of the data validation.

2.0 DATA REVIEW AND VALIDATION

Data validation is a systematic method for reviewing and qualifying the presented analytical data for their intended use. The objective of this data validation report is to identify any unacceptable or faulty measurements if any, as reported by the laboratory.

EMAX Laboratory in Torrance, California performed the chemical analysis of the samples. Army Corps of Engineers and the State of California have certified EMAX laboratory to perform the EPA Methods of analysis described within this report.

Fifteen (15) ground water samples, which included one trip blank sample, one equipment blank sample and one field duplicate sample, were collected on 10-23-12 and 10-24-12. EMAX Laboratory received the samples on 10-24-12.

2.1 Data Reporting

The data was delivered in one package as Level III and Level IV deliverables. Ten percent of the data was subjected to validation to the equivalent of EPA Level IV. EMAX Laboratory provided the following information in one data package for both LEVEL III and LEVEL IV deliverable.

- Sample identification number;
- Date of sample collection;
- Sample matrix type;
- Analysis method;
- Target lists and results of analysis;
- Quantitation limits and/or Reporting Limits;
- Laboratory qualifiers and qualifier definitions;
- Copies of sample logs and chain-of-custody logs;
- Sample preparation log (with the sample extraction date)
- Sample Analysis log (Instrument injection log)
- Summary of initial and continuing calibrations;
- Quality control results.

- Case narrative for each method.
- Raw data for all the initial calibration standards, Initial calibration verification standards (ICV), continuing calibration standards (CCV), ion fragments for positive hits, internal standard area counts and retention time window width, where applicable. Raw data for one sample (10-23-12- AMW-4R) designated as level IV data deliverable in the chain of custody, as well as all the data associated with QC samples were also included.

Data validation was performed in three stages: first an initial review of the analytical reports and QA/QC information was performed using summary results and summary tables only. Then, a full review of all analytical reports, QA/QC information, as well as the corresponding raw and analytical data was carried out. Finally summary tables and corresponding raw data of initial and continuing calibration standards, the extraction log, and injection (sequence) log were fully reviewed. Overall review assessed the effects of QA/QC results on the data usability. The review included such parameters as holding times, initial and continuing calibration method requirements, equipment performance check standards (tune check and degradation standards), surrogate recoveries, method blank results, lab control sample (LCS) and lab control sample duplicate (LCSD) for accuracy and precision.

Level IV review compared the reported analytical results with those obtained from the raw data. Raw data was submitted for one sample at Level IV data deliverable for all the analytical methods requested on the chain of custody. Calculations and corresponding equations, as well as analyte identification criteria were all verified.

2.2 Data Evaluation

The following parameters were evaluated in the preliminary data review:

- Analysis performed and sample identifications were verified to be in accordance with the information provided on the chain-of-custody (COC);
- Technical holding times were confirmed for all samples with regard to the requested method of analysis (collection to extraction and extraction to analysis);

- Reported quantitation limits were compared with the project measurement objectives;
- Initial and continuing calibrations were evaluated;
- Equipment performance standards (tuning check standard) was evaluated
- Field and laboratory blank results were evaluated;
- LCS/LCSD results were evaluated; and
- Field and laboratory matrix duplicate results, trip blank results as well as surrogate recoveries, internal standards and instrument performance check compounds were evaluated.
- Chromatograms and mass spectrum results as well as ion fragments for positive hits were evaluated

The following is a list of sample identifications and corresponding laboratory sample identification numbers:

CLIENT ID	EMAX ID#
10-23-12- AMW-4R	J163.01
10-23-12-WB-2-4	J163.02
10-23-12-TB-1	J163.03
10-23-12-WB-2-1	J163.04
10-23-12-PWB-9	J163.05
10-23-12-PWB-11	J163.06
10-23-12-PWB-5	J163.07
10-23-12-PWB-8	J163.08
10-23-12-PWB-16	J163.09
10-24-12- PWB-12	J163.10
10-24-12-PWB-4	J163.11
10-24-12-PWB-13A	J163.12
10-24-12-PWB-14	J163.13
10-24-12-FDUP-2	J163.14
10-23-12-EB-1	J163.15

Field duplicate and associated sample	
10-24-12-FDUP-2	10-24-12- PWB-4

Table 2-1 below shows the specified analysis for constituents in the water samples, the corresponding Environmental Protection Agency (EPA) analytical method, the corresponding practical quantitation limits (PQL/RL), regulatory levels, and the effluent discharge limits of specific constituents if available.

TABLE 2-1
Summary of Analytical Parameters
Brown & Bryant, Arvin, California

MATRIX	CONSTITUENT	EPA METHOD	RLs (µg/L)	REGULATORY LEVEL (µg/L)	EFFLUENT DISCHARGE LIMITS (µg/L)	
Water	Volatile Organic Compounds	8260B	1	NA	NA	
	Fumigants (EDB, DBCP and 1,2,3-Trichloropropane)	8260B SIM	0.05-0.05 0.005(1,2,3-TCP)	NA	NA	
	Herbicides (Dinoseb)	8151A	0.40	NA	NA	
	Fixed gases	Dissolved Hydrogen	RSK175	10.0	NA	NA
		Methane	RSK175	1.0	NA	NA
	Ferrous Iron	SM3500	2.0mg/L	NA	NA	
	Sulfide	SM4500S2D	0.1mg/L	NA	NA	
	Anions By IC	Nitrite-N	300.0	0.100(mg/L)	NA	NA
		Nitrate-N	300.0	0.100(mg/L)	NA	NA
		Sulfate	300.0	0.500(mg/L)	NA	NA
Total Organic Carbon	415.1	1.0mg/L	NA	NA		

Notes:

RL = Reporting Limit,

NA = Not Available

µg/L = microgram/Liter

mg/L= milligram/Liter

2.2.1 Holding Times

Technical holding times are defined as the maximum time allowed between sample collection, extraction and analysis. A 14-day collection-to-analysis holding time was used for EPA Method 8260B and 8260B SIM. A 7-day holding time from collection to extraction, and 40-day holding time from extraction-to-analysis was met, for EPA Method 8151A. Holding time of 48-Hours from collection to analysis was met for analysis of Anions.

TABLE 2-2
Summary of Analytical Methods and Holding Time Requirements
Brown & Bryant, Arvin, California

ANALYSIS Method	MATRIX	HOLDING TIME REQUIREMENT	DATA QUALIFIED AS "J"	DATA QUALIFIED AS "R"
EPA Method 8260B	Water	14 days to analysis	None. Holding times were met	None. Holding times were met
EPA Method 8260B SIM	Water	14 days to analysis	None. Holding times were met	None. Holding times were met
EPA Method 8151A	Water	7 days to extraction, 40 days to analysis	None. Holding times were met	None. Holding times were met
Nitrate, Nitrite & by EPA Method 300.0	Water	48 hours to extraction and analysis	None. Holding times were met	None. Holding times were met
Sulfate by EPA Method 300.0	Water	28 days from collection to analysis	None. Holding times were met	None. Holding times were met
Sulfide by SM4500S2D	Water	7 days from collection to analysis	None. Holding times were met	None. Holding times were met
Ferrous Iron by SM3500	Water	24 hours from collection to analysis	None. Holding times were met	None. Holding times were met
TOC by Method 415.1	Water	28 days to analysis	None. Holding times were met	None. Holding times were met
Dissolved Hydrogen and Methane by RSK175	Water	14 days from collection to analysis	None. Holding times were met	None. Holding times were met

2.2.2 Laboratory and Field Blanks

The objective of laboratory and field blanks is to determine the presence and extent of contamination resulting from laboratory or field activities. Blanks reported here included method and/or extraction blanks equipment blank and trip blank. The result of analysis of method blank is discussed in section 4.0 for each method. All samples were transported in five ice preserved coolers and were stored in a refrigerator upon arrival to the laboratory. The temperatures of the coolers were recorded as 2.9°C to 4.4°C for each upon arrival. All samples were received intact and in good condition.

3.0 QUALITY ASSURANCE OBJECTIVES

Quality assurance (QA) objectives define analytical parameters that validate the conclusions drawn from the results. Quality assurance was assessed through the following means: precision, accuracy, representativeness, completeness, and comparability (PARCC).

3.1 Qualitative QA Objectives

Qualitative aspects of QA for analytical data are characterized by completeness and representativeness.

3.1.1 Comparability

Comparability defines the level of confidence with which one data set can be compared with another. Comparability is related to accuracy and precision. It is also a measure of the data's reliability. All units for comparability are in accordance with standard procedures so that the results could be compared with other laboratories if necessary.

3.1.2 Representativeness

Representativeness is a quantity, which presents whether the results of analysis accurately portray the actual site conditions. Representativeness is a qualitative parameter, which signifies the extent of accuracy and precision, to which the data represent a characteristic population, parameter variations at a sampling point, process condition, or environmental conditions. The sampling procedures described within the approved QAPP (Eco & Associates, Inc., final version, April 2011) are designed to provide samples representative of the site conditions.

3.2 Quantitative QA Objectives

Quantitative QA Objectives for analytical data are defined as precision, accuracy, completeness, and method quantitation limits. These quantitative parameters are established in order to monitor the overall quality of analytical data produced by the laboratory. The laboratory performing the analytical methods specified in Table 2-1, and the case narratives, which is included in the data package from the laboratory, ensures the quality of the analytical data.

3.2.1 Precision

Precision is a measure of the closeness with which multiple analyses of a given sample agree with each other. It describes the agreement between two or more measurements that have been made in exactly the same way. Precision is measured through matrix spike/matrix spike duplicate samples, surrogate standards, and laboratory control samples. The relative percent difference (RPD) is calculated as a means of quantifying precision. The following equation is used for this purpose:

$$\text{RPD} = \frac{R_1 - R_2}{(R_1 + R_2)/2} \times 100$$

Where:

RPD = Relative percent difference

R₁ = Result of the first duplicate or measured sample concentration

R₂ = Result of the second duplicate or known sample or duplicate concentration

When analytes are present at concentrations below or near the quantitation limit, precision is measured, using MS/MSD, and/or LCS/LCSD results.

Precision results are discussed in Section 4.0 of this report.

3.2.2 Accuracy

Accuracy indicates the closeness of the measurement to its true or accepted value. Accuracy measures agreement between a result and its true value. Method-specific QA objectives for precision and accuracy were based on the quality control limits developed by the laboratory for the analytical methods, specified in Table 2-1. These procedures may affect the accuracy of the data presented. Additionally, initial and continuing calibrations were used to verify that the analytical instrument accurately measured the compound concentrations. Calculations were independently verified for the response factors and percent differences (%Ds).

3.2.3 Completeness

Completeness is defined as the percentage of total measurements, which are judged to be valid. The completeness objective is to obtain a sufficient amount of valid data to enable the goals and objectives of the project to be achieved.

Completeness is quantified by computing the fraction of reports, which remained valid after the sampling procedures were reviewed and the results conformed to QA/QC protocols. The following equation was used to calculate completeness:

$$\text{Completeness} = \frac{\text{No. of valid field samples analyzed}}{\text{No. of valid field samples collected}} \times 100$$

Completeness is affected by anything that reduces the number of samples analyzed (such as a sample bottle breaking), as well as acceptance or non-acceptance of analytical results.

4.0 DATA VALIDATION

This data review covers fifteen (15) water samples listed on page 8 including dilutions and reanalysis if applicable. The analyses were according to the following EPA Methods:

EPA Method 8260B for volatile organic compounds

EPA Method 8260B SIM for fumigants (EDB, DBCP and 1, 2, 3-Trichloropropane)

EPA Method 8151A for Chlorinated Herbicides (Dinoseb)

Anions (Nitrite-N, Nitrate-N and Sulfate) by IC, EPA Method 300.0

Total Organic Carbon; Method 415.1

Ferrous Iron by Standard Method 3500

Total Sulfide by Standard Method 4500-S2D

Methane and dissolved Hydrogen by EPA Method RSK175

This review follows USEPA Analytical Operations/Data Quality Center (*AOC National Functional Guidelines for Organic Data Review* (USEPA, August 2002); and EM 200-1-10 Guidance for Evaluating Performance-based Chemical Data, US Army Corps of Engineers (USACE), June 2005. The following subsections correlate to the above guidelines.

A summary table summarizing all data and qualification, if any is provided at the end of this report. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

The following are definitions of the data qualifiers:

- U Indicates the compound was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None indicates the finding did not significantly impact the data; therefore qualification was not required.

4.1. VOC (EPA Method 5030B/8260B)

Technical Holding Times

A 14-day technical holding time requirement was met for all the samples. A total of fifteen (15) ground water samples were collected on 10-23-12 and 10-24-12. All samples and sample dilutions were analyzed on 10-25-12. Samples, QC samples and sample dilutions were analyzed with reference to one analytical batch (preparation batch: VO06J19).

The chain-of-custody was reviewed for documentation of sample information and method of analysis.

Table 1 in appendix A summarizes the list of samples with the results and qualification notations.

Tuning criteria

The performance of the instrument was checked by injection of a single component tune check standard (BFB: Bromofluorobenzene) prior to initial calibration on 08-15-12. At the start of analytical batch on 10-25-12, the tune check standard was also injected. All the mass ratio requirements were within the assigned criteria.

Initial Calibration

Ground water samples were analyzed with reference to one set of initial calibration. Initial calibration curve was generated on 08-15-12 using instrument ID # T-O06 for analysis. A multilevel calibration curve ranging from 0.3 $\mu\text{g/L}$ to 100 $\mu\text{g/L}$ was used for this purpose. Internal standard curve type was used for initial calibration. Minimum response factor for system performance check compounds (SPCCs) were within the method acceptable limits. Response factors at each level were randomly recalculated and all agreed with the response factors submitted in the initial calibration summary table.

Minimum average response factors for the system performance check compounds (SPCCs) for each instrument were recognized according to the following tables:

Table 4.1.1: System Performance Check Compounds (Initial calibration)

System Performance check compounds (SPCCs)	Min. Ave. Response Factor (Method limits)	Ave. Res. Factor 08-15-12 (Calculated) Instrument ID#: T-O06
Chloromethane	≥ 0.10	0.310
1,1 -dichloroethane	≥ 0.10	0.637
Bromoform	≥ 0.10	0.348
Chlorobenzene	≥ 0.30	0.939
1,1,2,2-Tetrachloroethane	≥ 0.30	0.625

Average response factor curve fit was mainly used to show linearity within initial calibration levels for each compound. Maximum 15% RSD limit was met for most of the target compounds.

Least square linear regression curve fit was used for the following compounds where %RSD exceeded the maximum 15 percent limit.

Target Analytes	Least Square Linear Regression (CCF) 08-15-12 Instrument ID#: T-O06
Methylene chloride	0.9963
Tetrahydrofuran	0.9958
Bromoform	0.9971

Calibration check compounds (CCCs) met the acceptance criteria for %RSD among the response factors calculated for each level. The method acceptance limits and the calculated %RSD among the response factors for initial calibration are listed in table 4.1.2.

Table 4.1.2 Calibration Check Compounds (CCCs): Initial Calibration

Calibration Check Compounds (CCCs)	Response Factors %RSD (Limit)	Response Factors %RSD 08-15-12 Instrument ID#: T-O06
1,1-Dichloroethene	≤ 30%	4.54
Chloroform	≤ 30%	6.39
1,2-Dichloropropane	≤ 30%	4.61
Toluene	≤ 30%	6.76
Ethyl benzene	≤ 30%	9.90
Vinyl chloride	≤ 30%	13.2

Initial Calibration Verification and Continuing Calibration verification (Daily Calibration)

Initial calibration was verified by a second source standard at the end of calibration and before sample analysis on 08-16-12. Percent differences (%D) between initial calibration average response factors (RRFs) and the initial calibration verification response factors (RFs) were less than or equal to 20% for almost all target compounds.

One continuing calibration check standard was analyzed at the beginning of each analytical shift on 10-25-12. Prior to continuing calibration standard analysis, **instrument performance check standard** (BFB tune check) was carried out. It passed all the method tuning criteria.

The minimum average response factors for the system performance check compounds (SPCCs) for continuing calibration standards were all within the method limits. The following table list average response factors for system performance check compounds.

Table 4.1.3: System Performance Check Compounds: (Daily calibration)

System Performance Check compounds (SPCCs)	Minimum response factor (Method limits)	Second source St.	Continuing cal.
		Response factors CCRF 08-16-12	Response factors CCRF 10-25-12
Chloromethane	≥ 0.10	0.325	0.343
1,1-Dichloroethane	≥ 0.10	0.608	0.628
Chlorobenzene	≥ 0.10	0.936	0.956
Bromoform	≥ 0.30	0.393	0.346
1,1,2,2-Tetrachloroethane	≥ 0.30	0.672	0.579

Calculated percent differences (%drift) between initial calibration RRFs (average response factors) and the continuing calibration response factors (CCRF) were less than or equal to 20% for all the Calibration Check Compounds (CCCs) and less than or equal to 20% for all other target analytes. The area counts for all internal standards were within ± 50-150 percent of the same level in the initial calibration. The calculated % difference between RFs from continuing calibration and average response factors from initial calibration is summarized in Table 4.1.4 for continuing calibration compounds as follows:

Table 4.1.4 Calibration Check Compounds (CCCs): ICV and Daily Calibration

Calibration Check Compounds (CCCs)	%Deviation From Initial calibration (Acceptance Limit)	Deviation from Initial calibration 2 nd source (08-16-12)	Deviation from Initial calibration Daily calibration (10-25-12)
Vinyl chloride	≤ 20%	3.0%	15.9%
1,1-Dichloroethene	≤ 20%	1.3%	6.1%
Chloroform	≤ 20%	2.8%	7.3%
1,2-Dichloropropane	≤ 20%	0.3%	1.3%
Toluene	≤ 20%	1.3%	2.1%
Ethyl benzene	≤ 20%	0.60%	1.4%

Deviation from the initial calibration was less than 20 percent for the rest of target list (Non-CC compounds).

Quality Control: The QC samples reported consisted of one method blank and one set of LCS/LCSD. No sample was designated to be spiked as MS/MSD; therefore results and percent recoveries of LCS/LCSD were evaluated for both precision as well as accuracy. The full list of target compounds were spiked and reported for LCS/LCSD. Percent recoveries and percent RPDs for all the QC samples reported were within the project acceptance limits for all reported compounds.

The results, percent recoveries and RPDs were recalculated randomly and all agreed with the reported QC summary table.

Method blank: One method blank was presented with the data package, analyzed on 10-25-12 (batch # VO06J19). Method blank was reported as non-detected for all the analytes in the target list.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-2 was identified as field duplicate of sample 10-24-12-PWB-4. Results of positive hits for sample and corresponding sample duplicate are shown in the following table:

Analyte	10-24-12 FDUP-2 µg/L	10-24-12 PWB-4 µg/L	%RPD
1,2,3-Trichloropropane	9.4	9.4	≤1%
1,2-Dichloropropane	3.2	3.4	6.1%
Chloroform	0.27J	0.30J	10.5%

Surrogate recoveries were all within the method's acceptance limits. The reported results for each sample are incorporated in table 1 in appendix A.

Raw data for one sample, 10-23-12- AMW-4R, was submitted as level IV data deliverable. Raw data for all associated QC samples were also included as Level IV data deliverable. The results calculated from the raw data, agreed with all the results reported in data summary reports. The sample results together with the surrogate recoveries are tabulated in table 1 appendix A.

4.2. EPA Method 5030B/8260B SIM (FUMIGANTS)

Technical Holding Times

A 14-day technical holding time requirement was met for all the samples. A total of thirteen (13) ground water samples were collected on 10-23-12 and 10-24-12. All samples and QC samples were analyzed on 10-26-12 and 10-29-12. Samples and QC samples were analyzed with reference to two preparation batches (VO05J20 and VO05J21).

The chain-of-custody was reviewed for documentation of sample information and method of analysis. Samples were analyzed for three fumigants: 1,2-Dibromomethane (EDB), 1,2,3-Trichloropropane (TCP), and 1,2-Dibromo-3-chloropropane (DBCP). A Mass detector at Selected Ion Monitoring mode (SIM) was used to achieve low detection limits required for the target compounds.

Table 2 in appendix A summarizes the list of samples with the results and qualification notations.

Tuning criteria

The performance of the instrument was checked by injection of a single component tune check standard (BFB: Bromofluorobenzene) prior to initial calibration and at the start of each analytical batch. All mass ratios were within the method assigned criteria.

Initial Calibration

Ground water samples were analyzed with reference to one set of initial calibration using purge and trap together with GC/MSD at selected ion monitoring mode. Instrument ID # T-O05 was used for the analysis. Initial calibration curve was generated on 10-09-12. A multilevel calibration curve ranging from 5ng/L (ppt) to 1000ng/L (ppt) was used for this purpose. Instrument performance check standard (BFB) was analyzed prior to initial calibration. It passed all the tuning criteria. Modified version of SW-846 8260B (SIM) was used for generation of calibration curve and data. Internal standard curve type was used for initial calibration. Minimum response factor for all the target compounds were within the method acceptable limits. Average response factor curve fit was used to show linearity. Percent relative standard deviation (%RSD) among response factors was less than 15% for all target analytes. Using results from raw data, response factors at each level were randomly recalculated and all agreed with the response factors submitted in the initial calibration summary table.

Initial Calibration Verification and Continuing Calibration (Daily calibration)

The initial calibration curve was verified by a second source standard (ICV) at the end of calibration and before sample analysis on 10-10-12. Quality control criteria regarding minimum response factors were within method acceptance limits. Percent differences (%D) between initial calibration average response factors (RRFs) and the initial calibration verification response factors (RFs) were less than or equal to 20% for all target compounds.

Two continuing calibration check standards were analyzed at the beginning of each analytical shift on 10-26-12 and 10-29-12. Prior to each continuing calibration, instrument performance check standard (BFB tune check) was carried out. Instrument mass ratios were all within specification of the method.

The calculated % difference (%D) between RFs from continuing calibration and average response factors from initial calibration is summarized in Table 4.2.1 for the targets of interest in this method as follows:

Table 4.2.1: Percent difference from initial calibration: (Daily calibration)

Target Compounds	% Deviation From Initial Calibration Method Criteria	% Deviation From Initial Calibration 2nd Source St. (Calculated) (10-10-12)	% Deviation From Initial Calibration Daily St. (Calculated) (10-26-12)	% Deviation From Initial Calibration Daily St. (Calculated) (10-29-12)
1,2-Dibromomethane (EDB)	≤ 20%	5.7%	11.1%	13.9%
1,2,3-Trichloropropane(TCP)	≤ 20%	7.5%	0.7%	0.8%
1,2-Dibromo-3-chloropropane (DBCP)	≤ 20%	8.8%	14.7%	3.4%

Calculated percent differences (%drift) between initial calibration RRFs (average response factors) and the continuing calibration response factors (CCRF) were less than or equal to 20% for all target analytes. The area counts for all internal standards were within ± 50-150 percent of the same level in the initial calibration.

Quality Control: The QC samples reported consisted of two method blanks and two sets of LCS/LCSD. No sample was recognized as MS/MSD in the chain of custody. Therefore, the response and percent recoveries of LCS/LCSD were evaluated for both accuracy and precision. All three target compounds were spiked and reported for LCS/LCSD. Percent recoveries and percent RPDs for both sets of LCS/LCSD were within the project acceptance limits for all reported compounds.

The results, percent recoveries and RPDs were recalculated randomly and all agreed with the reported QC summary tables.

Method blanks: Two method blanks were presented with the data package (analyzed on 10-26-12 and 10-29-12). Method blanks were reported as non-detected for all analytes in the target list.

Surrogate recoveries were all within the method's acceptance limits. The reported results for each sample are incorporated in table 1 in appendix A.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-2 was identified as field duplicate of sample 10-24-12-PWB-4. Results of positive hits for each sample and corresponding sample duplicate are shown in the following table:

Analyte	10-24-12 FDUP-2 µg/L	10-24-12 PWB-4 µg/L	%RPD
1,2-Dibromoethane (EDB)	ND	ND	NA
1,2-Dibromo-3-chloropropane	0.26	0.26	≤1
1, 2,3-Trichloropropane	14	14	≤1

Raw data for one sample, 10-23-12- AMW-4R, together with all further dilutions was submitted as level IV data deliverable. Raw data for all associated QC samples were also included as Level IV data deliverable. The results calculated from the raw data, agreed with all the results reported in data summary reports. The sample results together with the surrogate recoveries are tabulated in table 2 Appendix A.

4.3 DINOSEB BY GC/ECD (EPA Method 8151A)

Technical Holding Times

A 7-day technical holding time from sample collection to extraction and 40-day from extraction to analysis was met for all samples. A total of thirteen (13) ground water samples were collected on 10-23-12 and 10-24-12. Samples were extracted with one preparation batch on 10-29-12 (preparation batch # HEJ009W). Sample extracts were all analyzed within 40-day holding time on 10-30-12.

EPA Method 8151A uses GC equipped with two Electron Capture Detectors (ECDs) and two columns connected to the same injection port for analysis. Results and raw data generated

from both columns were submitted. Chlorinated Herbicides (Dinoseb) was determined by this method.

Initial Calibration

Samples were analyzed with reference to one initial calibration generated on 10-30-12. Seven calibration levels (20-200 µg/L) were used in initial calibration. Channel A and B were both calibrated. External standard curve type was used for calibration. Calibration factor (area for each compound versus concentration) was used for calculation. Average response factor was used to show linearity for each channel. Percent relative standard deviation (%RSD) among calibration factors (CFs) for both channel A and B were less than 20%. Retention time window width was established by using initial calibration standards at each level. All further sample and QC analysis identification were based on the assigned retention time windows set by initial calibration for each peak. The instrument was calibrated for the full list of Herbicides, both for initial calibration and continuing (daily calibration), but the result of analysis was reported only for Dinoseb.

Initial Calibration Verification (ICV) and Continuing (Daily) Calibration

Initial calibration curve was verified by a second source standard at the end of calibration and prior to sample analysis on 10-30-12. Percent difference between mean calibration factors from initial calibration and calibration factors calculated from the second source were less than 15% for both Dinoseb and MCP (used as surrogate).

Six continuing calibration standards with intervals of 10 sample injections were analyzed with samples, and QC samples. Samples were all analyzed on 10-30-12. Percent difference between initial calibration average response factors and the response factors calculated for Dinoseb from continuing calibrations were less than 20% for all standards. Results for surrogate recoveries and QC samples were reported from both channel A and B.

Quality Control samples consisted of method blank and one set of LCS/LCSD for preparation batch #HEJ009W. No sample was designated as MS/MSD in the chain of custody. Therefore, the results and recoveries of LCS/LCSD were evaluated for both accuracy and precision. Full Herbicide list was spiked for LCS/LCSD, but only Dinoseb and MCP (as

surrogate) were reported for precision and accuracy. Percent recoveries (%R) were within the project established QC limits for LCS/LCSD. Calculated %RPD was less than 30% acceptance limit

Method blank was reviewed for each component and no herbicide was found in the method blank for the extraction batch # HEJ009W.

Surrogate recoveries were all within the method's acceptable limits for all initial analyses. The calculated result for each sample is incorporated in table 3 in Appendix A.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-2 was recognized as field duplicate of sample 10-24-12-PWB-4 Results of analysis for each sample and corresponding sample duplicates are shown in the following table:

Analyte	10-24-12 FDUP-2 µg/L	10-24-12 PWB-4 µg/L	%RPD
Dinoseb	0.79	0.81	2.5%

Raw data for one sample, 10-23-12- AMW-4R, with related QC samples and dilutions were submitted at level IV deliverable. Raw data responses were used in recalculation and all verified the reported values.

4.4 Method 300.0: Anions

A total of thirteen (13) ground water samples were collected on 10-23-12 and 10-24-12. Samples were analyzed for Nitrate-N, Nitrite-N and Sulfate using Ion Chromatography (IC) on 10-24-12 and 10-25-12. All the field samples and dilutions were analyzed within 48-hour holding time requirement.

Anions such as Nitrate-N, Nitrite-N and Sulfate were separated from water samples by Ion chromatography. The separated anions in their acid form (very conductive) were measured

by conductivity. They were identified on the basis of retention time as compared to previously established time window by reference standards.

One set of initial calibration curve (ranging from 0.05 to 20 mg/L) was generated on 10-24-12. Instrument was initially calibrated with nine calibration levels. Linear curve type with correlation coefficients of at least 0.999 was used for each anion throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (concentration of each anion versus area count of each anion) was presented for each target compound. Area for each level was randomly checked with the values and equations presented with each calibration curve. All agreed with the raw data. A second source standard mixture at mid-point (1.0mg/L) was used to verify the linearity of initial calibration for each anion on 10-24-12. Recoveries were all within 90-110% of initial value.

Daily (Continuing) Calibrations:

Six continuing calibration standards were analyzed on 10-24-12 and 10-25-12 (one after each 10 injection intervals). Continuing calibration standards were analyzed with samples, sample dilutions and QC samples. The recoveries of target anions were within 90-110% of the expected values in all submitted continuing calibration standards. After each continuing calibration standard, one calibration blank was injected. All the blanks were reported as non-detected regarding all the target anions.

Quality Control Samples consisted of three method blanks and three sets of LCS/LCSD for each requested anion. No sample was designated to be spiked for MS/MSD in the chain of custody. Therefore, results and recoveries of LCS/LCSD were evaluated for both accuracy and precision. Recoveries of LCS/LCSD were within 90-110 % of spiked values; all covering the QC limits requirements. Percent RPDs were less than 20% for LCS/LCSD. Each QC set was analyzed with the same dilution factor as the one used for reporting the corresponding anion.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-2 was identified as field duplicate of sample 10-24-12-PWB-4. Results of analysis for sample and corresponding sample duplicate are shown in the following table:

Analyte	10-24-12 FDUP-2 µg/L	10-24-12 PWB-4 µg/L	%RPD
Nitrate-N	38.8	39.0	<1%
Nitrite-N	ND	ND	NA
Sulfate	106	107	<1%

Raw data for one sample (10-23-12- AMW-4R) with corresponding dilutions and all related QC samples were submitted for level IV data review. Raw data for samples with all QC samples and dilutions was reviewed comprehensively. The recalculated values from raw data agreed with the result submitted.

4.5 Total Organic Carbon (TOC) by EPA Method 415.1

A total of thirteen (13) ground water samples were collected on 10-23-12 and 10-24-12. Samples were analyzed for Total Organic Carbon (TOC) on 10-26-12, within 28-days holding time requirement. Organically bound carbons in water are measured by oxidation or combustion of organic molecules to single smaller molecules. TOC analyzers utilize high temperature combustion to convert Organic Carbon to carbon dioxide, which is measured by the analyzer. Non-Purgable Organic Carbon (NPOC) is the target of interest.

One set of initial calibration curve with at least 5 calibration levels (ranging from 1.0mg/L to 80 mg/L) was generated on 10-26-12. Linear curve type with correlation coefficients of at least 0.999933 was used throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (area versus concentration) was presented for Non-purgable Organic Carbon. Results for each level was randomly checked with the values and equations presented with the calibration curve. All agreed with the raw data.

A second source standard mixture at mid-point of the calibration curve (25mg/L) was used to verify the linearity of initial calibration on 10-26-12. Recoveries were all within 90-110% of initial value. Continuing calibration standards, together with continuing calibration blanks were analyzed at 10-injection intervals on 10-26-12. They all passed the assigned calibration criteria.

Quality Control Samples consisted of two method blanks and two sets of LCS/LCSD. No sample was designated to be spiked as MS/MSD in the chain of custody. Therefore, results and

recoveries of LCS/LCSD were use for evaluation of accuracy and precision. Recoveries of LCS/LCSD were within 80-120 % of spiked values, all covering the QC limit requirements. Percent RPDs were less than 20% for LCS/LCSD.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-2 was identified as field duplicate of sample 10-24-12-PWB-4. Results of TOC analysis for each sample and corresponding sample duplicates are shown in the following table:

Analyte	10-24-12 FDUP-2 mg/L	10-24-12 PWB-4 mg/L	%RPD
TOC	0.693J	0.721J	3.96%

Raw data and corresponding chromatogram for all thirteen samples with QC samples were presented with the data package. Four readings were recorded for each sample. Final reported results were average of the four readings for each sample. The sample results are tabulated in table 5 Appendix A.

4.6 Ferrous Iron by Standard Method 3500

A total of thirteen (13) ground water samples were collected on 10-23-12 and 10-24-12. Samples were analyzed for Ferrous Iron on 10-24-12, within 24-hour holding time. Ferrous Iron (in reduced form) reacts with an oxidation-reduction indicator (o-Phenanthroline), resulting in a colored complex. The intensity of color formed due to reaction, is proportional to the amount of ferrous iron in the solution and can be detected and measured by a spectrophotometer.

One set of initial calibration curve with at least 5 calibration levels (ranging from 2.0mg/L to 25 mg/L) was generated on 10-24-12. Linear curve type with correlation coefficients of at least 0.999970 was used throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (Absorbance versus concentration) was presented for initial calibration standards. Results for each level was randomly checked with the values and equations presented with the calibration curve. All agreed with the raw data.

A second source standard (ICV) mixture at mid-point (15mg/L) was used to verify the linearity of initial calibration on 10-24-12. Recoveries were all within 90-110% of initial value. six continuing calibration standards (CCV), together with continuing calibration blanks were analyzed with samples and QC samples on 10-24-12. They passed the calibration criteria.

Quality Control Samples consisted of method blank, LCS/LCSD, MS/MSD and sample/sample duplicate. Sample 10-24-12-FDUP-2 was spiked for MS/MSD. It was also analyzed as sample duplicate. Recoveries of LCS/LCSD and MS/MSD were within the acceptance limit of 80-120 % of spiked value. Percent RPDs were less than 20% for LCS/LCSD and MS/MSD.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-2 was recognized as field duplicate of sample 10-24-12-PWB-4. Both sample and the corresponding associated sample duplicate were reported as non-detected for Ferrous Iron.

Raw data that include results of analysis and calibration curve was presented for all thirteen samples together with QC samples. The sample results are tabulated in table 6 Appendix A.

4.7 Sulfide by Standard Method SM4500-S2D

A total of thirteen (13) ground water samples were collected on 10-23-12 and 10-24-12. Samples were analyzed for Total Sulfide on 10-29-12, within seven-day holding time.

The method is based on reaction of Sulfide, Ferric chloride and Amine-sulfuric acid to produce Methylene blue. The intensity of color is proportional to the sulfide concentration in water. The intensity of color resulting from reaction can be detected and measured by a spectrophotometer.

One set of initial calibration curve with at least 5 calibration levels (ranging from 0.1mg/L to 1 mg/L) was generated on 10-29-12. Linear curve type with correlation coefficient of at least 0.999299 was used throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (Absorbance versus concentration of standard solutions),

together with related equations was presented. Results for each level was randomly checked with the values and equations presented with the calibration curve. All agreed with the raw data.

A second source standard mixture at mid-point (0.5mg/L) was used to verify the linearity of each initial calibration on 10-29-12. Recoveries were all within 90-110% of initial value. Two continuing calibration standards, together with continuing calibration blanks were analyzed with samples and QC samples on 10-29-12. They passed the calibration criteria.

Quality Control Samples consisted of one method blank and one set of LCS/LCSD. No sample was marked as MS/MSD on the chain of custody. Therefore, results and recoveries of LCS/LCSD were used to evaluate accuracy and precision. Recoveries of LCS/LCSD were within 80-120 %, covering the QC limits requirements of spiked values. Percent RPDs were less than 20% for LCS/LCSD.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-2 was recognized as field duplicate of sample 10-24-12-PWB-4. Both field sample and associated field duplicate sample were reported as non-detected for total Sulfide.

Raw data (results of analysis together with the calibration curve) for all thirteen samples together with QC samples were presented with the data package. The sample results are tabulated in table 7 Appendix A.

4.8. METHANE and DISSOVED HYDROGEN by EPA Method RSK175

Technical Holding Times

A 14-day technical holding time from sample collection to analysis was met for all samples. A total of thirteen (13) ground water samples were collected on 10-23-12 and 10-24-12. Samples were all analyzed within the 14-day holding time on 10-31-12 and 11-01-12.

EPA Method RSK175 uses GC equipped with a thermal conductivity detector (TCD) and a flame ionization detector (FID). Sample from headspace is injected into a GC with a single column connected to two detectors in series. GC/FID response was used for Methane and GC/TCD response was used for Hydrogen.

Results and raw data generated from both detectors were submitted. Methane and dissolved hydrogen were determined by this method.

Initial Calibration

Samples were analyzed with reference to one initial calibration for each gas. GC/TCD was calibrated with five calibration levels (1000-50000 ppmv for Hydrogen) on 11-03-2011 and GC/FID was calibrated with five calibration levels (3-10000ppmv for Methane) on 02-27-12. The same instrument was used (instrument ID#GC8A) for both detectors but samples were injected separately for each calibration/detector. Both detectors were calibrated. External standard curve type was used for calibration. Calibration factor (area for each compound versus concentration) was used for calculation. Average response factor was used to show linearity for each channel.

Percent relative standard deviation (%RSD) among calibration factors (CFs) for both detectors (TCD) and (FID) were less than 20% with correlation coefficient of 0.999818 for Hydrogen and 0.999989 for Methane. Retention time window width was established by using initial calibration standards at each level. All further sample and QC analysis identification were based on the assigned time windows set by initial calibration for each peak. The instrument was calibrated for methane at least eighteen month prior to sample analysis.

Initial Calibration Verification (ICV) and Continuing (Daily) Calibration

Initial calibration verification standard (ICV) was submitted for Hydrogen (TCD detector). Raw data for initial calibration verification standard (ICV) was missing from the data package for Methane (FID detector). EMAX Laboratory was informed to provide the missing data. Percent difference was less than 20% for both detectors. Two continuing calibration standards with intervals of 10 sample injections were analyzed with samples and all the QC samples. All samples and QC samples were analyzed on 10-31-12 and 11-01-12. Percent

difference between initial calibration average response factors and the response factors calculated for each analyte from continuing calibrations were less than 20% for all standards.

Quality Control samples consisted of one method blank and one set of LCS/LCSD. No sample was marked as MS/MSD in the chain of custody. Therefore, results and recoveries of LCS/LCSD was used to evaluate data for accuracy and precision. Both Hydrogen and Methane were spiked and reported for LCS/LCSD. Percent recoveries (%R) were within the project established QC limits for LCS/LCSD. Calculated %RPD was less than 30% acceptance limit.

Method blank was reviewed for each component and no target analyte was found in the method blank for each detector.

Surrogate: No surrogate is used in this method.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-2 was recognized as field duplicate of sample 10-24-12-PWB-4. Both field samples and associated field duplicate samples were reported as non-detected for Hydrogen and Methane.

Raw data for all thirteen samples, with related QC samples were submitted at level IV deliverable. Raw data and chromatograms for samples and QC samples were submitted for both detectors (FID for Methane, and TCD for Hydrogen). Raw data responses were used in recalculation and all verified the reported values.

5.0 Conclusion

Overall, the data presented is generally regarded as acceptable for all the EPA methods listed in the chain of custody. The data can reliably be used for the purpose of this project.

6.0 References

1. *USEPA Analytical Operations/Data Quality Center (AOC) National Functional Guidelines for Organic Data Review* (USEPA, August 2002).
2. *Quality Assurance Project Plan, final Draft, Brown & Bryant, CA*, (Project No. Eco-11-501, Eco & Associates Inc., April 2011)
3. U.S. Environmental Protection Agency, Dec. 1996, *SW846 Laboratory Manual Physical/Chemical Methods*. Revision 3, Washington, D.C. 20460.
4. EM 200-1-10 Guidance for Evaluation Performance-based Chemical Data, US Army Corps of Engineers (USACE), June 2005.
5. Department of Defense Quality System Manual (DOD QSM), Version 4.2, 2010
6. EPA Methods for Chemical Analysis of Water and Wastes. EPA -600-4-79-020. Revised; March 1983.
7. Standard Methods for Examination of Water and Wastewater. 21st Edition, 2005.

7.0 APPENDIX A

Table 1-Volatile Organic Compounds component List: EPA Method 8260B

ANALYTE	RLs µg/L	10-23-12- AMW-4R	10-23-12- WB 2-4	10-23-12- TB-1	10-23-12- WB 2-1	10-23-12- PWB-9	10-23-12- PWB-11
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Acetone	10	U	U	U	U	U	U
Benzene	1.0	U	U	U	U	U	U
Bromobenzene	1.0	U	U	U	U	U	U
Bromochloromethane	1.0	U	U	U	U	U	U
Bromodichloromethane	1.0	U	U	U	U	U	U
Bromoform	1.0	U	U	U	U	U	U
Bromomethane	1.0	U	U	U	U	U	U
2-Butanone	10	U	U	U	U	U	U
n-Butylbenzene	1.0	U	U	U	U	U	U
sec-Butylbenzene	1.0	U	U	U	U	U	U
tert-Butylbenzene	1.0	U	U	U	U	U	U
Carbon Disulfide	1.0	U	U	U	U	U	U
Carbon Tetrachloride	1.0	0.40J	U	U	U	U	U
Chlorobenzene	1.0	U	U	U	U	U	U
Chloroethane	1.0	U	U	U	U	U	U
2-ChloroethylVinylether	1.0	U	U	U	U	U	U
Chloroform	1.0	U	0.32J	U	U	U	U
Chloromethane	1.0	U	U	U	U	U	U
2-Chlorotoluene	1.0	U	U	U	U	U	U
4-Chlorotoluene	1.0	U	U	U	U	U	U
1,2Dibromo3Chloropropane	1.0	U	U	U	U	U	U
Dibromochloromethane	1.0	U	U	U	U	U	U
1,2-Dibromoethane(EDB)	1.0	U	U	U	U	U	U
Dibromomethane	1.0	U	U	U	U	U	U
1,2-Dichlorobenzene	1.0	U	U	U	U	U	U
1,3-Dichlorobenzene	1.0	U	U	U	U	U	U
1,4-Dichlorobenzene	1.0	U	U	U	U	U	U
Dichlorodifluoromethan	1.0	U	U	U	U	U	U
1,1-Dichloroethane	1.0	U	U	U	U	U	U
1,2-Dichloroethane	1.0	U	U	U	U	U	U
1,1-Dichloroethene	1.0	U	U	U	U	U	U
Cis-1,2-Dichloroethene	1.0	U	U	U	U	U	U
trans-1,2-Dichloroethene	1.0	U	U	U	U	U	U
1,2-Dichloropropane	1.0	0.47J	1.6	U	0.60J	0.63J	0.68J
1,3-Dichloropropane	0.5	U	U	U	U	U	U
2,2-Dichloropropane	1.0	U	U	U	U	U	U
1,1-Dichloropropene	1.0	U	U	U	U	U	U
cis-1,3-Dichloropropene	1.0	U	U	U	U	U	U
trans-1,3-Dichloropropene	1.0	U	U	U	U	U	U
Ethylbenzene	1.0	U	U	U	U	U	U
Hexachlorobutadiene	1.0	U	U	U	U	U	U
2-Hexanone	10	U	U	U	U	U	U
Isopropylbenzene	1.0	U	U	U	U	U	U

ANALYTE	RLs µg/L	10-23-12- AMW-4R	10-23-12- WB 2-4	10-23-12- TB-1	10-23-12- WB 2-1	10-23-12- PWB-9	10-23-12- PWB-11
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
p-Isopropyltoluene	1.0	U	U	U	U	U	U
MTBE	1.0	U	U	U	U	U	U
4-Methyl-2-Pentanone	10.0	U	U	U	U	U	U
Methylene chloride	1.0	U	U	U	U	U	U
Naphthalene	1.0	U	U	U	U	U	U
n- Propylbenzene	1.0	U	U	U	U	U	U
Styrene	1.0	U	U	U	U	U	U
1,1,1,2-Tetrachloroethane	1.0	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	1.0	U	U	U	U	U	U
Tetrachloroethene	1.0	U	U	U	U	U	U
Toluene	1.0	U	U	U	U	U	U
1,2,3-Trichlorobenzene	1.0	U	U	U	U	U	U
1,2,4-Trichlorobenzene	1.0	U	U	U	U	U	U
1,1,1-Trichloroethane	1.0	U	U	U	U	U	U
1,1,2-Trichloroethane	1.0	U	U	U	U	U	U
Trichloroethene	1.0	U	U	U	U	U	U
Trichlorofluoromethane	1.0	U	U	U	U	U	U
1,2,3-Trichloropropane	1.0	U	U	U	0.69J	2.0	2.4
1,2,4-Trimethylbenzene	1.0	U	U	U	U	U	U
1,3,5-Trimethylbenzene	1.0	U	U	U	U	U	U
Vinyl Chloride	1.0	U	U	U	U	U	U
o-Xylene	1.0	U	U	U	U	U	U
m- & p-Xylenes	1.0	U	U	U	U	U	U
Surrogate (Limits)	(Limits)	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
1,2Dichloroeth-d4	70-120	89.7	92.0	87.7	89.8	95.3	93.2
4-Bromofluorbenze	75-120	84.3	84.7	85.2	86.2	84.9	87.6
Toluene-d8	85-120	105	101	102	108	103	103
Dibromofluoromethane	85-115	101	103	98.6	100	105	102

Table 1-Volatile Organic Compounds component List: EPA Method 8260B

ANALYTE	RLs	10-23-12- PWB-5	10-23-12- PWB-8	10-23-12- PWB-16	10-24-12- PWB-12	10-24-12- PWB-4	10-24-12- PWB-13A
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Acetone	10	U	U	U	U	U	U
Benzene	1.0	U	U	U	U	U	U
Bromobenzene	1.0	U	U	U	U	U	U
Bromochloromethane	1.0	U	U	U	U	U	U
Bromodichloromethane	1.0	U	U	U	U	U	U
Bromoform	1.0	U	U	U	U	U	U
Bromomethane	1.0	U	U	U	U	U	U
2-Butanone	10	U	U	U	U	U	U
n-Butylbenzene	1.0	U	U	U	U	U	U
sec-Butylbenzene	1.0	U	U	U	U	U	U
tert-Butylbenzene	1.0	U	U	U	U	U	U
Carbon Disulfide	1.0	U	U	U	U	U	U
Carbon Tetrachloride	1.0	U	U	U	U	U	U
Chlorobenzene	1.0	U	U	U	U	U	U
Chloroethane	1.0	U	U	U	U	U	U
2-ChloroethylVinylether	1.0	U	U	U	U	U	U
Chloroform	1.0	0.33J	0.39J	0.93J	0.78J	0.30J	14
Chloromethane	1.0	U	U	U	U	U	U
2-Chlorotoluene	1.0	U	U	U	U	U	U
4-Chlorotoluene	1.0	U	U	U	U	U	U
1,2-Dibromo3Chloropropane	1.0	U	U	U	2.8	U	1.2
Dibromochloromethane	1.0	U	U	U	U	U	U
1,2-Dibromoethane(EDB)	1.0	U	U	U	U	U	U
Dibromomethane	1.0	U	U	U	U	U	U
1,2-Dichlorobenzene	1.0	U	U	U	U	U	U
1,3-Dichlorobenzene	1.0	U	U	U	U	U	U
1,4-Dichlorobenzene	1.0	U	U	U	U	U	U
Dichlorodifluoromethan	1.0	U	U	U	U	U	U
1,1-Dichloroethane	1.0	U	U	U	U	U	U
1,2-Dichloroethane	1.0	U	U	U	U	U	U
1,1-Dichloroethene	1.0	U	U	U	U	U	U
Cis-1,2-Dichloroethene	1.0	U	U	U	U	U	U
trans-1,2-Dichloroethene	1.0	U	U	U	U	U	U
1,2-Dichloropropane	1.0	2.1	2.7	8.6	4.6	3.4	11
1,3-Dichloropropane	0.5	U	U	U	U	U	U
2,2-Dichloropropane	1.0	U	U	U	U	U	U
1,1-Dichloropropene	1.0	U	U	U	U	U	U
cis-1,3-Dichloropropene	1.0	U	U	U	U	U	U
trans-1,3-Dichloropropene	1.0	U	U	U	U	U	U
Ethylbenzene	1.0	U	U	U	U	U	U
Hexachlorobutadiene	1.0	U	U	U	U	U	U
2-Hexanone	10	U	U	U	U	U	U
Isopropylbenzene	1.0	U	U	U	U	U	U
p-Isopropyltoluene	1.0	U	U	U	U	U	U
MTBE	1.0	U	U	U	U	U	U
4-Methyl-2-Pentanone	10.0	U	U	U	U	U	U

ANALYTE	RLs	10-23-12- PWB-5	10-23-12- PWB-8	10-23-12- PWB-16	10-24-12- PWB-12	10-24-12- PWB-4	10-24-12- PWB-13A
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Methylene chloride	1.0	U	U	U	U	U	U
Naphthalene	1.0	U	U	U	U	U	U
n- Propylbenzene	1.0	U	U	U	U	U	U
Styrene	1.0	U	U	U	U	U	U
1,1,1,2-Tetrachloroethane	1.0	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	1.0	U	U	U	U	U	U
Tetrachloroethene	1.0	U	U	U	U	U	U
Toluene	1.0	U	U	U	U	U	U
1,2,3-Trichlorobenzene	1.0	U	U	U	U	U	U
1,2,4-Trichlorobenzene	1.0	U	U	U	U	U	U
1,1,1-Trichloroethane	1.0	U	U	U	U	U	U
1,1,2-Trichloroethane	1.0	U	U	U	U	U	U
Trichloroethene	1.0	U	U	U	U	U	U
Trichlorofluoromethane	1.0	U	U	U	U	U	U
1,2,3-Trichloropropane	1.0	8.8	9.3	2.4	13.0	9.4	8.6
1,2,4-Trimethylbenzene	1.0	U	U	U	U	U	U
1,3,5-Trimethylbenzene	1.0	U	U	U	U	U	U
Vinyl Chloride	1.0	U	U	U	U	U	U
o-Xylene	1.0	U	U	U	U	U	U
m- & p-Xylenes	1.0	U	U	U	U	U	U
Surrogate (Limits)		% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
1,2Dichloroeth-d4	70-120	95.9	94.0	97.5	94.6	97.1	96.7
4-Bromofluorbenze	75-120	87.1	86.4	84.4	84.8	87.2	83.8
Toluene-d8	85-120	104	105	104	105	105	104
Dibromofluoromethane	85-115	103	102	103	102	107	105

Table 1-Volatile Organic Compounds component List: EPA Method 8260B

ANALYTE	RLs	10-24-12- PWB-14	10-24-12- FDUP-2	10-24-12- EB-1			
	µg/L	µg/L	µg/L	µg/L			
Acetone	10	U	U	U			
Benzene	1.0	U	U	U			
Bromobenzene	1.0	U	U	U			
Bromochloromethane	1.0	U	U	U			
Bromodichloromethane	1.0	U	U	U			
Bromoform	1.0	U	U	U			
Bromomethane	1.0	U	U	U			
2-Butanone	10	U	U	U			
n-Butylbenzene	1.0	U	U	U			
sec-Butylbenzene	1.0	U	U	U			
tert-Butylbenzene	1.0	U	U	U			
Carbon Disulfide	1.0	U	U	U			
Carbon Tetrachloride	1.0	U	U	U			
Chlorobenzene	1.0	U	U	U			
Chloroethane	1.0	U	U	U			
2-ChloroethylVinylether	1.0	U	U	U			
Chloroform	1.0	10.0	0.27J	U			
Chloromethane	1.0	U	U	U			
2-Chlorotoluene	1.0	U	U	U			
4-Chlorotoluene	1.0	U	U	U			
1,2Dibromo3Chloropropane	1.0	U	U	U			
Dibromochloromethane	1.0	U	U	U			
1,2-Dibromoethane(EDB)	1.0	U	U	U			
Dibromomethane	1.0	U	U	U			
1,2-Dichlorobenzene	1.0	U	U	U			
1,3-Dichlorobenzene	1.0	U	U	U			
1,4-Dichlorobenzene	1.0	U	U	U			
Dichlorodifluoromethan	1.0	U	U	U			
1,1-Dichloroethane	1.0	U	U	U			
1,2-Dichloroethane	1.0	U	U	U			
1,1-Dichloroethene	1.0	U	U	U			
Cis-1,2-Dichloroethene	1.0	U	U	U			
trans-1,2-Dichloroethene	1.0	U	U	U			
1,2-Dichloropropane	1.0	17.0	3.2	U			
1,3-Dichloropropane	0.5	U	U	U			
2,2-Dichloropropane	1.0	U	U	U			
1,1-Dichloropropene	1.0	U	U	U			
cis-1,3-Dichloropropene	1.0	U	U	U			
trans-1,3-Dichloropropene	1.0	U	U	U			
Ethylbenzene	1.0	U	U	U			

ANALYTE	RLs	10-24-12- PWB-14	10-24-12- FDUP-2	10-24-12- EB-1			
	µg/L	µg/L	µg/L	µg/L			
Hexachlorobutadiene	1.0	U	U	U			
2-Hexanone	10	U	U	U			
Isopropylbenzene	1.0	U	U	U			
p-Isopropyltoluene	1.0	U	U	U			
MTBE	1.0	U	U	U			
4-Methyl-2-Pentanone	10.0	U	U	U			
Methylene chloride	1.0	U	U	U			
Naphthalene	1.0	U	U	U			
n- Propylbenzene	1.0	U	U	U			
Styrene	1.0	U	U	U			
1,1,1,2-Tetrachloroethane	1.0	U	U	U			
1,1,2,2-Tetrachloroethane	1.0	U	U	U			
Tetrachloroethene	1.0	U	U	U			
Toluene	1.0	U	U	U			
1,2,3-Trichlorobenzene	1.0	U	U	U			
1,2,4-Trichlorobenzene	1.0	U	U	U			
1,1,1-Trichloroethane	1.0	U	U	U			
1,1,2-Trichloroethane	1.0	U	U	U			
Trichloroethene	1.0	U	U	U			
Trichlorofluoromethane	1.0	U	U	U			
1,2,3-Trichloropropane	1.0	2.3	9.4	U			
1,2,4-Trimethylbenzene	1.0	U	U	U			
1,3,5-Trimethylbenzene	1.0	U	U	U			
Vinyl Chloride	1.0	U	U	U			
o-Xylene	1.0	U	U	U			
m-& p-Xylenes	1.0	U	U	U			
Surrogate (Limits)		% Recovery	% Recovery	% Recovery			
1,2Dichloroeth-d4	70-120	95.9	95.0	90.3			
4-Bromofluorbenze	75-120	85.2	85.8	83.7			
Toluene-d8	85-120	103	105	98.5			
Dibromofluoromethane	85-115	104	103	100			

Table 2-Fumigants (EDB, DBCP & 1, 2, 3-Trichloropropane): EPA Method 8260B (SIM)

ANALYTE	RLs µg/L	10-23-12- AMW-4R µg/L	10-23-12- WB 2-4 µg/L	10-23-12- WB 2-1 µg/L	10-23-12- PWB-9 µg/L	10-23-12- PWB-11 µg/L	10-23-12- PWB-5 µg/L
EDB	0.05	ND	ND	ND	ND	ND	ND
DBCP	0.05	ND	ND	ND	ND	ND	0.42
1,2,3-Trichloropropane	0.005	0.55	0.10	1.1	3.4	3.4	13
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
Toluene d8	80-120	95.8	105	89.3	89.7	98.4	97.2

Table 2-Fumigants (EDB, DBCP & 1, 2, 3-Trichloropropane): EPA Method 8260B (SIM)

ANALYTE	RLs µg/L	10-23-12- PWB-8 µg/L	10-23-12- PWB-16 µg/L	10-24-12- PWB-12 µg/L	10-24-12- PWB-4 µg/L	10-24-12- PWB-13A µg/L	10-24-12- PWB-14 µg/L
EDB	0.05	ND	ND	ND	ND	ND	ND
DBCP	0.05	0.51	ND	2.6	0.26	1.3	0.20
1,2,3-Trichloropropane	0.005	13.0	3.9	20.0	14.0	15.0	3.9
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
1,3-DBP (Surrogate)	80-120	90.4	104	84.0	89.1	103	92.1

Table 2-Fumigants (EDB, DBCP & 1, 2, 3-Trichloropropane): EPA Method 8260B (SIM)

ANALYTE	RLs µg/L	10-24-12- FDUP-2 µg/L					
EDB	0.05	ND					
DBCP	0.05	0.26					
1,2,3-Trichloropropane	0.005	14					
Surrogate parameters	Limits	% Recovery					
1,3-DBP (Surrogate)	80-120	90.6					

Table 3-Herbicides (Dinoseb): EPA Method 8151A

ANALYTE	RLs µg/L	10-23-12- AMW-4R µg/L	10-23-12- WB 2-4 µg/L	10-23-12- WB 2-1 µg/L	10-23-12- PWB-9 µg/L	10-23-12- PWB-11 µg/L	10-23-12- PWB-5 µg/L
Dinoseb	0.4	ND	ND	ND	0.77	0.35J	1.0
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
MCP (Surrogate)	40-140	98.9	98.1	91.9	101	98.1	89.3

Table 3-Herbicides (Dinoseb): EPA Method 8151A

ANALYTE	RLs µg/L	10-23-12- PWB-8 µg/L	10-23-12- PWB-16 µg/L	10-24-12- PWB-12 µg/L	10-24-12- PWB-4 µg/L	10-24-12- PWB-13A µg/L	10-24-12- PWB-14 µg/L
Dinoseb	0.4	1.1	ND	27.0	0.81	4.3	0.24J
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
MCP (Surrogate)	60-125	88.9	87.9	135	96.4	128	90.4

Table 3-Herbicides (Dinoseb): EPA Method 8151A

ANALYTE	RLs µg/L	10-24-12- FDUP-2 µg/L					
Dinoseb	0.4	0.79					
Surrogate parameters	Limits	% Recovery					
MCP (Surrogate)	60-125	98.1					

Table 4-Anions (Nitrate-N, Nitrite-N and Sulfate): EPA Method 300.0

ANALYTE	RLs mg/L	10-23-12- AMW-4R mg/L	10-23-12- WB 2-4 mg/L	10-23-12- WB 2-1 mg/L	10-23-12- PWB-9 mg/L	10-23-12- PWB-11 mg/L	10-23-12- PWB-5 mg/L
Anions							
Nitrate-N	0.1	28.4	10.7	27.1	29.1	34.9	43.1
Nitrite-N	0.1	ND	ND	ND	ND	ND	ND
Sulfate	0.5	141	43.9	124	51.2	78.0	97.3

Table 4-Anions (Nitrate-N, Nitrite-N and Sulfate): EPA Method 300.0

ANALYTE	RLs mg/L	10-23-12- PWB-8 mg/L	10-23-12- PWB-16 mg/L	10-24-12- PWB-12 mg/L	10-24-12- PWB-4 mg/L	10-24-12- PWB-13A mg/L	10-24-12- PWB-14 mg/L
Anions							
Nitrate-N	0.1	30.8	1.04	61.2	39.0	37.0	11.5
Nitrite-N	0.1	ND	ND	ND	ND	ND	ND
Sulfate	0.5	160	82.6	62.8	107	144	71.7

Table 4-Anions (Nitrate-N, Nitrite-N and Sulfate): EPA Method 300.0

ANALYTE	RLs mg/L	10-24-12- FDUP-2 mg/L					
Anions							
Nitrate-N	0.1	38.8					
Nitrite-N	0.1	ND					
Sulfate	0.5	106					

Table 5-Total Organic Carbon: EPA Method 415.1

ANALYTE	RLs mg/L	10-23-12- AMW-4R mg/L	10-23-12- WB 2-4 mg/L	10-23-12- WB 2-1 mg/L	10-23-12- PWB-9 mg/L	10-23-12- PWB-11 mg/L	10-23-12- PWB-5 mg/L
TOC	1.0	0.739J	ND	0.666J	0.732J	0.605J	0.712J

Table 5-Total Organic Carbon: EPA Method 415.1

ANALYTE	RLs mg/L	10-23-12- PWB-8 mg/L	10-23-12- PWB-16 mg/L	10-24-12- PWB-12 mg/L	10-24-12- PWB-4 mg/L	10-24-12- PWB-13A mg/L	10-24-12- PWB-14 mg/L
TOC	1.0	0.671J	0.842J	0.705J	0.721J	0.883J	0.570J

Table 5-Total Organic Carbon: EPA Method 415.1

ANALYTE	RLs mg/L	10-24-12- FDUP-2 mg/L					
TOC	1.0	0.639J					

Table 6-Ferrous Iron: Standard Method 3500

ANALYTE	RLs mg/L	10-23-12- AMW-4R mg/L	10-23-12- WB 2-4 mg/L	10-23-12- WB 2-1 mg/L	10-23-12- PWB-9 mg/L	10-23-12- PWB-11 mg/L	10-23-12- PWB-5 mg/L
Ferrous Iron	2.0	ND	ND	ND	ND	0.551J	ND

Table 6-Ferrous Iron: Standard Method 3500

ANALYTE	RLs mg/L	10-23-12- PWB-8 mg/L	10-23-12- PWB-16 mg/L	10-24-12- PWB-12 mg/L	10-24-12- PWB-4 mg/L	10-24-12- PWB-13A mg/L	10-24-12- PWB-14 mg/L
Ferrous Iron	2.0	ND	ND	ND	ND	ND	ND

Table 6-Ferrous Iron: Standard Method 3500

ANALYTE	RLs mg/L	10-24-12- FDUP-2 mg/L					
Ferrous Iron	2.0	ND					

Table 7-Sulfide: Standard Method 4500S2D

ANALYTE	RLs mg/L	10-23-12- AMW-4R mg/L	10-23-12- WB 2-4 mg/L	10-23-12- WB 2-1 mg/L	10-23-12- PWB-9 mg/L	10-23-12- PWB-11 mg/L	10-23-12- PWB-5 mg/L
Sulfide	0.1	ND	ND	ND	0.0380J	ND	ND

Table 7-Sulfide: Standard Method 4500S2D

ANALYTE	RLs mg/L	10-23-12- PWB-8 mg/L	10-23-12- PWB-16 mg/L	10-24-12- PWB-12 mg/L	10-24-12- PWB-4 mg/L	10-24-12- PWB-13A mg/L	10-24-12- PWB-14 mg/L
Sulfide	0.1	ND	ND	ND	ND	ND	ND

Table 7-Sulfide: Standard Method 4500S2D

ANALYTE	RLs mg/L	10-24-12- FDUP-2 mg/L					
Sulfide	0.1	ND					

Table 8- Methane and Dissolved Hydrogen: RSK175

ANALYTE	RLs µg/L	10-23-12- AMW-4R mg/L	10-23-12- WB 2-4 mg/L	10-23-12- WB 2-1 mg/L	10-23-12- PWB-9 mg/L	10-23-12- PWB-11 mg/L	10-23-12- PWB-5 mg/L
Hydrogen	1.0	ND	ND	ND	ND	ND	ND
Methane	10	ND	ND	ND	ND	ND	ND

Table 8- Methane and Dissolved Hydrogen: RSK175

ANALYTE	RLs µg/L	10-23-12- PWB-8 mg/L	10-23-12- PWB-16 mg/L	10-24-12- PWB-12 mg/L	10-24-12- PWB-4 mg/L	10-24-12- PWB-13A mg/L	10-24-12- PWB-14 mg/L
Hydrogen	1.0	ND	ND	ND	ND	ND	ND
Methane	10	ND	ND	ND	ND	ND	ND

Table 8- Methane and Dissolved Hydrogen: RSK175

ANALYTE	RLs µg/L	10-24-12- FDUP-2 µg/L					
Hydrogen	1.0	ND					
Methane	10	ND					

Data Validation Report

Groundwater Monitoring Data

for

Brown & Bryant

Arvin, CA

Project No.: Eco-12-548

SDG#: 12J181

LEVEL III & IV

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1.0 INTRODUCTION	
1.1 Objectives and Scope of the Data Validation	5
1.2 Organization of the Report	5
2.0 DATA REVIEW AND VALIDATION	
2.1 Data Reporting	6
2.2 Data Evaluation	7
2.2.1 Holding Times	9
2.2.2 Laboratory and Field Blanks	10
3.0 QUALITY ASSURANCE OBJECTIVES	
3.1 Qualitative QA Objectives	11
3.1.1 Comparability	11
3.1.2 Representativeness	11
3.2 Quantitative QA Objectives	11
3.2.1 Precision	12
3.2.2 Accuracy	12
3.2.3 Completeness	13
4.0 DATA VALIDATION	
4.0 Results of Data Validation	14
4.1 Volatile Organic Compounds (EPA 8260B)	15
4.2 Fumigants by EPA Method EPA 8260B(SIM)	19
4.3 Herbicides by (EPA Method 8151A)	22
5.0 Conclusion	25
6.0 REFERENCES	25
7.0 APPENDIX A: Table of sample results	26

EXECUTIVE SUMMARY

This data validation report presents the evaluation and validation of the analytical data for twelve ground water samples collected on 10-24-12 and 10-25-12 as part of biannually groundwater monitoring at Brown and Bryant, Arvin, California (CA). EMAX Laboratory in Torrance, California performed the chemical analysis of the samples. The United States Army Corps of Engineers and the State of California have certified EMAX Laboratory to perform the analysis described within this project. (Eco & Associates Inc., April 2011).

Twelve (12) ground water samples, which included one trip blank sample and one field duplicate sample, were collected on 10-24-12 and 10-25-12. EMAX Laboratory received the samples on 10-25-12. Trip blank sample accompanied the samples for volatile organic compounds and was analyzed for EPA Method 8260B only. The data was delivered in one package as Level III and Level IV deliverables. 10% of the data was subjected to validation to equivalent of EPA Level IV data validation. Raw data for one sample from this sample group (10-25-12- EPAS-2) was submitted as level IV deliverable for all the requested analytical methods. Raw data for sample designated as MS/MSD (10-25-12-WA-1) together with all other QC samples were also submitted.

Level III data validation examined quality assurance/quality control (QA/QC) elements such as holding time, (both extraction and analysis), critical quality control measures, completeness of the results, extraction logs, instrument injection logs and summaries of initial and continuing calibrations for the following EPA methods of analysis:

Volatile Organic Compounds by EPA Method **8260B**

Fumigants (EDB, DBCP and 1, 2, 3-Trichloropropane) by EPA Method **8260B SIM**

Dinoseb by EPA Method **8151A**

The analytical results, QC results, initial calibration and related continuing calibration data were comprehensively compared with the corresponding raw data and chromatograms presented for Level IV data validation.

All samples were analyzed for each of the components listed in the corresponding EPA Methods. The evaluation indicated that all the analytical work was performed as requested on the chain of custody. The extraction and analytical holding times were met for all samples in each method and subsequent dilutions.

Generally, data presented with this data package was considered acceptable and met quality control acceptance limits for each EPA Method, with some technical variations. The deviations are discussed in section 4.0 for each method. The results of sample analysis are tabulated in Appendix A.

1.0 INTRODUCTION

This report presents the evaluation and validation of analytical data collected as part of biannually groundwater monitoring at Brown and Bryant Superfund Site at Arvin, California.

1.1 Objectives and Scope of Data Validation

The main objective of this report is to evaluate the acceptability of groundwater data. The data validation was performed according to the analytical requirements of the method in the *Quality Assurance Project Plan, final Draft, Brown and Bryant, Arvin, CA*, (Project No: Eco-12-548, Eco & Associates Inc. April 2012), EM 200-1-10 Guidance for Evaluation Performance-based Chemical Data, US Army Corps of Engineers (USACE), June 2005, *USEPA Analytical Operations/Data Quality Center (AOC) National Functional Guidelines for Organic Data Review* (USEPA, August 2002) and Department of Defense Quality Systems Manual (DoD QSM) Version 4.2, 2010 .

1.2 Organization of the Report

Section 2.0 describes the components of the data review. Section 3.0 provides the qualitative quality assurance objectives. Section 4.0 summarizes the findings and conclusions of the data validation.

2.0 DATA REVIEW AND VALIDATION

Data validation is a systematic method for reviewing and qualifying the presented analytical data for their intended use. The objective of this data validation report is to identify any unacceptable or faulty measurements if any, as reported by the laboratory.

EMAX Laboratory in Torrance, California performed the chemical analysis of the samples. Army Corps of Engineers and the State of California have certified EMAX laboratory to perform the EPA Methods of analysis described within this report.

Twelve (12) ground water samples, which included one trip blank and one field duplicate sample, were collected on 10-24-12 and 10-25-12. EMAX Laboratory received the samples on 10-25-12.

2.1 Data Reporting

The data was delivered in one package as Level III and Level IV deliverables. Ten percent of the data was subjected to validation to the equivalent of EPA Level IV. EMAX Laboratory provided the following information in one data package for both LEVEL III and LEVEL IV deliverable.

- Sample identification number;
- Date of sample collection;
- Sample matrix type;
- Analysis method;
- Target lists and results of analysis;
- Quantitation limits and/or Reporting Limits;
- Laboratory qualifiers and qualifier definitions;
- Copies of sample logs and chain-of-custody logs;
- Sample preparation log (with the sample extraction date)
- Sample Analysis log (Instrument injection log)
- Summary of initial and continuing calibrations;
- Quality control results.

- Case narrative for each method.
- Raw data for all the initial calibration standards, Initial calibration verification standards (ICV), continuing calibration standards (CCV), ion fragments for positive hits, internal standard area counts and retention time window width, where applicable. Raw data for one sample (10-25-12- EPAS-2) designated as level IV in the chain of custody as well as data sample spiked as MS/MSD (10-25-12-WA-1); together with the associated QC samples were also included.

Data validation was performed in three stages: first an initial review of the analytical reports and QA/QC information was performed using summary results and summary tables only. Then, a full review of all analytical reports, QA/QC information, as well as the corresponding raw and analytical data was carried out. Finally summary tables and corresponding raw data of initial and continuing calibration standards, the extraction log, and injection (sequence) log were fully reviewed. Overall review assessed the effects of QA/QC results on the data usability. The review included such parameters as holding times, initial and continuing calibration method requirements, equipment performance check standards (tune check and degradation standards), surrogate recoveries, method blank results, lab control sample (LCS) and matrix spike/matrix spike duplicate (MS/MSD) for accuracy and precision.

Level IV review compared the reported analytical results with those obtained from the raw data. Raw data was submitted for one sample at Level IV data deliverable for all the analytical methods requested on the chain of custody. Calculations and corresponding equations, as well as analyte identification criteria were all verified.

2.2 Data Evaluation

The following parameters were evaluated in the preliminary data review:

- Analysis performed and sample identifications were verified to be in accordance with the information provided on the chain-of-custody (COC);
- Technical holding times were confirmed for all samples with regard to the requested method of analysis (collection to extraction and extraction to analysis);
- Reported quantitation limits were compared with the project measurement objectives;

- Initial and continuing calibrations were evaluated;
- Equipment performance standards (tuning check standard) was evaluated
- Field and laboratory blank results were evaluated;
- LCS/LCSD and MS/MSD results were evaluated; and
- Field and laboratory matrix duplicate results, trip blank results as well as surrogate recoveries, internal standards and instrument performance check compounds were evaluated.
- Chromatograms and mass spectrum results as well as ion fragments for positive hits were evaluated

The following is a list of sample identifications and corresponding laboratory sample identification numbers:

CLIENT ID	EMAX ID#
10-24-12 WA-3	J181.01
10-25-12 WA-9	J181.02
10-25-12 PWA-7A	J181.03
10-25-12-WA-1	J181.04
10-25-12-PWA-3	J181.05
10-25-12-WA-5	J181.06
10-25-12-EPAS-2	J181.07
10-25-12-WA-2	J181.08
10-25-12-EPAS-4	J181.09
10-25-12-PWA-2	J181.10
10-25-12-FDUP-4	J181.11
10-25-12-TB-3	J181.12
10-25-12-WA-1MS	J181.04 MS
10-25-12-WA-1MSD	J181.04 MSD
10-25-12-WA-1DUP	J181.04 DUP

Field duplicate and associated sample	
10-25-12-FDUP-4	10-25-12- EPAS-2

Table 2-1 below shows the specified analysis for constituents in the water samples, the corresponding Environmental Protection Agency (EPA) analytical method, the corresponding

practical quantitation limits (PQL/RL), regulatory levels, and the effluent discharge limits of specific constituents if available.

TABLE 2-1
Summary of Analytical Parameters
Brown & Bryant, Arvin, California

MATRIX	CONSTITUENT	EPA METHOD	RLs (µg/L)	REGULATORY LEVEL (µg/L)	EFFLUENT DISCHARGE LIMITS (µg/L)
Water	Volatile Organic Compounds	8260B	1	NA	NA
	Fumigants (EDB, DBCP and 1,2,3-Trichloropropane)	8260B SIM	0.05-0.05 0.005(1,2,3-TCP)	NA	NA
	Herbicides (Dinoseb)	8151A	0.40	NA	NA

Notes:

RL = Reporting Limit,

NA = Not Available

µg/L = microgram/Liter

mg/L = milligram/Liter

2.2.1 Holding Times

Technical holding times are defined as the maximum time allowed between sample collection, extraction and analysis. A 14-day collection-to-analysis holding time was used for EPA Method 8260B and 8260B SIM. A 7-day holding time from collection to extraction, and 40-day holding time from extraction-to-analysis was met, for EPA Method 8151A.

TABLE 2-2
Summary of Analytical Methods and Holding Time Requirements
Brown & Bryant, Arvin, California

ANALYSIS Method	MATRIX	HOLDING TIME REQUIREMENT	DATA QUALIFIED AS "J"	DATA QUALIFIED AS "R"
EPA Method 8260B	Water	14 days to analysis	None. Holding times were met	None. Holding times were met
EPA Method 8260B SIM	Water	14 days to analysis	None. Holding times were met	None. Holding times were met
EPA Method 8151A	Water	7 days to extraction, 40 days to analysis	None. Holding times were met	None. Holding times were met

2.2.2 Laboratory and Field Blanks

The objective of laboratory and field blanks is to determine the presence and extent of contamination resulting from laboratory or field activities. Blanks reported here included method and/or extraction blanks and trip blank. The result of analysis of method blank is discussed in section 4.0 for each method. All samples were transported in three ice preserved coolers and were stored in a refrigerator upon arrival to the laboratory. The temperatures of the coolers were recorded as 2.0°C to 3.2°C for each upon arrival. All samples were received intact and in good condition.

3.0 QUALITY ASSURANCE OBJECTIVES

Quality assurance (QA) objectives define analytical parameters that validate the conclusions drawn from the results. Quality assurance was assessed through the following means: precision, accuracy, representativeness, completeness, and comparability (PARCC).

3.1 Qualitative QA Objectives

Qualitative aspects of QA for analytical data are characterized by completeness and representativeness.

3.1.1 Comparability

Comparability defines the level of confidence with which one data set can be compared with another. Comparability is related to accuracy and precision. It is also a measure of the data's reliability. All units for comparability are in accordance with standard procedures so that the results could be compared with other laboratories if necessary.

3.1.2 Representativeness

Representativeness is a quantity, which presents whether the results of analysis accurately portray the actual site conditions. Representativeness is a qualitative parameter, which signifies the extent of accuracy and precision, to which the data represent a characteristic population, parameter variations at a sampling point, process condition, or environmental conditions. The sampling procedures described within the approved QAPP (Eco & Associates, Inc., final version, April 2011) are designed to provide samples representative of the site conditions.

3.2 Quantitative QA Objectives

Quantitative QA Objectives for analytical data are defined as precision, accuracy, completeness, and method quantitation limits. These quantitative parameters are established in order to monitor the overall quality of analytical data produced by the laboratory. The laboratory performing the analytical methods specified in Table 2-1, and the case narratives, which is included in the data package from the laboratory, ensures the quality of the analytical data.

3.2.1 Precision

Precision is a measure of the closeness with which multiple analyses of a given sample agree with each other. It describes the agreement between two or more measurements that have been made in exactly the same way. Precision is measured through matrix spike/matrix spike duplicate samples, surrogate standards, and laboratory control samples. The relative percent difference (RPD) is calculated as a means of quantifying precision. The following equation is used for this purpose:

$$\text{RPD} = \frac{R_1 - R_2}{(R_1 + R_2)/2} \times 100$$

Where:

RPD = Relative percent difference

R₁ = Result of the first duplicate or measured sample concentration

R₂ = Result of the second duplicate or known sample or duplicate concentration

When analytes are present at concentrations below or near the quantitation limit, precision is measured, using MS/MSD, and/or LCS/LCSD results.

Precision results are discussed in Section 4.0 of this report.

3.2.2 Accuracy

Accuracy indicates the closeness of the measurement to its true or accepted value. Accuracy measures agreement between a result and its true value. Method-specific QA objectives for precision and accuracy were based on the quality control limits developed by the laboratory for the analytical methods, specified in Table 2-1. These procedures may affect the accuracy of the data presented. Additionally, initial and continuing calibrations were used to verify that the analytical instrument accurately measured the compound concentrations. Calculations were independently verified for the response factors and percent differences (%Ds).

3.2.3 Completeness

Completeness is defined as the percentage of total measurements, which are judged to be valid. The completeness objective is to obtain a sufficient amount of valid data to enable the goals and objectives of the project to be achieved.

Completeness is quantified by computing the fraction of reports, which remained valid after the sampling procedures were reviewed and the results conformed to QA/QC protocols. The following equation was used to calculate completeness:

$$\text{Completeness} = \frac{\text{No. of valid field samples analyzed}}{\text{No. of valid field samples collected}} \times 100$$

Completeness is affected by anything that reduces the number of samples analyzed (such as a sample bottle breaking), as well as acceptance or non-acceptance of analytical results.

4.0 DATA VALIDATION

This data review covers twelve (12) water samples listed on page 8 including dilutions and reanalysis if applicable. The analyses were according to the following EPA Methods:

EPA Method 8260B for volatile organic compounds

EPA Method 8260B SIM for fumigants (EDB, DBCP and 1, 2, 3-Trichloropropane)

EPA Method 8151A for Chlorinated Herbicides (Dinoseb)

This review follows USEPA Analytical Operations/Data Quality Center (*AOC National Functional Guidelines for Organic Data Review* (USEPA, August 2002); and EM 200-1-10 Guidance for Evaluating Performance-based Chemical Data, US Army Corps of Engineers (USACE), June 2005. The following subsections correlate to the above guidelines.

A summary table summarizing all data and qualification, if any is provided at the end of this report. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

The following are definitions of the data qualifiers:

- U Indicates the compound was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None indicates the finding did not significantly impact the data; therefore qualification was not required.

4.1. VOC (EPA Method 5030B/8260B)

Technical Holding Times

A 14-day technical holding time requirement was met for all the samples. A total of twelve (12) ground water samples were collected on 10-24-12 and 10-25-12. All samples and sample dilutions were analyzed on 10-26-12 and 10-29-12. Samples, QC samples and sample dilutions were analyzed with reference to two analytical batches (preparation batch: VO06J20 and VO06J21).

The chain-of-custody was reviewed for documentation of sample information and method of analysis.

Table 1 in appendix A summarizes the list of samples with the results and qualification notations.

Tuning criteria

The performance of the instrument was checked by injection of a single component tune check standard (BFB: Bromofluorobenzene) prior to initial calibration on 08-15-12. At the start of each analytical batch on 10-26-12 and 10-29-12, the tune check standard was also injected. All the mass ratio requirements were within the assigned criteria.

Initial Calibration

Ground water samples were analyzed with reference to one set of initial calibration. Initial calibration curve was generated on 08-15-12 using instrument ID # T-O06 for analysis. A multilevel calibration curve ranging from 0.3 μ g/L to 100 μ g/L was used for this purpose. Internal standard curve type was used for initial calibration. Minimum response factor for system performance check compounds (SPCCs) were within the method acceptable limits. Response factors at each level were randomly recalculated and all agreed with the response factors submitted in the initial calibration summary table.

Minimum average response factors for the system performance check compounds (SPCCs) for each instrument were recognized according to the following tables:

Table 4.1.1: System Performance Check Compounds (Initial calibration)

System Performance check compounds (SPCCs)	Min. Ave. Response Factor (Method limits)	Ave. Res. Factor 08-15-12 (Calculated) Instrument ID#: T-O06
Chloromethane	≥ 0.10	0.310
1,1 -dichloroethane	≥ 0.10	0.637
Bromoform	≥ 0.10	0.348
Chlorobenzene	≥ 0.30	0.939
1,1,2,2-Tetrachloroethane	≥ 0.30	0.625

Average response factor curve fit was mainly used to show linearity within initial calibration levels for each compound. Maximum 15% RSD limit was met for most of the target compounds.

Least square linear regression curve fit was used for the following compounds where %RSD exceeded the maximum 15 percent limit.

Target Analytes	Least Square Linear Regression (CCF) 08-15-12 Instrument ID#: T-O06
Methylene chloride	0.9963
Tetrahydrofuran	0.9958
Bromoform	0.9971

Calibration check compounds (CCCs) met the acceptance criteria for %RSD among the response factors calculated for each level. The method acceptance limits and the calculated %RSD among the response factors for initial calibration are listed in table 4.1.2.

Table 4.1.2 Calibration Check Compounds (CCCs): Initial Calibration

Calibration Check Compounds (CCCs)	Response Factors %RSD (Limit)	Response Factors %RSD 08-15-12 Instrument ID#: T-O06
1,1-Dichloroethene	≤ 30%	4.54
Chloroform	≤ 30%	6.39
1,2-Dichloropropane	≤ 30%	4.61
Toluene	≤ 30%	6.76
Ethyl benzene	≤ 30%	9.90
Vinyl chloride	≤ 30%	13.2

Initial Calibration Verification and Continuing Calibration verification (Daily Calibration)

Initial calibration was verified by a second source standard at the end of calibration and before sample analysis on 08-16-12. Percent differences (%D) between initial calibration average response factors (RRFs) and the initial calibration verification response factors (RFs) were less than or equal to 20% for almost all target compounds.

Two continuing calibration check standards were analyzed at the beginning of each analytical shift on 10-26-12 and 10-29-12. Prior to continuing calibration standard analysis, **instrument performance check standard** (BFB tune check) was carried out. It passed all the method tuning criteria.

The minimum average response factors for the system performance check compounds (SPCCs) for continuing calibration standards were all within the method limits. The following table list average response factors for system performance check compounds.

Table 4.1.3: System Performance Check Compounds: (Daily calibration)

System Performance Check compounds (SPCCs)	Minimum response factor (Method limits)	Second source St.	Continuing cal.	Continuing cal.
		Response factors CCRF 08-16-12	Response factors CCRF 10-26-12	Response factors CCRF 10-29-12
Chloromethane	≥ 0.10	0.325	0.296	0.314
1,1-Dichloroethane	≥ 0.10	0.608	0.631	0.621
Chlorobenzene	≥ 0.10	0.936	0.967	0.994
Bromoform	≥ 0.30	0.393	0.336	0.370
1,1,2,2-Tetrachloroethane	≥ 0.30	0.672	0.561	0.583

Calculated percent differences (%drift) between initial calibration RRFs (average response factors) and the continuing calibration response factors (CCRF) were less than or equal to 20% for all the Calibration Check Compounds (CCCs) and less than or equal to 20% for all other target analytes. The area counts for all internal standards were within ± 50-150 percent of the same level in the initial calibration. The calculated % difference between RFs from continuing calibration and average response factors from initial calibration is summarized in Table 4.1.4 for continuing calibration compounds as follows:

Table 4.1.4 Calibration Check Compounds (CCCs): ICV and Daily Calibration

Calibration Check Compounds (CCCs)	%Deviation From Initial calibration (Acceptance Limit)	Deviation from Initial calibration 2 nd source (08-16-12)	Deviation from Initial calibration Daily calibration (10-26-12)	Deviation from Initial calibration Daily calibration (10-29-12)
Vinyl chloride	-≤ 20%	3.0%	3.0%	8.2%
1,1-Dichloroethene	-≤ 20%	1.3%	2.3%	1.3%
Chloroform	-≤ 20%	2.8%	8.01%	3.6%
1,2-Dichloropropane	-≤ 20%	0.3%	0.8%	3.1%
Toluene	-≤ 20%	1.3%	2.2%	4.7%
Ethyl benzene	-≤ 20%	0.60%	1.8%	2.4%

Deviation from the initial calibration was less than 20 percent for the rest of target list (Non-CC compounds). However, percent difference for Tetrahydrofuran exceeded the maximum 20% limit in both daily standards analyzed on 10-26-12 (34%) and 10-29-12 (27.7%).

Quality Control: The QC samples reported consisted of two method blanks, two sets of LCS/LCSD and MS/MSD. Client's designated sample (10-25-12-WA-1) was spiked for precision as MS/MSD. The full list of target compounds were spiked and reported for LCS/LCSD and MS/MSD. Percent recoveries and percent RPDs for all the QC samples reported were within the project acceptance limits for all reported compounds.

The results, percent recoveries and RPDs were recalculated randomly and all agreed with the reported QC summary table.

Method blank: Two method blanks were presented with the data package, analyzed on 10-26-12 and 10-29-12. Method blanks were reported as non-detected for all the analytes in the target list.

Field duplicate sample and its associated sample: Sample 10-25-12-FDUP-4 was identified as field duplicate of sample 10-25-12-EPAS-2. Results of positive hits for each sample and corresponding sample duplicate are shown in the following table:

Analyte	10-25-12 FDUP-4 µg/L	10-25-12 EPAS-2 µg/L	%RPD
1,2,3-Trichloropropane	3.7	3.4	8.45%
1,2-Dibromo-3-chloropropane	0.96J	0.81J	16.9%
Chloroform	3.0	2.8	6.9%
1,2-Dichloropropane	30	29	3.39%

Surrogate recoveries were all within the method's acceptance limits. The reported results for each sample are incorporated in table 1 in appendix A.

Raw data for one sample, 10-25-12- EPAS-2, with all following dilutions was submitted as level IV data deliverable. Raw data for all associated QC samples were also included as Level IV data deliverable. The results calculated from the raw data, agreed with all the results reported in data summary reports. The sample results together with the surrogate recoveries are tabulated in table 1 appendix A.

4.2. EPA Method 5030B/8260B SIM (FUMIGANTS)

Technical Holding Times

A 14-day technical holding time requirement was met for all the samples. A total of eleven (11) ground water samples were collected on 10-24-12 and 10-25-12. All samples and QC samples were analyzed on 10-30-12 and 11-01-12. Samples and QC samples were analyzed with reference to two preparation batches (VO05J22 and VO05K01).

The chain-of-custody was reviewed for documentation of sample information and method of analysis. Samples were analyzed for three fumigants: 1,2-Dibromomethane (EDB), 1,2,3-Trichloropropane (TCP), and 1,2-Dibromo-3-chloropropane (DBCP). A Mass detector at Selected Ion Monitoring mode (SIM) was used to achieve low detection limits required for the target compounds.

Table 2 in appendix A summarizes the list of samples with the results and qualification notations.

Tuning criteria

The performance of the instrument was checked by injection of a single component tune check standard (BFB: Bromofluorobenzene) prior to initial calibration and at the start of each analytical batch. All mass ratios were within the method assigned criteria.

Initial Calibration

Ground water samples were analyzed with reference to one set of initial calibration using purge and trap together with GC/MSD at selected ion monitoring mode. Instrument ID # T-O05 was used for the analysis. Initial calibration curve was generated on 10-09-12. A multilevel calibration curve ranging from 5ng/L (ppt) to 1000ng/L (ppt) was used for this purpose. Instrument performance check standard (BFB) was analyzed prior to initial calibration. It passed all the tuning criteria. Modified version of SW-846 8260B (SIM) was used for generation of calibration curve and data. Internal standard curve type was used for initial calibration. Minimum response factor for all the target compounds were within the method acceptable limits. Average response factor curve fit was used to show linearity. Percent relative standard deviation (%RSD) among response factors was less than 15% for all target analytes. Using results from raw data, response factors at each level were randomly recalculated and all agreed with the response factors submitted in the initial calibration summary table.

Initial Calibration Verification and Continuing Calibration (Daily calibration)

The initial calibration curve was verified by a second source standard (ICV) at the end of calibration and before sample analysis on 10-10-12. Quality control criteria regarding minimum response factors were within methods, acceptance limits. Percent differences (%D) between initial calibration average response factors (RRFs) and the initial calibration verification response factors (RFs) were less than or equal to 20% for all target compounds.

Continuing calibration check standard was analyzed at the beginning of each analytical shift on 10-30-12 and 11-01-12. Prior to each continuing calibration, instrument performance check standard (BFB tune check) was carried out. Instrument mass ratios were all within specification of the method.

The calculated % difference (%D) between RFs from continuing calibration and average response factors from initial calibration is summarized in Table 4.2.1 for the targets of interest in this method as follows:

Table 4.2.1: Percent difference from initial calibration: (Daily calibration)

Target Compounds	% Deviation From Initial Calibration Method Criteria	% Deviation From Initial Calibration 2 nd Source St. (Calculated) (10-10-12)	% Deviation From Initial Calibration Daily St. (Calculated) (10-30-12)	% Deviation From Initial Calibration Daily St. (Calculated) (11-01-12)
1,2-Dibromomethane (EDB)	≤ 20%	5.7%	8.4%	9.1%
1,2,3-Trichloropropane(TCP)	≤ 20%	7.5%	2.4%	5.0%
1,2-Dibromo-3-chloropropane (DBCP)	≤ 20%	8.8%	16.7%	2.5%

Calculated percent differences (%drift) between initial calibration RRFs (average response factors) and the continuing calibration response factors (CCRF) were less than or equal to 20% for all target analytes. The area counts for all internal standards were within ± 50-150 percent of the same level in the initial calibration.

Quality Control: The QC samples reported consisted of two method blanks, two sets of LCS/LCSD and MS/MSD. Client's designated sample (10-25-12-WA-1) was spiked for precision as MS/MSD. All three target compounds were spiked and reported for LCS/LCSD and MS/MSD. Percent recoveries and percent RPDs for both sets of LCS/LCSD were within the project acceptance limits for all reported compounds. Due to high level of contamination in the parent sample, percent recovery failed the maximum acceptance limit of 125% for 1,2,3-Trichloropropane in MS/MSD (236% and 150% respectively).

The results, percent recoveries and RPDs were recalculated randomly and all agreed with the reported QC summary tables.

Method blank: Two method blanks were presented with the data package (analyzed on

10-30-12 and 11-01-12). Method blanks were reported as non-detected for all analytes in the target list.

Surrogate recoveries were all within the method's acceptance limits. The reported results for each sample are incorporated in table 1 in appendix A.

Field duplicate sample and its associated sample: Sample 10-25-12-FDUP-4 was identified as field duplicate of sample 10-25-12-EPAS-2. Results of positive hits for each sample and corresponding sample duplicate are shown in the following table:

Analyte	10-25-12 FDUP-4 µg/L	10-25-12 EPAS-2 µg/L	%RPD
1,2-Dibromoethane (EDB)	ND	ND	NA
1,2-Dibromo-3-chloropropane	0.89	0.89	≤1
1, 2,3-Trichloropropane	5.2	5.6	7.41%

Raw data for one sample, 10-25-12- EPAS-2, together with all further dilutions was submitted as level IV data deliverable. Raw data for all associated QC samples were also included as Level IV data deliverable. The results calculated from the raw data, agreed with all the results reported in data summary reports. The sample results together with the surrogate recoveries are tabulated in table 2 Appendix A.

4.3 DINOSEB BY GC/ECD (EPA Method 8151A)

Technical Holding Times

A 7-day technical holding time from sample collection to extraction and 40-day from extraction to analysis was met for all samples. A total of eleven (11) ground water samples were collected on 10-24-12 and 10-25-12. Samples were extracted with one preparation batch on 10-30-12 (preparation batch # HEJ010W). Sample extracts were all analyzed within 40-day holding time on 10-31-12 and 11-01-12.

EPA Method 8151A uses GC equipped with two Electron Capture Detectors (ECDs) and two columns connected to the same injection port for analysis. Results and raw data generated from both columns were submitted. Chlorinated Herbicides (Dinoseb) was determined by this method.

Initial Calibration

Samples were analyzed with reference to one initial calibration generated on 10-30-12. Seven calibration levels (20-200 µg/L) were used in initial calibration. Channel A and B were both calibrated. External standard curve type was used for calibration. Calibration factor (area for each compound versus concentration) was used for calculation. Average response factor was used to show linearity for each channel. Percent relative standard deviation (%RSD) among calibration factors (CFs) for both channel A and B were less than 20%. Retention time window width was established by using initial calibration standards at each level. All further sample and QC analysis identification were based on the assigned retention time windows set by initial calibration for each peak. The instrument was calibrated for the full list of Herbicides, both for initial calibration and continuing (daily calibration), but the result of analysis was reported only for Dinoseb.

Initial Calibration Verification (ICV) and Continuing (Daily) Calibration

Initial calibration curve was verified by a second source standard at the end of calibration and prior to sample analysis on 10-30-12. Percent difference between mean calibration factors from initial calibration and calibration factors calculated from the second source were less than 15% for both Dinoseb and MCP (used as surrogate).

Six continuing calibration standards with intervals of 10 sample injections were analyzed with samples, and QC samples. Samples were all analyzed on 10-30-12 and 11-01-12. Percent difference between initial calibration average response factors and the response factors calculated for Dinoseb from continuing calibrations were less than 20% for all standards. Results for surrogate recoveries and QC samples were reported from both channel A and B.

Quality Control samples consisted of method blank, one set of LCS/LCSD and MS/MSD for preparation batch #HEJ010W. Client designated sample 10-24-12-WA-1 was

spiked for accuracy and precision. Full Herbicide list was spiked for LCS/LCSD and MS/MSD, but only Dinoseb and MCPP (as surrogate) were reported for precision and accuracy. Percent recoveries (%R) were within the project established QC limits for LCS and MS/MSD. Calculated %RPD was less than 30% acceptance limit

Method blank was reviewed for each component and no herbicide was found in the method blank for the extraction batch # HEJ010W.

Surrogate recoveries were all within the method's acceptable limits for most initial analyses. Due to high dilution factors used in analysis, surrogate was diluted out for three samples and no surrogate recovery was reported for these samples. The calculated result for each sample is incorporated in table 3 in Appendix A.

Field duplicate sample and its associated sample: Sample 10-25-12-FDUP-4 was recognized as field duplicate of sample 10-25-12-EPAS-2. Results of analysis for each sample and corresponding sample duplicates are shown in the following table:

Analyte	10-25-12 FDUP-4 µg/L	10-25-12 EPAS-2 µg/L	%RPD
Dinoseb	7.2	7.7	6.71

Raw data for one sample, 10-25-12- EPAS-2, with related QC samples and dilutions were submitted at level IV deliverable. Raw data responses were used in recalculation and all verified the reported values.

5.0 Conclusion

Overall, the data presented is generally regarded as acceptable for all the EPA methods listed in the chain of custody. The data can reliably be used for the purpose of this project.

6.0 References

1. *USEPA Analytical Operations/Data Quality Center (AOC) National Functional Guidelines for Organic Data Review* (USEPA, August 2002).
2. *Quality Assurance Project Plan, final Draft, Brown & Bryant, CA*, (Project No. Eco-11-501, Eco & Associates Inc., April 2011)
3. U.S. Environmental Protection Agency, Dec. 1996, *SW846 Laboratory Manual Physical/Chemical Methods*. Revision 3, Washington, D.C. 20460.
4. EM 200-1-10 Guidance for Evaluation Performance-based Chemical Data, US Army Corps of Engineers (USACE), June 2005.
5. Department of Defense Quality System Manual (DOD QSM), Version 4.2, 2010
6. EPA Methods for Chemical Analysis of Water and Wastes. EPA -600-4-79-020. Revised; March 1983.
7. Standard Methods for Examination of Water and Wastewater. 21st Edition, 2005.

7.0 APPENDIX A

Table 1-Volatile Organic Compounds component List: EPA Method 8260B

ANALYTE	RLs	10-24-12- WA-3	10-25-12- WA-9	10-25-12- PWA-7A	10-25-12- WA-1	10-25-12- PWA-3	10-25-12- WA-5
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Acetone	10	U	U	U	U	U	U
Benzene	1.0	U	U	U	U	U	U
Bromobenzene	1.0	U	U	U	U	U	U
Bromochloromethane	1.0	U	U	U	U	U	U
Bromodichloromethane	1.0	U	U	U	U	U	U
Bromoform	1.0	U	U	U	U	U	U
Bromomethane	1.0	U	U	U	U	U	U
2-Butanone	10	U	U	U	U	U	U
n-Butylbenzene	1.0	U	U	U	U	U	U
sec-Butylbenzene	1.0	U	U	U	U	U	U
tert-Butylbenzene	1.0	U	U	U	U	U	U
Carbon Disulfide	1.0	U	U	U	U	U	U
Carbon Tetrachloride	1.0	U	U	U	U	U	U
Chlorobenzene	1.0	U	U	U	U	U	U
Chloroethane	1.0	U	U	U	U	U	U
2-ChloroethylVinylether	1.0	U	U	U	U	U	U
Chloroform	1.0	0.5J	0.33J	U	3.7	5.9	0.39J
Chloromethane	1.0	U	U	U	U	U	U
2-Chlorotoluene	1.0	U	U	U	U	U	U
4-Chlorotoluene	1.0	U	U	U	U	U	U
1,2Dibromo3Chloropropane	1.0	1.0	U	U	U	U	U
Dibromochloromethane	1.0	U	U	U	U	U	U
1,2-Dibromoethane(EDB)	1.0	U	U	U	U	U	U
Dibromomethane	1.0	U	U	U	U	U	U
1,2-Dichlorobenzene	1.0	U	U	U	U	U	U
1,3-Dichlorobenzene	1.0	U	U	U	U	U	U
1,4-Dichlorobenzene	1.0	U	U	U	U	U	U
Dichlorodifluoromethan	1.0	U	U	U	U	U	U
1,1-Dichloroethane	1.0	U	U	U	U	U	U
1,2-Dichloroethane	1.0	U	U	U	U	U	U
1,1-Dichloroethene	1.0	U	U	U	U	U	0.82J
Cis-1,2-Dichloroethene	1.0	U	U	U	U	U	U
trans-1,2-Dichloroethene	1.0	U	U	U	U	U	U
1,2-Dichloropropane	1.0	2.3	U	U	0.21J	0.33J	5.1
1,3-Dichloropropane	0.5	U	U	U	U	U	U
2,2-Dichloropropane	1.0	U	U	U	U	U	U
1,1-Dichloropropene	1.0	U	U	U	U	U	U
cis-1,3-Dichloropropene	1.0	U	U	U	U	U	U
trans-1,3-Dichloropropene	1.0	U	U	U	U	U	U
Ethylbenzene	1.0	U	U	U	U	U	U
Hexachlorobutadiene	1.0	U	U	U	U	U	U
2-Hexanone	10	U	U	U	U	U	U
Isopropylbenzene	1.0	U	U	U	U	U	U
p-Isopropyltoluene	1.0	U	U	U	U	U	U
MTBE	1.0	U	U	U	0.63J	U	U

ANALYTE	RLs µg/L	10-24-12- WA-3	10-25-12- WA-9	10-25-12- PWA-7A	10-25-12- WA-1	10-25-12- PWA-3	10-25-12- WA-5
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
4-Methyl-2-Pentanone	10.0	U	U	U	U	U	U
Methylene chloride	1.0	U	U	U	U	U	U
Naphthalene	1.0	U	U	U	U	U	U
n- Propylbenzene	1.0	U	U	U	U	U	U
Styrene	1.0	U	U	U	U	U	U
1,1,1,2-Tetrachloroethane	1.0	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	1.0	U	U	U	U	U	U
Tetrachloroethene	1.0	0.61J	U	U	U	U	0.43J
Toluene	1.0	U	U	U	U	U	U
1,2,3-Trichlorobenzene	1.0	U	U	U	U	U	U
1,2,4-Trichlorobenzene	1.0	U	U	U	U	U	U
1,1,1-Trichloroethane	1.0	U	U	U	U	U	U
1,1,2-Trichloroethane	1.0	U	U	U	U	U	U
Trichloroethene	1.0	U	U	U	U	U	U
Trichlorofluoromethane	1.0	U	U	U	U	U	U
1,2,3-Trichloropropane	1.0	71	U	U	0.89J	U	U
1,2,4-Trimethylbenzene	1.0	U	U	U	U	U	U
1,3,5-Trimethylbenzene	1.0	U	U	U	U	U	U
Vinyl Chloride	1.0	U	U	U	U	U	U
o-Xylene	1.0	U	U	U	U	U	U
m- & p-Xylenes	1.0	U	U	U	U	U	U
Surrogate (Limits)	(Limits)	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
1,2Dichloroeth-d4	70-120	81.5	88.4	88.0	93.5	93.5	92.8
4-Bromofluorbenze	75-120	89.2	87.4	84.9	86.4	87.1	84.8
Toluene-d8	85-120	108	105	106	107	105	107
Dibromofluoromethane	85-115	96.9	100	99.0	102	106	102

Table 1-Volatile Organic Compounds component List: EPA Method 8260B

ANALYTE	RLs	10-25-12- EPAS-2	10-25-12- WA-2	10-25-12- EPAS-3	10-25-12- PWA-2	10-25-12- FDUP-4	10-25-12- TB-3
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Acetone	10	U	U	U	U	U	U
Benzene	1.0	U	U	1.1	1.2	U	U
Bromobenzene	1.0	U	U	U	U	U	U
Bromochloromethane	1.0	U	U	U	U	U	U
Bromodichloromethane	1.0	U	0.62J	U	U	U	U
Bromoform	1.0	U	U	U	U	U	U
Bromomethane	1.0	U	U	U	U	U	U
2-Butanone	10	U	U	U	U	U	U
n-Butylbenzene	1.0	U	U	U	U	U	U
sec-Butylbenzene	1.0	U	U	U	U	U	U
tert-Butylbenzene	1.0	U	U	U	U	U	U
Carbon Disulfide	1.0	U	U	U	U	U	U
Carbon Tetrachloride	1.0	U	U	U	U	U	U
Chlorobenzene	1.0	U	U	2.0	1.7	U	U
Chloroethane	1.0	U	U	U	U	U	U
2-ChloroethylVinylether	1.0	U	U	U	U	U	U
Chloroform	1.0	2.8	53	4.4	9.7	3.0	U
Chloromethane	1.0	U	U	U	U	U	U
2-Chlorotoluene	1.0	U	U	U	U	U	U
4-Chlorotoluene	1.0	U	U	U	U	U	U
1,2Dibromo3Chloropropane	1.0	0.81J	U	310	360	0.96J	U
Dibromochloromethane	1.0	U	U	U	U	U	U
1,2-Dibromoethane(EDB)	1.0	U	U	2.7	79	U	U
Dibromomethane	1.0	U	U	U	U	U	U
1,2-Dichlorobenzene	1.0	U	U	0.62J	0.85J	U	U
1,3-Dichlorobenzene	1.0	U	U	0.31J	0.35J	U	U
1,4-Dichlorobenzene	1.0	U	U	U	U	U	U
Dichlorodifluoromethan	1.0	U	U	U	U	U	U
1,1-Dichloroethane	1.0	U	U	0.65J	0.64J	U	U
1,2-Dichloroethane	1.0	U	U	4.2	10	U	U
1,1-Dichloroethene	1.0	U	U	U	U	U	U
Cis-1,2-Dichloroethene	1.0	U	U	U	U	U	U
trans-1,2-Dichloroethene	1.0	U	U	U	U	U	U
1,2-Dichloropropane	1.0	29	U	4500	6600	30.0	U
1,3-Dichloropropane	0.5	U	U	5.6	8.9	U	U
2,2-Dichloropropane	1.0	U	U	U	U	U	U
1,1-Dichloropropene	1.0	U	U	0.96J	0.85J	U	U
cis-1,3-Dichloropropene	1.0	U	U	U	0.35J	U	U
trans-1,3-Dichloropropene	1.0	U	U	U	U	U	U
Ethylbenzene	1.0	U	U	U	U	U	U
Hexachlorobutadiene	1.0	U	U	U	U	U	U
2-Hexanone	10	U	U	U	U	U	U
Isopropylbenzene	1.0	U	U	U	U	U	U
p-Isopropyltoluene	1.0	U	U	U	U	U	U
MTBE	1.0	U	U	U	U	U	U
4-Methyl-2-Pentanone	10.0	U	U	U	U	U	U
Methylene chloride	1.0	U	U	U	U	U	U

ANALYTE	RLs	10-25-12- EPAS-2	10-25-12- WA-2	10-25-12- EPAS-3	10-25-12- PWA-2	10-25-12- FDUP-4	10-25-12- TB-3
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Naphthalene	1.0	U	U	U	U	U	U
n- Propylbenzene	1.0	U	U	U	U	U	U
Styrene	1.0	U	U	U	U	U	U
1,1,1,2-Tetrachloroethane	1.0	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	1.0	U	U	U	U	U	U
Tetrachloroethene	1.0	U	U	0.27J	0.30J	U	U
Toluene	1.0	U	U	U	U	U	U
1,2,3-Trichlorobenzene	1.0	U	U	U	U	U	U
1,2,4-Trichlorobenzene	1.0	U	U	U	U	U	U
1,1,1-Trichloroethane	1.0	U	U	U	U	U	U
1,1,2-Trichloroethane	1.0	U	U	1.3	1.6	U	U
Trichloroethene	1.0	U	U	U	U	U	U
Trichlorofluoromethane	1.0	U	U	U	U	U	U
1,2,3-Trichloropropane	1.0	3.4	U	540	910	3.7	U
1,2,4-Trimethylbenzene	1.0	U	U	U	U	U	U
1,3,5-Trimethylbenzene	1.0	U	U	U	U	U	U
Vinyl Chloride	1.0	U	U	U	0.35J	U	U
o-Xylene	1.0	U	U	U	U	U	U
m- & p-Xylenes	1.0	U	U	U	U	U	U
Surrogate (Limits)		% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
1,2Dichloroeth-d4	70-120	91.6	93.0	94.7	94.2	98.1	87.0
4-Bromofluorbenze	75-120	84.4	85.6	108	107	83.3	89.4
Toluene-d8	85-120	103	104	108	104	102	107
Dibromofluoromethane	85-115	103	100	103	103	107	101

Table 2-Fumigants (EDB, DBCP & 1, 2, 3-Trichloropropane): EPA Method 8260B (SIM)

ANALYTE	RLs µg/L	10-24-12- WA-3 µg/L	10-25-12- WA-9 µg/L	10-25-12- PWA-7A µg/L	10-25-12- WA-1 µg/L	10-25-12- PWA-3 µg/L	10-25-12- WA-5 µg/L
EDB	0.05	ND	ND	ND	ND	ND	ND
DBCP	0.05	1.1	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	0.005	140	0.012	0.67	1.5	0.11	0.39
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
Toluene d8	80-120	101	94.6	116	92.9	113	95.7

Table 2-Fumigants (EDB, DBCP & 1, 2, 3-Trichloropropane): EPA Method 8260B (SIM)

ANALYTE	RLs µg/L	10-25-12- EPAS-2 µg/L	10-25-12- WA-2 µg/L	10-25-12- EPAS-3 µg/L	10-25-12- PWA-2 µg/L	10-25-12- FDUP-4 µg/L	
EDB	0.05	ND	ND	3.0	81	ND	
DBCP	0.05	0.89	ND	240	310	0.89	
1,2,3-Trichloropropane	0.005	5.6	0.0094	660	1100	5.2	
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	
1,3-DBP (Surrogate)	80-120	85.7	102	85.0	95.5	91.8	

Table 3-Herbicides (Dinoseb): EPA Method 8151A

ANALYTE	RLs µg/L	10-24-12- WA-3 µg/L	10-25-12- WA-9 µg/L	10-25-12- PWA-7A µg/L	10-25-12- WA-1 µg/L	10-25-12- PWA-3 µg/L	10-25-12- WA-5 µg/L
Dinoseb	0.4	41.0	ND	ND	0.35J	ND	ND
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
MCP (Surrogate)	40-140	DO*	101	92.3	94.4	89.4	84.5

*DO: Surrogate was diluted out due to high dilution factor used in analysis

Table 3-Herbicides (Dinoseb): EPA Method 8151A

ANALYTE	RLs µg/L	10-25-12- EPAS-2 µg/L	10-25-12- WA-2 µg/L	10-25-12- EPAS-3 µg/L	10-25-12- PWA-2 µg/L	10-25-12- FDUP-4 µg/L	10-25-12- EPAS-2 µg/L
Dinoseb	0.4	7.7	ND	1,400	9,100	7.2	
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	
MCP (Surrogate)	60-125	138	92.7	DO*	DO*	133	

* DO: Surrogate was diluted out due to high dilution factor used in analysis

Data Validation Report

Groundwater Monitoring Data

for

Brown & Bryant

Arvin, CA

Project No.: Eco-12-548

SDG#: 12J182

LEVEL III & IV

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1.0 INTRODUCTION	
1.1 Objectives and Scope of the Data Validation	5
1.2 Organization of the Report	5
2.0 DATA REVIEW AND VALIDATION	
2.1 Data Reporting	6
2.2 Data Evaluation	7
2.2.1 Holding Times	10
2.2.2 Laboratory and Field Blanks	11
3.0 QUALITY ASSURANCE OBJECTIVES	
3.1 Qualitative QA Objectives	12
3.1.1 Comparability	12
3.1.2 Representativeness	12
3.2 Quantitative QA Objectives	12
3.2.1 Precision	13
3.2.2 Accuracy	13
3.2.3 Completeness	14
4.0 DATA VALIDATION	
4.0 Results of Data Validation	15
4.1 Volatile Organic Compounds (EPA 8260B)	16
4.2 Fumigants by EPA Method EPA 8260B(SIM)	20
4.3 Herbicides by (EPA Method 8151A)	23
4.4 Anions, EPA Method 300.0	26
4.5 (Total Organic Carbon) St Method 415.1	27
4.6 (Ferrous Iron) SM3500	28
4.7 (Sulfide) SM4500S2D	30
4.8 (Methane & dissolved Hydrogen) EPA Method RSK175	31
5.0 Conclusion	33
6.0 REFERENCES	33
7.0 APPENDIX A: Table of sample results	34

EXECUTIVE SUMMARY

This data validation report presents the evaluation and validation of the analytical data for seven ground water samples collected on 10-24-12 as part of biannually groundwater monitoring at Brown and Bryant, Arvin, California (CA). EMAX Laboratory in Torrance, California performed the chemical analysis of the samples. The United States Army Corps of Engineers and the State of California have certified EMAX Laboratory to perform the analysis described within this project. (Eco & Associates Inc., April 2011).

Seven (7) ground water samples, which included one trip blank sample and one field duplicate sample, were collected on 10-24-12. EMAX Laboratory received the samples on 10-25-12. Trip blank sample accompanied the samples for volatile organic compounds and was analyzed for EPA Method 8260B only. The data was delivered in one package as Level III and Level IV deliverables. 10% of the data was subjected to validation to equivalent of EPA Level IV data validation. Raw data for one sample from this sample group (10-24-12- PWB-7A) was submitted as level IV deliverable for all the requested analytical methods. Raw data for sample designated as MS/MSD (10-24-12- WB2-3) together with all other QC samples were also submitted.

Level III data validation examined quality assurance/quality control (QA/QC) elements such as holding time, (both extraction and analysis), critical quality control measures, completeness of the results, extraction logs, instrument injection logs and summaries of initial and continuing calibrations for the following EPA methods of analysis:

Volatile Organic Compounds by EPA Method **8260B**

Fumigants (EDB, DBCP and 1, 2, 3-Trichloropropane) by EPA Method **8260B SIM**

Dinoseb by EPA Method **8151A**

Anions (Nitrite-N, Nitrate-N and Sulfate) by IC, EPA Method **300.0**

Total Organic Carbon by Method **415.1**

Ferrous Iron by Standard Method **3500**

Total Sulfide by Standard Method **4500-S2D**

Methane and dissolved Hydrogen by EPA Method **RSK175**

The analytical results, QC results, initial calibration and related continuing calibration data were comprehensively compared with the corresponding raw data and chromatograms presented for Level IV data validation.

All samples were analyzed for each of the components listed in the corresponding EPA Methods. The evaluation indicated that all the analytical work was performed as requested on the chain of custody. The extraction and analytical holding times were met for all samples in each method and subsequent dilutions.

Generally, data presented with this data package was considered acceptable and met quality control acceptance limits for each EPA Method, with some technical variations. The deviations are discussed in section 4.0 for each method. The results of sample analysis are tabulated in Appendix A.

1.0 INTRODUCTION

This report presents the evaluation and validation of analytical data collected as part of biannually groundwater monitoring at Brown and Bryant Superfund Site at Arvin, California.

1.1 Objectives and Scope of Data Validation

The main objective of this report is to evaluate the acceptability of groundwater data. The data validation was performed according to the analytical requirements of the method in the *Quality Assurance Project Plan, final Draft, Brown and Bryant, Arvin, CA*, (Project No: Eco-12-548, Eco & Associates Inc. April 2012), EM 200-1-10 Guidance for Evaluation Performance-based Chemical Data, US Army Corps of Engineers (USACE), June 2005, *USEPA Analytical Operations/Data Quality Center (AOC) National Functional Guidelines for Organic Data Review* (USEPA, August 2002) and Department of Defense Quality Systems Manual (DoD QSM) Version 4.2, 2010 .

1.2 Organization of the Report

Section 2.0 describes the components of the data review. Section 3.0 provides the qualitative quality assurance objectives. Section 4.0 summarizes the findings and conclusions of the data validation.

2.0 DATA REVIEW AND VALIDATION

Data validation is a systematic method for reviewing and qualifying the presented analytical data for their intended use. The objective of this data validation report is to identify any unacceptable or faulty measurements if any, as reported by the laboratory.

EMAX Laboratory in Torrance, California performed the chemical analysis of the samples. Army Corps of Engineers and the State of California have certified EMAX laboratory to perform the EPA Methods of analysis described within this report.

Seven (7) ground water samples, which included one field duplicate sample, were collected on 10-24-12. EMAX Laboratory received the samples on 10-25-12.

2.1 Data Reporting

The data was delivered in one package as Level III and Level IV deliverables. Ten percent of the data was subjected to validation to the equivalent of EPA Level IV. EMAX Laboratory provided the following information in one data package for both LEVEL III and LEVEL IV deliverable.

- Sample identification number;
- Date of sample collection;
- Sample matrix type;
- Analysis method;
- Target lists and results of analysis;
- Quantitation limits and/or Reporting Limits;
- Laboratory qualifiers and qualifier definitions;
- Copies of sample logs and chain-of-custody logs;
- Sample preparation log (with the sample extraction date)
- Sample Analysis log (Instrument injection log)
- Summary of initial and continuing calibrations;
- Quality control results.
- Case narrative for each method.

- Raw data for all the initial calibration standards, Initial calibration verification standards (ICV), continuing calibration standards (CCV), ion fragments for positive hits, internal standard area counts and retention time window width, where applicable. Raw data for one sample (10-24-12- PWB-7A) designated as level IV in the chain of custody as well as sample selected as MS/MSD (10-24-12-WB2-3); together with the associated QC samples were also included.

Data validation was performed in three stages: first an initial review of the analytical reports and QA/QC information was performed using summary results and summary tables only. Then, a full review of all analytical reports, QA/QC information, as well as the corresponding raw and analytical data was carried out. Finally summary tables and corresponding raw data of initial and continuing calibration standards, the extraction log, and injection (sequence) log were fully reviewed. Overall review assessed the effects of QA/QC results on the data usability. The review included such parameters as holding times, initial and continuing calibration method requirements, equipment performance check standards (tune check and degradation standards), surrogate recoveries, method blank results, lab control sample (LCS) and matrix spike/matrix spike duplicate (MS/MSD) for accuracy and precision.

Level IV review compared the reported analytical results with those obtained from the raw data. Raw data was submitted for one sample at Level IV data deliverable for all the analytical methods requested on the chain of custody. Calculations and corresponding equations, as well as analyte identification criteria were all verified.

2.2 Data Evaluation

The following parameters were evaluated in the preliminary data review:

- Analysis performed and sample identifications were verified to be in accordance with the information provided on the chain-of-custody (COC);
- Technical holding times were confirmed for all samples with regard to the requested method of analysis (collection to extraction and extraction to analysis);

- Reported quantitation limits were compared with the project measurement objectives;
- Initial and continuing calibrations were evaluated;
- Equipment performance standards (tuning check standard) was evaluated
- Field and laboratory blank results were evaluated;
- LCS/LCSD and MS/MSD results were evaluated; and
- Field and laboratory matrix duplicate results, trip blank results as well as surrogate recoveries, internal standards and instrument performance check compounds were evaluated.
- Chromatograms and mass spectrum results as well as ion fragments for positive hits were evaluated

The following is a list of sample identifications and corresponding laboratory sample identification numbers:

CLIENT ID	EMAX ID#
10-24-12 TB-2	J182.01
10-24-12 WB 2-3	J182.02
10-24-12 PWB-15	J182.03
10-24-12-PWB-2	J182.04
10-24-12-PWB-7A	J182.05
10-24-12 WB 2-2	J182.06
10-24-12-FDUP-3	J182.07
10-24-12-WB2-3MS	J182.02MS
10-24-12-WB2-3MSD	J182.02MSD
10-24-12-WB2-3DUP	J182.02DUP

Field duplicate and associated sample	
10-24-12-FDUP-3	10-24-12- WB2-2

Table 2-1 below shows the specified analysis for constituents in the water samples, the corresponding Environmental Protection Agency (EPA) analytical method, the corresponding practical quantitation limits (PQL/RL), regulatory levels, and the effluent discharge limits of specific constituents if available.

TABLE 2-1
Summary of Analytical Parameters
Brown & Bryant, Arvin, California

MATRIX	CONSTITUENT	EPA METHOD	RLs (µg/L)	REGULATORY LEVEL (µg/L)	EFFLUENT DISCHARGE LIMITS (µg/L)	
Water	Volatile Organic Compounds	8260B	1	NA	NA	
	Fumigants (EDB, DBCP and 1,2,3-Trichloropropane)	8260B SIM	0.05-0.05 0.005(1,2,3-TCP)	NA	NA	
	Herbicides (Dinoseb)	8151A	0.40	NA	NA	
	Fixed gases	Dissolved Hydrogen	RSK175	10.0	NA	NA
		Methane	RSK175	1.0	NA	NA
	Ferrous Iron	SM3500	2.0mg/L	NA	NA	
	Sulfide	SM4500S2D	0.1mg/L	NA	NA	
	Anions By IC	Nitrite-N	300.0	0.100(mg/L)	NA	NA
		Nitrate-N	300.0	0.100(mg/L)	NA	NA
		Sulfate	300.0	0.500(mg/L)	NA	NA
Total Organic Carbon	415.1	1.0mg/L	NA	NA		

Notes:

RL = Reporting Limit,

NA = Not Available

µg/L = microgram/Liter

mg/L= milligram/Liter

2.2.1 Holding Times

Technical holding times are defined as the maximum time allowed between sample collection, extraction and analysis. A 14-day collection-to-analysis holding time was used for EPA Method 8260B and 8260B SIM. A 7-day holding time from collection to extraction, and 40-day holding time from extraction-to-analysis was met, for EPA Method 8151A. Holding time of 48-Hours from collection to analysis was met for analysis of Anions.

TABLE 2-2
Summary of Analytical Methods and Holding Time Requirements
Brown & Bryant, Arvin, California

ANALYSIS Method	MATRIX	HOLDING TIME REQUIREMENT	DATA QUALIFIED AS "J"	DATA QUALIFIED AS "R"
EPA Method 8260B	Water	14 days to analysis	None. Holding times were met	None. Holding times were met
EPA Method 8260B SIM	Water	14 days to analysis	None. Holding times were met	None. Holding times were met
EPA Method 8151A	Water	7 days to extraction, 40 days to analysis	None. Holding times were met	None. Holding times were met
Nitrate, Nitrite & by EPA Method 300.0	Water	48 hours to extraction and analysis	None. Holding times were met	None. Holding times were met
Sulfate by EPA Method 300.0	Water	28 days from collection to analysis	None. Holding times were met	None. Holding times were met
Sulfide by SM4500S2D	Water	7 days from collection to analysis	None. Holding times were met	None. Holding times were met
Ferrous Iron by SM3500	Water	24 hours from collection to analysis	Holding times were not met	Samples analyzed one day past holding time
TOC by Method 415.1	Water	28 days to analysis	None. Holding times were met	None. Holding times were met
Dissolved Hydrogen and Methane by RSK175	Water	14 days from collection to analysis	None. Holding times were met	None. Holding times were met

2.2.2 Laboratory and Field Blanks

The objective of laboratory and field blanks is to determine the presence and extent of contamination resulting from laboratory or field activities. Blanks reported here included method and/or extraction blanks equipment blank and trip blank. The result of analysis of method blank is discussed in section 4.0 for each method. All samples were transported in three ice preserved coolers and were stored in a refrigerator upon arrival to the laboratory. The temperatures of the coolers were recorded as 2.0°C for each upon arrival. All samples were received intact and in good condition.

3.0 QUALITY ASSURANCE OBJECTIVES

Quality assurance (QA) objectives define analytical parameters that validate the conclusions drawn from the results. Quality assurance was assessed through the following means: precision, accuracy, representativeness, completeness, and comparability (PARCC).

3.1 Qualitative QA Objectives

Qualitative aspects of QA for analytical data are characterized by completeness and representativeness.

3.1.1 Comparability

Comparability defines the level of confidence with which one data set can be compared with another. Comparability is related to accuracy and precision. It is also a measure of the data's reliability. All units for comparability are in accordance with standard procedures so that the results could be compared with other laboratories if necessary.

3.1.2 Representativeness

Representativeness is a quantity, which presents whether the results of analysis accurately portray the actual site conditions. Representativeness is a qualitative parameter, which signifies the extent of accuracy and precision, to which the data represent a characteristic population, parameter variations at a sampling point, process condition, or environmental conditions. The sampling procedures described within the approved QAPP (Eco & Associates, Inc., final version, April 2011) are designed to provide samples representative of the site conditions.

3.2 Quantitative QA Objectives

Quantitative QA Objectives for analytical data are defined as precision, accuracy, completeness, and method quantitation limits. These quantitative parameters are established in order to monitor the overall quality of analytical data produced by the laboratory. The laboratory performing the analytical methods specified in Table 2-1, and the case narratives, which is included in the data package from the laboratory, ensures the quality of the analytical data.

3.2.1 Precision

Precision is a measure of the closeness with which multiple analyses of a given sample agree with each other. It describes the agreement between two or more measurements that have been made in exactly the same way. Precision is measured through matrix spike/matrix spike duplicate samples, surrogate standards, and laboratory control samples. The relative percent difference (RPD) is calculated as a means of quantifying precision. The following equation is used for this purpose:

$$\text{RPD} = \frac{R_1 - R_2}{(R_1 + R_2)/2} \times 100$$

Where:

RPD = Relative percent difference

R₁ = Result of the first duplicate or measured sample concentration

R₂ = Result of the second duplicate or known sample or duplicate concentration

When analytes are present at concentrations below or near the quantitation limit, precision is measured, using MS/MSD, and/or LCS/LCSD results.

Precision results are discussed in Section 4.0 of this report.

3.2.2 Accuracy

Accuracy indicates the closeness of the measurement to its true or accepted value. Accuracy measures agreement between a result and its true value. Method-specific QA objectives for precision and accuracy were based on the quality control limits developed by the laboratory for the analytical methods, specified in Table 2-1. These procedures may affect the accuracy of the data presented. Additionally, initial and continuing calibrations were used to verify that the analytical instrument accurately measured the compound concentrations. Calculations were independently verified for the response factors and percent differences (%Ds).

3.2.3 Completeness

Completeness is defined as the percentage of total measurements, which are judged to be valid. The completeness objective is to obtain a sufficient amount of valid data to enable the goals and objectives of the project to be achieved.

Completeness is quantified by computing the fraction of reports, which remained valid after the sampling procedures were reviewed and the results conformed to QA/QC protocols. The following equation was used to calculate completeness:

$$\text{Completeness} = \frac{\text{No. of valid field samples analyzed}}{\text{No. of valid field samples collected}} \times 100$$

Completeness is affected by anything that reduces the number of samples analyzed (such as a sample bottle breaking), as well as acceptance or non-acceptance of analytical results.

4.0 DATA VALIDATION

This data review covers seven (7) water samples listed on page 8 including dilutions and reanalysis if applicable. The analyses were according to the following EPA Methods:

EPA Method 8260B for volatile organic compounds

EPA Method 8260B SIM for fumigants (EDB, DBCP and 1, 2, 3-Trichloropropane)

EPA Method 8151A for Chlorinated Herbicides (Dinoseb)

Anions (Nitrite-N, Nitrate-N and Sulfate) by IC, EPA Method 300.0

Total Organic Carbon; Method 415.1

Ferrous Iron by Standard Method 3500

Total Sulfide by Standard Method 4500-S2D

Methane and dissolved Hydrogen by EPA Method RSK175

This review follows USEPA Analytical Operations/Data Quality Center (AOC) *National Functional Guidelines for Organic Data Review* (USEPA, August 2002); and EM 200-1-10 *Guidance for Evaluating Performance-based Chemical Data*, US Army Corps of Engineers (USACE), June 2005. The following subsections correlate to the above guidelines.

A summary table summarizing all data and qualification, if any is provided at the end of this report. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

The following are definitions of the data qualifiers:

- U Indicates the compound was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None indicates the finding did not significantly impact the data; therefore qualification was not required.

4.1. VOC (EPA Method 5030B/8260B)

Technical Holding Times

A 14-day technical holding time requirement was met for all the samples. A total of seven (7) ground water samples were collected on 10-24-12. All samples and sample dilutions were analyzed on 10-30-12. Samples, QC samples and sample dilutions were analyzed with reference to one analytical batch (preparation batch: VO06J22).

The chain-of-custody was reviewed for documentation of sample information and method of analysis.

Table 1 in appendix A summarizes the list of samples with the results and qualification notations.

Tuning criteria

The performance of the instrument was checked by injection of a single component tune check standard (BFB: Bromofluorobenzene) prior to initial calibration on 08-15-12. At the start of analytical batch on 10-30-12, the tune check standard was also injected. All the mass ratio requirements were within the assigned criteria.

Initial Calibration

Ground water samples were analyzed with reference to one set of initial calibration using GC/MSD with instrument ID # TO-06. Initial calibration curve was generated on 08-15-12. A multilevel calibration curve ranging from 0.3µg/L to 100µg/L was used for this purpose. Internal standard curve type was used for initial calibration. Minimum response factor for system performance check compounds (SPCCs) were within the method acceptable limits. Response factors at each level were randomly recalculated and all agreed with the response factors presented in the initial calibration summary table.

Minimum average response factors for the system performance check compounds (SPCCs) for each instrument were recognized according to the following tables:

Table 4.1.1: System Performance Check Compounds (Initial calibration)

System Performance check compounds (SPCCs)	Min. Ave. Response Factor (Method limits)	Ave. Res. Factor 08-15-12 (Calculated) Instrument ID#: T-O06
Chloromethane	≥ 0.10	0.310
1,1 -dichloroethane	≥ 0.10	0.637
Bromoform	≥ 0.10	0.348
Chlorobenzene	≥ 0.30	0.939
1,1,2,2-Tetrachloroethane	≥ 0.30	0.625

Average response factor curve fit was mainly used to show linearity within initial calibration levels for each compound. Maximum 15% RSD limit was met for most of the target compounds.

Least square linear regression curve fit was used for the following compounds where %RSD exceeded the maximum 15 percent limit.

Target Analytes	Least Square Linear Regression (CCF) 08-15-12 Instrument ID#: T-O06
Methylene chloride	0.9963
Tetrahydrofuran	0.9958
Bromoform	0.9971

Calibration check compounds (CCCs) met the acceptance criteria for %RSD among the response factors calculated for each level. The method acceptance limits and the calculated %RSD among the response factors for initial calibration are listed in table 4.1.2.

Table 4.1.2 Calibration Check Compounds (CCCs): Initial Calibration

Calibration Check Compounds (CCCs)	Response Factors %RSD (Limit)	Response Factors %RSD 08-15-12 Instrument ID#: T-O06
1,1-Dichloroethene	$\leq 30\%$	4.54
Chloroform	$\leq 30\%$	6.39
1,2-Dichloropropane	$\leq 30\%$	4.61
Toluene	$\leq 30\%$	6.76
Ethyl benzene	$\leq 30\%$	9.90
Vinyl chloride	$\leq 30\%$	13.2

Initial Calibration Verification and Continuing Calibration verification (Daily Calibration)

Initial calibration was verified by a second source standard at the end of calibration and before sample analysis on 08-16-12. Percent differences (%D) between initial calibration average response factors (RRFs) and the initial calibration verification response factors (RFs) were less than or equal to 20% for all target compounds.

One continuing calibration check standard was analyzed at the beginning of analytical shift on 10-30-12. Prior to continuing calibration standard analysis, **instrument performance check standard** (BFB tune check) was carried out. It passed all the method tuning criteria.

The minimum average response factors for the system performance check compounds (SPCCs) for continuing calibration standards were all within the method limits. The following table list average response factors for system performance check compounds.

Table 4.1.3: System Performance Check Compounds: (Daily calibration)

System Performance Check compounds (SPCCs)	Minimum response factor (Method limits)	Second source St.	Continuing cal.
		Response factors CCRF 08-16-12	Response factors CCRF 10-30-12
Chloromethane	≥ 0.10	0.325	0.329
1,1-Dichloroethane	≥ 0.10	0.608	0.655
Chlorobenzene	≥ 0.10	0.936	1.016
Bromoform	≥ 0.30	0.393	0.368
1,1,2,2-Tetrachloroethane	≥ 0.30	0.672	0.608

Calculated percent differences (%drift) between initial calibration RRFs (average response factors) and the continuing calibration response factors (CCRF) were less than or equal to 20% for all the Calibration Check Compounds (CCCs) and less than or equal to 20% for all other target analytes. The area counts for all internal standards were within ± 50-150 percent of the same level in the initial calibration. The calculated % difference between RFs from continuing calibration and average response factors from initial calibration is summarized in Table 4.1.4 for continuing calibration compounds as follows:

Table 4.1.4 Calibration Check Compounds (CCCs): ICV and Daily Calibration

Calibration Check Compounds (CCCs)	%Deviation From Initial calibration (Acceptance Limit)	Deviation from Initial calibration 2 nd source (08-16-12)	Deviation from Initial calibration Daily calibration (10-30-12)
Vinyl chloride	≤ 20%	3.0%	6.1%
1,1-Dichloroethene	≤ 20%	1.3%	1.7%
Chloroform	≤ 20%	2.8%	4.3%
1,2-Dichloropropane	≤ 20%	0.3%	2.1%
Toluene	≤ 20%	1.3%	3.3%
Ethyl benzene	≤ 20%	0.60%	4.2%

Deviation from the initial calibration was less than 20 percent for the rest of target list (Non-CC compounds). However, percent difference exceeded 20% maximum level for Tetrahydrofurn (23.4%).

Quality Control: The QC samples reported consisted of one method blank, one set of LCS/LCSD and MS/MSD. Client's designated sample (10-24-12-WB2-3) was spiked for precision as MS/MSD. The full list of target compounds were spiked and reported for LCS/LCSD and MS/MSD. Percent recoveries and percent RPDs for all the QC samples reported were within the project acceptance limits for all reported compounds.

The results, percent recoveries and RPDs were recalculated randomly and all agreed with the reported QC summary table.

Method blank: One method blank was presented with the data package, analyzed on 10-30-12. Method blank was reported as non-detected for all the analytes in the target list.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-3 was identified as field duplicate of sample 10-24-12-WB2-2. Results of positive hits for each sample and corresponding sample duplicate are shown in the following table:

Analyte	10-24-12 FDUP-3 µg/L	10-24-12 WB2-2 µg/L	%RPD
1,2,3-Trichloropropane	5.6	5.7	1.77%
1,2-Dichloropropane	1.1	0.99J	11.4%

Surrogate recoveries were all within the method's acceptance limits. The reported results for each sample are incorporated in table 1 in appendix A.

Raw data for one sample, 10-24-12- PWB-7A, was submitted as level IV data deliverable. Raw data for all associated QC samples were also included as Level IV data deliverable. The results calculated from the raw data, agreed with all the results reported in data summary reports. The sample results together with the surrogate recoveries are tabulated in table 1 appendix A.

4.2. EPA Method 5030B/8260B SIM (FUMIGANTS)

Technical Holding Times

A 14-day technical holding time requirement was met for all the samples. A total of six (6) ground water samples were collected on 10-24-12. All samples and QC samples were analyzed on 10-31-12. Samples and QC samples were analyzed with reference to one preparation batch (VO05J23).

The chain-of-custody was reviewed for documentation of sample information and method of analysis. Samples were analyzed for three fumigants: 1,2-Dibromomethane (EDB), 1,2,3-Trichloropropane (TCP), and 1,2-Dibromo-3-chloropropane (DBCP). A Mass detector at Selected Ion Monitoring mode (SIM) was used to achieve low detection limits required for the target compounds.

Table 2 in appendix A summarizes the list of samples with the results and qualification notations.

Tuning criteria

The performance of the instrument was checked by injection of a single component tune check standard (BFB: Bromofluorobenzene) prior to initial calibration and at the start of each analytical batch. All mass ratios were within the method assigned criteria.

Initial Calibration

Ground water samples were analyzed with reference to one set of initial calibration using purge and trap together with GC/MSD at selected ion monitoring mode. Instrument ID # T-O05 was used for the analysis. Initial calibration curve was generated on 10-09-12. A multilevel calibration curve ranging from 5ng/L (ppt) to 1000ng/L (ppt) was used for this purpose. Instrument performance check standard (BFB) was analyzed prior to initial calibration. It passed all the tuning criteria. Modified version of SW-846 8260B (SIM) was used for generation of calibration curve and data. Internal standard curve type was used for initial calibration. Minimum response factor for all the target compounds were within the method acceptable limits. Average response factor curve fit was used to show linearity. Percent relative standard deviation (%RSD) among response factors was less than 15% for all target analytes. Using results from raw data, response factors at each level were randomly recalculated and all agreed with the response factors submitted in the initial calibration summary table.

Initial Calibration Verification and Continuing Calibration (Daily calibration)

The initial calibration curve was verified by a second source standard (ICV) at the end of calibration and before sample analysis on 10-10-12. Quality control criteria regarding minimum response factors were within methods, acceptance limits. Percent differences (%D) between initial calibration average response factors (RRFs) and the initial calibration verification response factors (RFs) were less than or equal to 20% for all target compounds.

Continuing calibration check standard was analyzed at the beginning of analytical shift on 10-31-12. Prior to each continuing calibration, instrument performance check standard (BFB tune check) was carried out. Instrument mass ratios were all within specification of the method.

The calculated % difference (%D) between RFs from continuing calibration and average response factors from initial calibration is summarized in Table 4.2.1 for the targets of interest in this method as follows:

Table 4.2.1: Percent difference from initial calibration: (Daily calibration)

Target Compounds	% Deviation From Initial Calibration Method Criteria	% Deviation From Initial Calibration 2nd Source St. (Calculated) (10-10-12)	% Deviation From Initial Calibration Daily St. (Calculated) (10-29-12)
1,2-Dibromomethane (EDB)	≤ 20%	5.7%	3.1%
1,2,3-Trichloropropane(TCP)	≤ 20%	7.5%	2.9%
1,2-Dibromo-3-chloropropane (DBCP)	≤ 20%	8.8%	10.8%

Calculated percent differences (%drift) between initial calibration RRFs (average response factors) and the continuing calibration response factors (CCRF) were less than or equal to 20% for all target analytes. The area counts for all internal standards were within ± 50-150 percent of the same level in the initial calibration.

Quality Control: The QC samples reported consisted of one method blank, one set of LCS/LCSD and MS/MSD. Client's designated sample (10-24-12-WB2-3) was spiked for precision as MS/MSD. All three target compounds were spiked and reported for LCS/LCSD and MS/MSD. Percent recoveries and percent RPDs for LCS/LCSD and MS/MSD were within the project acceptance limits for all reported compounds. However, recovery of 1,2,3-trichloropropane exceeded maximum acceptance limit of 125% in MS (134%).

The results, percent recoveries and RPDs were recalculated randomly and all agreed with the reported QC summary tables.

Method blank: One method blank was presented with the data package (analyzed on 10-31-12,). Method blanks were reported as non-detected for all analytes in the target list.

Surrogate recoveries were all within the method's acceptance limits. The reported results for each sample are incorporated in table 1 in appendix A.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-3 was identified as field duplicate of sample 10-24-12-WB2-2. Results of positive hits for each sample and corresponding sample duplicate are shown in the following table:

Analyte	10-24-12 FDUP-3 µg/L	10-24-12 WB2-2 µg/L	%RPD
1,2-Dibromoethane (EDB)	ND	ND	NA
1,2-Dibromo-3-chloropropane	0.29	0.30	3.39%
1, 2,3-Trichloropropane	8.6	9.3	7.82%

Raw data for one sample, 10-24-12- PWB-7A, together with all further dilutions was submitted as level IV data deliverable. Raw data for all associated QC samples were also included as Level IV data deliverable. The results calculated from the raw data, agreed with all the results reported in data summary reports. The sample results together with the surrogate recoveries are tabulated in table 2 Appendix A.

4.3 DINOSEB BY GC/ECD (EPA Method 8151A)

Technical Holding Times

A 7-day technical holding time from sample collection to extraction and 40-day from extraction to analysis was met for all samples. A total of six (6) ground water samples were collected on 10-24-12. Samples were extracted with one preparation batch on 10-30-12 (preparation batch # HEJ010W). Sample extracts were all analyzed within 40-day holding time on 10-31-12 and 11-01-12.

EPA Method 8151A uses GC equipped with two Electron Capture Detectors (ECDs) and two columns connected to the same injection port for analysis. Results and raw data generated from both columns were submitted. Chlorinated Herbicides (Dinoseb) was determined by this method.

Initial Calibration

Samples were analyzed with reference to one initial calibration generated on 10-30-12. Seven calibration levels (20-200 µg/L) were used in initial calibration. Channel A and B were both calibrated. External standard curve type was used for calibration. Calibration factor (area for each compound versus concentration) was used for calculation. Average response factor was used to show linearity for each channel. Percent relative standard deviation (%RSD) among calibration factors (CFs) for both channel A and B were less than 20%. Retention time window width was established by using initial calibration standards at each level. All further sample and QC analysis identification were based on the assigned retention time windows set by initial calibration for each peak. The instrument was calibrated for the full list of Herbicides, both for initial calibration and continuing (daily calibration), but the result of analysis was reported only for Dinoseb.

Initial Calibration Verification (ICV) and Continuing (Daily) Calibration

Initial calibration curve was verified by a second source standard at the end of calibration and prior to sample analysis on 10-30-12. Percent difference between mean calibration factors from initial calibration and calibration factors calculated from the second source were less than 15% for both Dinoseb and MCP (used as surrogate).

Six continuing calibration standards with intervals of 10 sample injections were analyzed with samples, and QC samples. Samples were all analyzed on 10-31-12 and 11-01-12. Percent difference between initial calibration average response factors and the response factors calculated for Dinoseb from continuing calibrations were less than 20% for all standards. Recovery of Dinoseb for two of the daily check standards were biased high in column B only. Results for surrogate recoveries and QC samples were reported from both channel A and B.

Quality Control samples consisted of method blank, one set of LCS/LCSD and MS/MSD for preparation batch #HEJ010W. Client designated sample 10-24-12-WB2-3 was spiked for accuracy and precision. Full Herbicide list was spiked for LCS/LCSD and MS/MSD, but only Dinoseb and MCP (as surrogate) were reported for precision and accuracy. Percent

recoveries (%R) were within the project established QC limits for LCS. Recovery of Dinoseb failed the lower acceptance limit in MS as shown below:

Target compound	10-24-12- WB2-3 MS %Recovery	10-24-12- WB2-3 MSD %Recovery	Acceptance limits%
Dinoseb	17*	40	20-100

*Failed QC acceptance limits

Calculated %RPD was less than 30% acceptance limit.

Method blank was reviewed for each component and no herbicide was found in the method blank for the extraction batch # HEJ010W.

Surrogate recoveries were all within the method's acceptable limits for all initial analyses. The calculated result for each sample is incorporated in table 3 in Appendix A.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-3 was recognized as field duplicate of sample 10-24-12-WB2-2 Results of analysis for each sample and corresponding sample duplicates are shown in the following table:

Analyte	10-24-12 FDUP-3 µg/L	10-24-12 WB2-2 µg/L	%RPD
Dinoseb	0.91	0.90	1.1%

Raw data for one sample, 10-24-12- PWB-7A, with related QC samples and dilutions were submitted at level IV deliverable. Raw data responses were used in recalculation and all verified the reported values.

4.4 Method 300.0: Anions

A total of six (6) ground water samples were collected on 10-24-12. Samples were analyzed for Nitrate-N, Nitrite-N and Sulfate using Ion Chromatography (IC) on 10-25-12 and 10-26-12. All the field samples and dilutions were analyzed within 48-hour holding time requirement.

Anions such as Nitrate-N, Nitrite-N and Sulfate were separated from water samples by Ion chromatography. The separated anions in their acid form (very conductive) were measured by conductivity. They were identified on the basis of retention time as compared to previously established time window by reference standards.

One set of initial calibration curve (ranging from 0.05 to 20 mg/L) was generated on 10-24-12. Instrument was initially calibrated with nine calibration levels. Linear curve type with correlation coefficients of at least 0.999 was used for each anion throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (concentration of each anion versus area count of each anion) was presented for each target compound. Area for each level was randomly checked with the values and equations presented with each calibration curve. All agreed with the raw data. A second source standard mixture at mid-point (1.0mg/L) was used to verify the linearity of initial calibration for each anion on 10-24-12. Recoveries were all within 90-110% of initial value.

Daily (Continuing) Calibrations:

Three continuing calibration standards were analyzed on 10-25-12 and 10-26-12 with intervals of ten injections. Continuing calibration standards were analyzed with samples, sample dilutions and QC samples. The recoveries of target anions were within 90-110% of the expected values in all submitted continuing calibration standards. After each continuing calibration standard, one calibration blank was injected. All the blanks were reported as non-detected regarding all the target anions.

Quality Control Samples consisted of two method blanks, two sets of LCS/LCSD, sample duplicate and MS/MSD for each requested anion. Sample 10-24-12-WB2-3 was spiked for MS/MSD and also analyzed as sample duplicate. Recoveries of LCS/LCSD were within 90-110 % of spiked values and that of MS/MSD was within 80-120%, all covering the QC limits

requirements. Percent RPDs were less than 20% for LCS/LCSD and MS/MSD. Each QC set was analyzed with the same dilution factor as the one used for reporting the corresponding anion.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-3 was identified as field duplicate of sample 10-24-12-WB2-2. Results of analysis for sample and corresponding sample duplicate are shown in the following table:

Analyte	10-24-12 FDUP-1 µg/L	10-24-12 WB2-2 µg/L	%RPD
Nitrate-N	38.6	38.6	<1%
Nitrite-N	ND	ND	NA
Sulfate	98.7	97.0	1.74%

Raw data for one sample (10-24-12- PWB-7A) with corresponding dilutions and all related QC samples were submitted for level IV data review. Raw data for samples with all QC samples and dilutions was reviewed comprehensively. The recalculated values from raw data agreed with the result submitted.

4.5 Total Organic Carbon (TOC) by EPA Method 415.1

A total of six (6) ground water samples were collected on 10-24-12. Samples were analyzed for Total Organic Carbon (TOC) on 10-29-12, within 28-days holding time requirement. Organically bound carbons in water are measured by oxidation or combustion of organic molecules to single smaller molecules. TOC analyzers utilize high temperature combustion to convert Organic Carbon to carbon dioxide, which is measured by the analyzer. Non-Purgable Organic Carbon (NPOC) is the target of interest.

One set of initial calibration curve with at least 5 calibration levels (ranging from 1.0mg/L to 80 mg/L) was generated on 10-29-12. Linear curve type with correlation coefficients of at least 0.999851 was used throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (area versus concentration) was presented for Non-purgable Organic Carbon. Results for each level was randomly checked with the values and equations presented with the calibration curve. All agreed with the raw data.

A second source standard mixture at mid-point of the calibration curve (25mg/L) was used to verify the linearity of initial calibration on 10-29-12. Recoveries were all within 90-110% of initial value. Continuing calibration standards, together with continuing calibration blanks were analyzed at 10-injection intervals on 10-29-12. They all passed the assigned calibration criteria.

Quality Control Samples consisted of method blank, one set of LCS/LCSD and MS/MSD. Sample 10-24-12-WB2-3 was spiked for MS/MSD. Recoveries of LCS/LCSD were within 80-120 % of spiked values and that of MS/MSD was within 75-125%, all covering the QC limits requirements. Percent RPDs were less than 20% for LCS/LCSD and MS/MSD.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-3 was identified as field duplicate of sample 10-24-12-WB2-2. Results of TOC analysis for each sample and corresponding sample duplicates are shown in the following table:

Analyte	10-24-12 FDUP-3 mg/L	10-24-12 WB2-2 mg/L	%RPD
TOC	0.851J	0.798J	6.43%

Raw data and corresponding chromatogram for all six samples with QC samples were presented with the data package. Four readings were recorded for each sample. Final reported results were average of the four readings for each sample. The sample results are tabulated in table 5 Appendix A.

4.6 Ferrous Iron by Standard Method 3500

A total of six (6) ground water samples were collected on 10-24-12. Samples were analyzed for Ferrous Iron on 10-26-12 (one day past 24-hour holding time). Ferrous Iron (in reduced form) reacts with an oxidation-reduction indicator (o-Phenanthroline), resulting in a colored complex. The intensity of color formed due to reaction, is proportional to the amount of ferrous iron in the solution and can be detected and measured by a spectrophotometer.

One set of initial calibration curve with at least 5 calibration levels (ranging from

2.0mg/L to 25 mg/L) was generated on 10-26-12. Linear curve type with correlation coefficients of at least 0.999628 was used throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (Absorbance versus concentration) was presented for initial calibration standards. Results for each level was randomly checked with the values and equations presented with the calibration curve. All agreed with the raw data.

A second source standard (ICV) mixture at mid-point (15mg/L) was used to verify the linearity of initial calibration on 10-26-12. Recoveries were all within 90-110% of initial value. Three continuing calibration standards (CCV), together with continuing calibration blanks were analyzed with samples and QC samples on 10-26-12. They passed the calibration criteria.

Quality Control Samples consisted of method blank, LCS/LCSD, MS/MSD and sample/sample duplicate. Sample 10-24-12-WB2-3 was spiked for MS/MSD. It was also analyzed as sample duplicate. Recoveries of LCS/LCSD were within the acceptance limit (80-120 % of spiked value). However, recoveries of MS/MSD failed the lower acceptance limit as shown in the following table:

Target compound	10-24-12- WB2-3 MS %Recovery	10-24-12- WB2-3 MSD %Recovery	Acceptance limits%
Ferrous Iron	29%*	29%*	80-120

* Failed QC acceptance limits

Percent RPDs were less than 20% for LCS/LCSD and MS/MSD.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-3 was recognized as field duplicate of sample 10-24-12-WB2-3. Both sample and the corresponding associated sample duplicate were reported as non-detected for Ferrous Iron.

Raw data that include results of analysis and calibration curve was presented for all six samples together with QC samples. The sample results are tabulated in table 6 Appendix A.

4.7 Sulfide by Standard Method SM4500-S2D

A total of six (6) ground water samples were collected on 10-24-12. Samples were analyzed for Total Sulfide on 10-29-12, within seven-day holding time.

The method is based on reaction of Sulfide, Ferric chloride and Amine-sulfuric acid to produce Methylene blue. The intensity of color is proportional to the sulfide concentration in water. The intensity of color resulting from reaction can be detected and measured by a spectrophotometer.

One set of initial calibration curve with at least 5 calibration levels (ranging from 0.1mg/L to 1 mg/L) was generated on 10-29-12. Linear curve type with correlation coefficient of at least 0.999259 was used throughout analysis. Percent RSD among calibration factors was less than 15%. Calibration curve (Absorbance versus concentration of standard solutions), together with related equations was presented. Results for each level was randomly checked with the values and equations presented with the calibration curve. All agreed with the raw data.

A second source standard mixture at mid-point (0.5mg/L) was used to verify the linearity of each initial calibration on 10-29-12. Recoveries were all within 90-110% of initial value. Two continuing calibration standards, together with continuing calibration blanks were analyzed with samples and QC samples on 10-29-12. They passed the calibration criteria.

Quality Control Samples consisted of one method blank, one set of LCS/LCSD, one MS and a sample duplicate. Sample 10-24-12-WB2-3 was spiked as MS and analyzed as sample duplicate as well. Recoveries of LCS/LCSD and MS were within 80-120 %, covering the QC limits requirements of spiked values. Percent RPDs were less than 20% for both sets of LCS/LCSD. Sample and sample duplicate results were reported as non-detected.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-3 was recognized as field duplicate of sample 10-24-12-WB2-2. Both field sample and associated field duplicate sample were reported as non-detected for total Sulfide.

Raw data (results of analysis together with the calibration curve) for all six samples together with QC samples were presented with the data package. The sample results are tabulated in table 7 Appendix A.

4.8. METHANE and DISSOLVED HYDROGEN by EPA Method RSK175

Technical Holding Times

A 14-day technical holding time from sample collection to analysis was met for all samples. A total of six (6) ground water samples were collected on 10-24-12. Samples were all analyzed within the 14-day holding time on 11-05-12 and 11-06-12.

EPA Method RSK175 uses GC equipped with a thermal conductivity detector (TCD) and a flame ionization detector (FID). Sample from headspace is injected into a GC with a single column connected to two detectors in series. GC/FID response was used for Methane and GC/TCD response was used for Hydrogen.

Results and raw data generated from both detectors were submitted. Methane and dissolved hydrogen were determined by this method.

Initial Calibration

Samples were analyzed with reference to one initial calibration for each gas. GC/TCD was calibrated with five calibration levels (1000-50000 ppmv for Hydrogen) on 11-03-2011 and GC/FID was calibrated with five calibration levels (3-10000ppmv for Methane) on 02-27-12. The same instrument was used (instrument ID#GC8A) for both detectors but samples were injected separately for each calibration/detector. Both detectors were calibrated. External standard curve type was used for calibration. Calibration factor (area for each compound versus concentration) was used for calculation. Average response factor was used to show linearity for each channel.

Percent relative standard deviation (%RSD) among calibration factors (CFs) for both detectors (TCD) and (FID) were less than 20% with correlation coefficient of 0.999818 for Hydrogen and 0.999989 for Methane. Retention time window width was established by using

initial calibration standards at each level. All further sample and QC analysis identification were based on the assigned time windows set by initial calibration for each peak. The instrument was calibrated for methane at least eighteen month prior to sample analysis.

Initial Calibration Verification (ICV) and Continuing (Daily) Calibration

Initial calibration verification standard (ICV) was submitted for Hydrogen (TCD detector). Raw data for initial calibration verification standard (ICV) was missing from the data package for Methane (FID detector). EMAX Laboratory was informed to provide the missing data. Percent difference was less than 20% for both detectors. Two continuing calibration standards with intervals of 10 sample injections were analyzed with samples and all the QC samples. All samples and QC samples were analyzed on 11-05-12 and 11-06-12. Percent difference between initial calibration average response factors and the response factors calculated for each analyte from continuing calibrations were less than 20% for all standards.

Quality Control samples consisted of one method blank, one set of LCS/LCSD and MS/MSD. Client designated sample 10-24-12-WB2-3 was spiked for accuracy and precision. Both Hydrogen and Methane were spiked and reported for LCS/LCSD and MS/MSD. Percent recoveries (%R) were within the project established QC limits for LCS/LCSD and MS/MSD. Calculated %RPD was less than 30% acceptance limit.

Method blank was reviewed for each component and no target analyte was found in the method blank for each detector.

Surrogate: No surrogate is used in this method.

Field duplicate sample and its associated sample: Sample 10-24-12-FDUP-3 was recognized as field duplicate of sample 10-24-12-WB2-2. Both field samples and associated field duplicate samples were reported as non-detected for Hydrogen and Methane.

Raw data for all six samples, with related QC samples were submitted at level IV deliverable. Raw data for samples and QC samples were submitted for both detectors (FID for

Methane, and TCD for Hydrogen). Raw data responses were used in recalculation and all verified the reported values.

5.0 Conclusion

Overall, the data presented is generally regarded as acceptable for all the EPA methods listed in the chain of custody. The data can reliably be used for the purpose of this project.

6.0 References

1. *USEPA Analytical Operations/Data Quality Center (AOC) National Functional Guidelines for Organic Data Review* (USEPA, August 2002).
2. *Quality Assurance Project Plan, final Draft, Brown & Bryant, CA*, (Project No. Eco-11-501, Eco & Associates Inc., April 2011)
3. U.S. Environmental Protection Agency, Dec. 1996, *SW846 Laboratory Manual Physical/Chemical Methods*. Revision 3, Washington, D.C. 20460.
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5. Department of Defense Quality System Manual (DOD QSM), Version 4.2, 2010
6. EPA Methods for Chemical Analysis of Water and Wastes. EPA -600-4-79-020. Revised; March 1983.
7. Standard Methods for Examination of Water and Wastewater. 21st Edition, 2005.

7.0 APPENDIX A

Table 1-Volatile Organic Compounds component List: EPA Method 8260B

ANALYTE	RLs µg/L	10-24-12- TB-2	10-24-12- WB2-3	10-24-12- PWB-15	10-24-12- PWB-2	10-24-12- PWB-7A	10-24-12- WB2-2
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Acetone	10	U	U	U	U	U	U
Benzene	1.0	U	U	U	U	U	U
Bromobenzene	1.0	U	U	U	U	U	U
Bromochloromethane	1.0	U	U	U	U	U	U
Bromodichloromethane	1.0	U	U	U	U	U	U
Bromoform	1.0	U	U	U	U	U	U
Bromomethane	1.0	U	U	U	U	U	U
2-Butanone	10	U	U	U	U	U	U
n-Butylbenzene	1.0	U	U	U	U	U	U
sec-Butylbenzene	1.0	U	U	U	U	U	U
tert-Butylbenzene	1.0	U	U	U	U	U	U
Carbon Disulfide	1.0	U	U	U	U	U	U
Carbon Tetrachloride	1.0	U	U	U	U	U	U
Chlorobenzene	1.0	U	U	U	U	U	U
Chloroethane	1.0	U	U	U	U	U	U
2-ChloroethylVinylether	1.0	U	U	U	U	U	U
Chloroform	1.0	U	0.52J	8.7	2.1	0.54J	U
Chloromethane	1.0	U	0.42J	U	U	U	U
2-Chlorotoluene	1.0	U	U	U	U	U	U
4-Chlorotoluene	1.0	U	U	U	U	U	U
1,2Dibromo3Chloropropane	1.0	U	U	U	U	1.3	U
Dibromochloromethane	1.0	U	U	U	U	U	U
1,2-Dibromoethane(EDB)	1.0	U	U	U	U	U	U
Dibromomethane	1.0	U	U	U	U	U	U
1,2-Dichlorobenzene	1.0	U	U	U	U	U	U
1,3-Dichlorobenzene	1.0	U	U	U	U	U	U
1,4-Dichlorobenzene	1.0	U	U	U	U	U	U
Dichlorodifluoromethan	1.0	U	U	U	U	U	U
1,1-Dichloroethane	1.0	U	U	U	U	U	U
1,2-Dichloroethane	1.0	U	U	U	U	U	U
1,1-Dichloroethene	1.0	U	U	U	U	U	U
Cis-1,2-Dichloroethene	1.0	U	U	U	U	U	U
trans-1,2-Dichloroethene	1.0	U	U	U	U	U	U
1,2-Dichloropropane	1.0	U	1.1	7.9	6.6	17	0.99
1,3-Dichloropropane	0.5	U	U	U	U	U	U
2,2-Dichloropropane	1.0	U	U	U	U	U	U
1,1-Dichloropropene	1.0	U	U	U	U	U	U
cis-1,3-Dichloropropene	1.0	U	U	U	U	U	U
trans-1,3-Dichloropropene	1.0	U	U	U	U	U	U
Ethylbenzene	1.0	U	U	U	U	U	U
Hexachlorobutadiene	1.0	U	U	U	U	U	U
2-Hexanone	10	U	U	U	U	U	U
Isopropylbenzene	1.0	U	U	U	U	U	U

ANALYTE	RLs µg/L	10-24-12- TB-2	10-24-12- WB2-3	10-24-12- PWB-15	10-24-12- PWB-2	10-24-12- PWB-7A	10-24-12- WB2-2
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
p-Isopropyltoluene	1.0	U	U	U	U	U	U
MTBE	1.0	U	U	U	U	U	U
4-Methyl-2-Pentanone	10.0	U	U	U	U	U	U
Methylene chloride	1.0	U	U	U	U	U	U
Naphthalene	1.0	U	U	U	U	U	U
n- Propylbenzene	1.0	U	U	U	U	U	U
Styrene	1.0	U	U	U	U	U	U
1,1,1,2-Tetrachloroethane	1.0	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	1.0	U	U	U	U	U	U
Tetrachloroethene	1.0	U	U	U	0.24J	U	U
Toluene	1.0	U	U	U	U	U	U
1,2,3-Trichlorobenzene	1.0	U	U	U	U	U	U
1,2,4-Trichlorobenzene	1.0	U	U	U	U	U	U
1,1,1-Trichloroethane	1.0	U	U	U	U	U	U
1,1,2-Trichloroethane	1.0	U	U	U	U	U	U
Trichloroethene	1.0	U	U	U	U	U	U
Trichlorofluoromethane	1.0	U	U	U	U	U	U
1,2,3-Trichloropropane	1.0	U	U	0.74J	0.52J	35.0	5.7
1,2,4-Trimethylbenzene	1.0	U	U	U	U	U	U
1,3,5-Trimethylbenzene	1.0	U	U	U	U	U	U
Vinyl Chloride	1.0	U	U	U	U	U	U
o-Xylene	1.0	U	U	U	U	U	U
m- & p-Xylenes	1.0	U	U	U	U	U	U
Surrogate (Limits)	(Limits)	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
1,2Dichloroeth-d4	70-120	87.5	89.8	89.1	90.8	91.2	91.1
4-Bromofluorbenze	75-120	88.1	87.1	86.8	84.3	83.2	86.4
Toluene-d8	85-120	105	104	105	105	107	105
Dibromofluoromethane	85-115	101	101	101	103	102	103

Table 1-Volatile Organic Compounds component List: EPA Method 8260B

ANALYTE	RLs µg/L	10-24-12- FDUP-3 µg/L					
Acetone	10	U					
Benzene	1.0	U					
Bromobenzene	1.0	U					
Bromochloromethane	1.0	U					
Bromodichloromethane	1.0	U					
Bromoform	1.0	U					
Bromomethane	1.0	U					
2-Butanone	10	U					
n-Butylbenzene	1.0	U					
sec-Butylbenzene	1.0	U					
tert-Butylbenzene	1.0	U					
Carbon Disulfide	1.0	U					
Carbon Tetrachloride	1.0	U					
Chlorobenzene	1.0	U					
Chloroethane	1.0	U					
2-ChloroethylVinylether	1.0	U					
Chloroform	1.0	U					
Chloromethane	1.0	U					
2-Chlorotoluene	1.0	U					
4-Chlorotoluene	1.0	U					
1,2Dibromo3Chloropropane	1.0	U					
Dibromochloromethane	1.0	U					
1,2-Dibromoethane(EDB)	1.0	U					
Dibromomethane	1.0	U					
1,2-Dichlorobenzene	1.0	U					
1,3-Dichlorobenzene	1.0	U					
1,4-Dichlorobenzene	1.0	U					
Dichlorodifluoromethan	1.0	U					
1,1-Dichloroethane	1.0	U					
1,2-Dichloroethane	1.0	U					
1,1-Dichloroethene	1.0	U					
Cis-1,2-Dichloroethene	1.0	U					
trans-1,2-Dichloroethene	1.0	U					
1,2-Dichloropropane	1.0	1.1					
1,3-Dichloropropane	0.5	U					
2,2-Dichloropropane	1.0	U					
1,1-Dichloropropene	1.0	U					
cis-1,3-Dichloropropene	1.0	U					

ANALYTE	RLS µg/L	10-24-12- FDUP-3 µg/L					
trans-1,3-Dichloropropene	1.0	U					
Ethylbenzene	1.0	U					
Hexachlorobutadiene	1.0	U					
2-Hexanone	10	U					
Isopropylbenzene	1.0	U					
p-Isopropyltoluene	1.0	U					
MTBE	1.0	U					
4-Methyl-2-Pentanone	10.0	U					
Methylene chloride	1.0	U					
Naphthalene	1.0	U					
n- Propylbenzene	1.0	U					
Styrene	1.0	U					
1,1,1,2-Tetrachloroethane	1.0	U					
1,1,2,2-Tetrachloroethane	1.0	U					
Tetrachloroethene	1.0	U					
Toluene	1.0	U					
1,2,3-Trichlorobenzene	1.0	U					
1,2,4-Trichlorobenzene	1.0	U					
1,1,1-Trichloroethane	1.0	U					
1,1,2-Trichloroethane	1.0	U					
Trichloroethene	1.0	U					
Trichlorofluoromethane	1.0	U					
1,2,3-Trichloropropane	1.0	5.6					
1,2,4-Trimethylbenzene	1.0	U					
1,3,5-Trimethylbenzene	1.0	U					
Vinyl Chloride	1.0	U					
o-Xylene	1.0	U					
m-& p-Xylenes	1.0	U					
Surrogate (Limits)		% Recovery					
1,2Dichloroeth-d4	70-120	95.1					
4-Bromofluorbenze	75-120	84.8					
Toluene-d8	85-120	104					
Dibromofluoromethane	85-115	106					

Table 2-Fumigants (EDB, DBCP & 1, 2, 3-Trichloropropane): EPA Method 8260B (SIM)

ANALYTE	RLs µg/L	10-24-12- WB2-3 µg/L	10-24-12- PWB-15 µg/L	10-24-12- PWB-2 µg/L	10-24-12- PWB-7A µg/L	10-24-12- WB2-2 µg/L	10-24-12- FDUP-3 µg/L
EDB	0.05	ND	ND	ND	ND	ND	ND
DBCP	0.05	ND	0.11	ND	1.3	0.30	0.29
1,2,3-Trichloropropane	0.005	0.50	1.2	1.1	55	9.3	8.6
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
Toluene d8	80-120	95.7	91.5	92.2	85.1	88.4	85.4

Table 3-Herbicides (Dinoseb): EPA Method 8151A

ANALYTE	RLs µg/L	10-24-12- WB2-3 µg/L	10-24-12- PWB-15 µg/L	10-24-12- PWB-2 µg/L	10-24-12- PWB-7A µg/L	10-24-12- WB2-2 µg/L	10-24-12- FDUP-3 µg/L
Dinoseb	0.4	ND	0.36J	ND	17	0.90	0.91
Surrogate parameters	Limits	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery	% Recovery
MCP (Surrogate)	40-140	59.1	95.9	101	136	98.6	95.3

Table 4-Anions (Nitrate-N, Nitrite-N and Sulfate): EPA Method 300.0

ANALYTE	RLs mg/L	10-24-12- WB2-3 mg/L	10-24-12- PWB-15 mg/L	10-24-12- PWB-2 mg/L	10-24-12- PWB-7A mg/L	10-24-12- WB2-2 mg/L	10-24-12- FDUP-3 mg/L
Anions							
Nitrate-N	0.1	5.22	24.6	29.6	53.6	38.6	38.6
Nitrite-N	0.1	12.0	ND	ND	ND	ND	ND
Sulfate	0.5	95.6	77.6	98.7	57.4	97.0	98.7

Table 5-Total Organic Carbon: EPA Method 415.1

ANALYTE	RLs mg/L	10-24-12- WB2-3 mg/L	10-24-12- PWB-15 mg/L	10-24-12- PWB-2 mg/L	10-24-12- PWB-7A mg/L	10-24-12- WB2-2 mg/L	10-24-12- FDUP-3 mg/L
TOC	1.0	0.946J	0.740J	0.735J	0.959J	0.798J	0.851J

Table 6-Ferrous Iron: Standard Method 3500

ANALYTE	RLs mg/L	10-24-12- WB2-3 mg/L	10-24-12- PWB-15 mg/L	10-24-12- PWB-2 mg/L	10-24-12- PWB-7A mg/L	10-24-12- WB2-2 mg/L	10-24-12- FDUP-3 mg/L
Ferrous Iron	2.0	ND	ND	ND	ND	ND	ND

Table 7-Sulfide: Standard Method 4500S2D

ANALYTE	RLs mg/L	10-24-12- WB2-3 mg/L	10-24-12- PWB-15 mg/L	10-24-12- PWB-2 mg/L	10-24-12- PWB-7A mg/L	10-24-12- WB2-2 mg/L	10-24-12- FDUP-3 mg/L
Sulfide	0.1	ND	ND	ND	ND	ND	ND

Table 8- Methane and Dissolved Hydrogen: RSK175

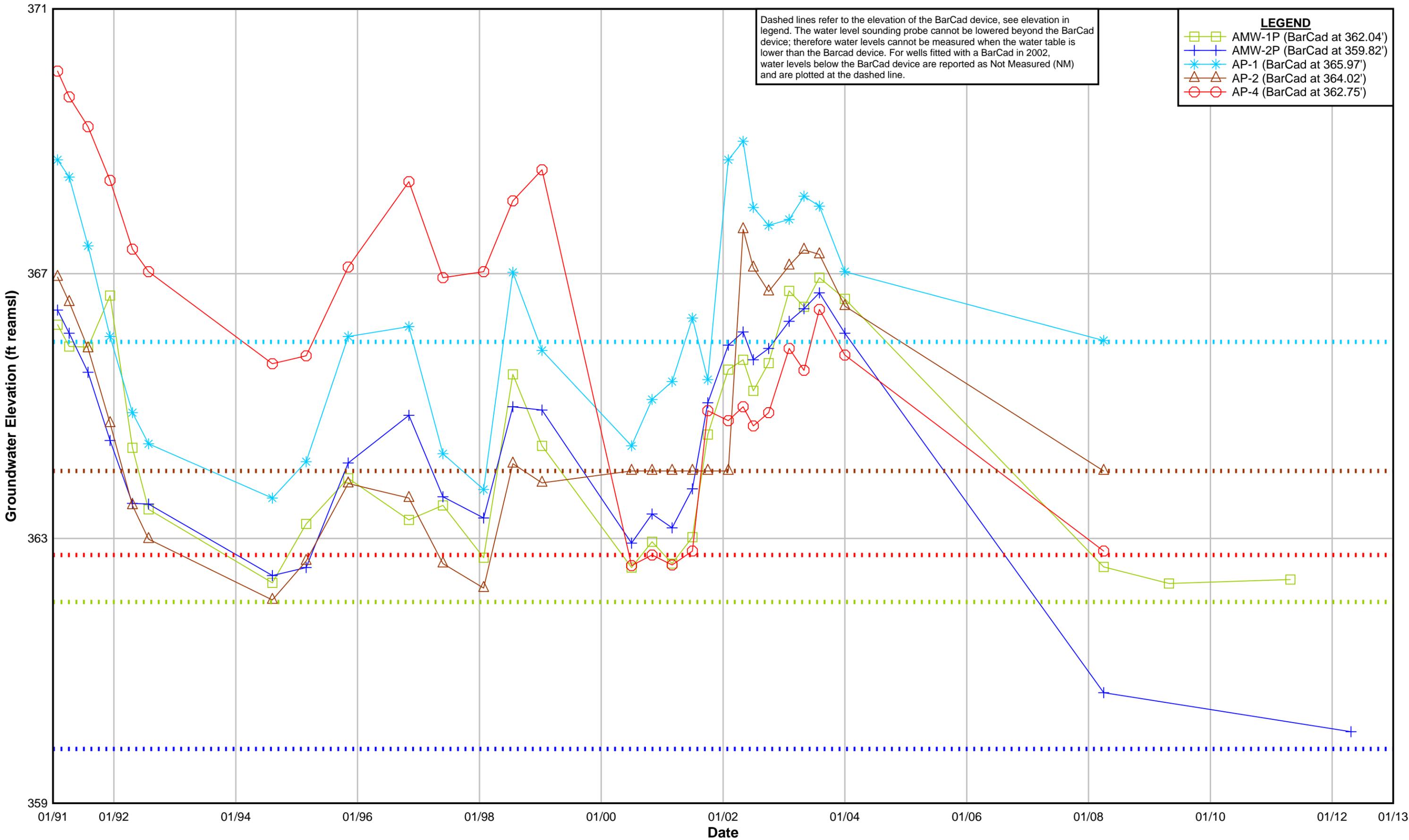
ANALYTE	RLs µg/L	10-24-12- WB2-3 mg/L	10-24-12- PWB-15 mg/L	10-24-12- PWB-2 mg/L	10-24-12- PWB-7A mg/L	10-24-12- WB2-2 mg/L	10-24-12- FDUP-3 mg/L
Hydrogen	1.0	ND	ND	ND	ND	ND	ND
Methane	10	8.8	ND	ND	ND	ND	ND

APPENDIX D

GROUNDWATER ELEVATION GRAPHS

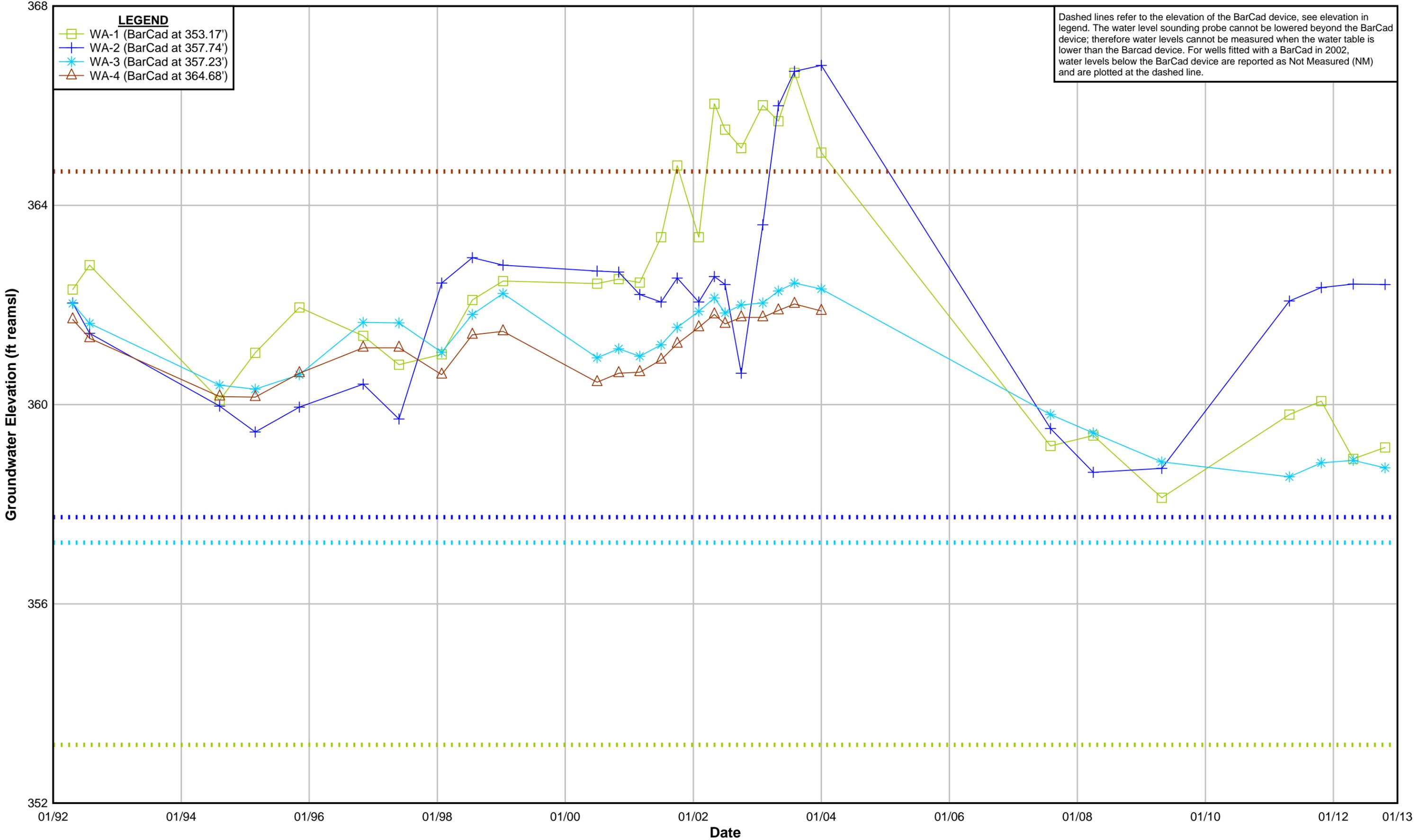
Graph D1: Groundwater Elevations (A-Zone)

AMW-AP Series Wells



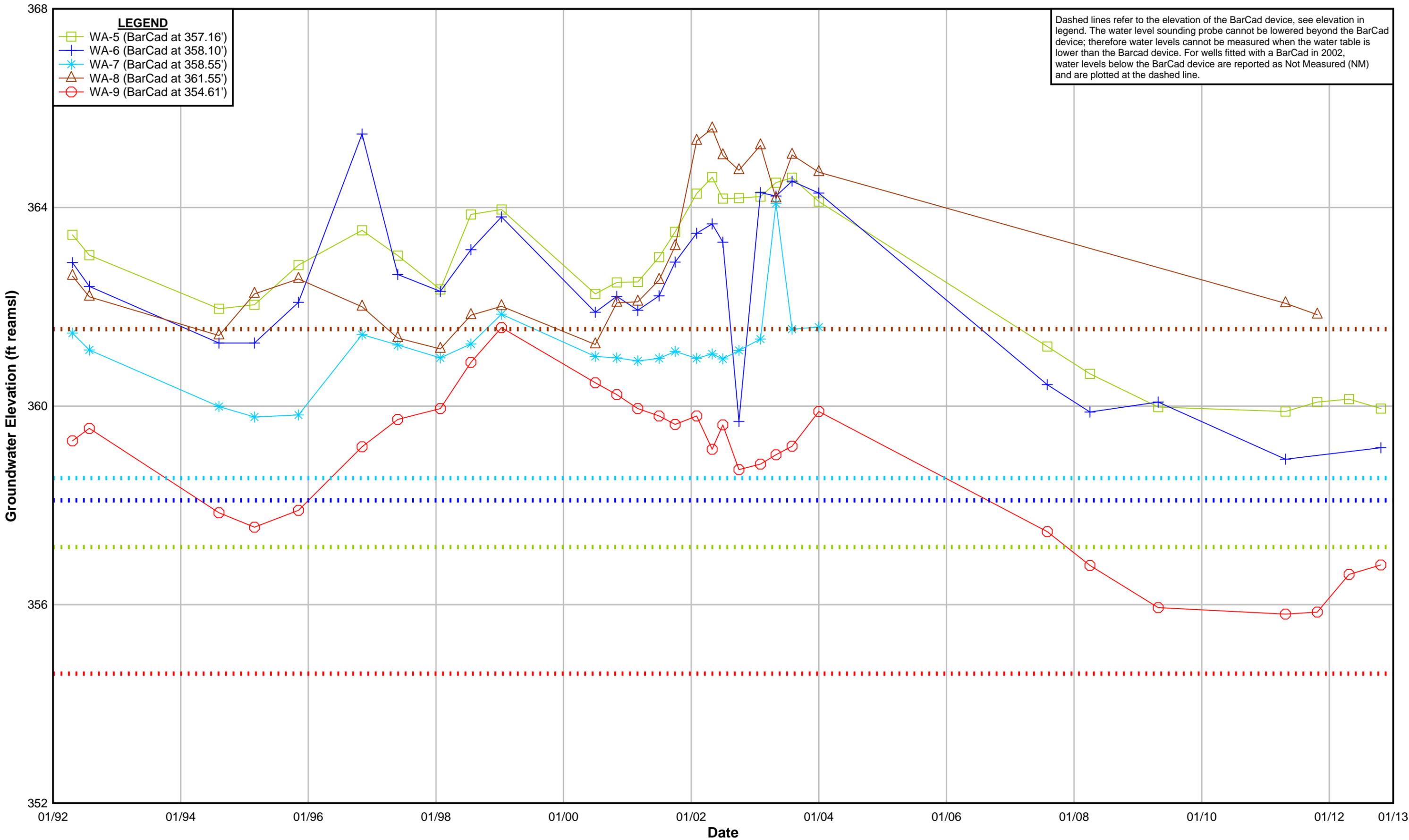
Graph D2: Groundwater Elevations (A-Zone)

WA Series Wells (Part 1)



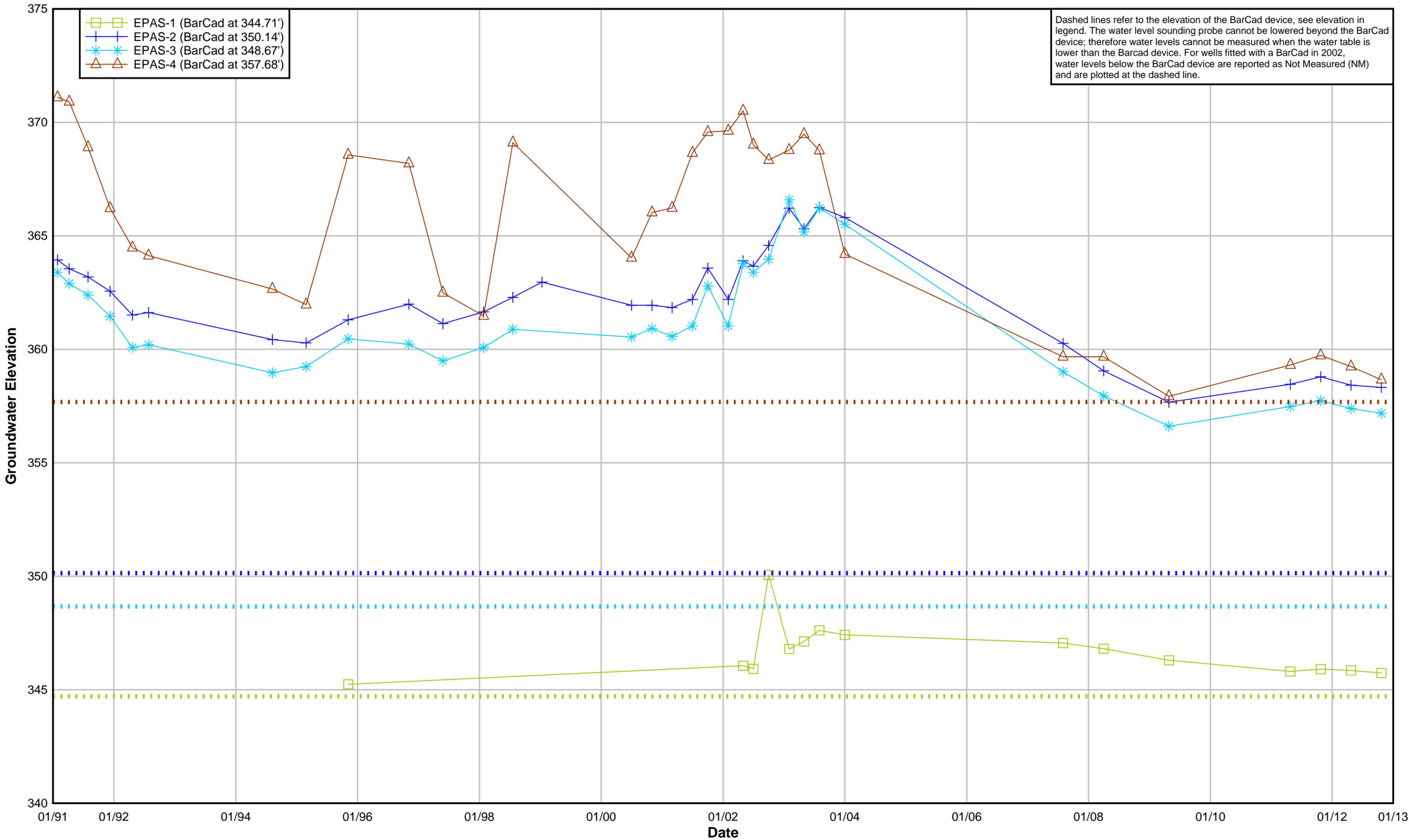
Graph D3: Groundwater Elevations (A-Zone)

WA Series Wells (Part 2)



Graph D4: Groundwater Elevations (A-Zone)

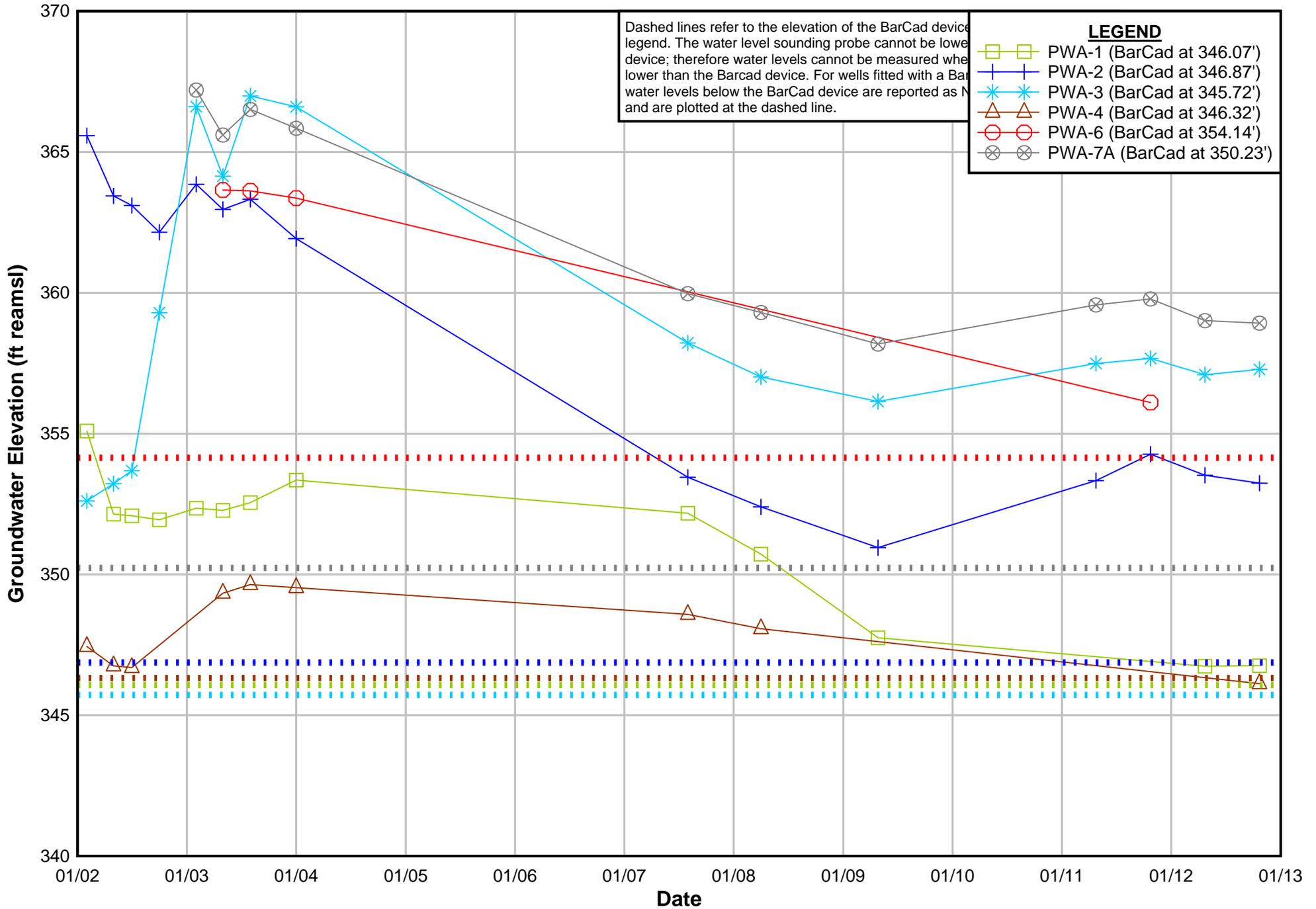
EPAS-Series Wells



Dashed lines refer to the elevation of the BarCad device, see elevation in legend. The water level sounding probe cannot be lowered beyond the BarCad device; therefore water levels cannot be measured when the water table is lower than the Barcad device. For wells fitted with a BarCad in 2002, water levels below the BarCad device are reported as Not Measured (NM) and are plotted at the dashed line.

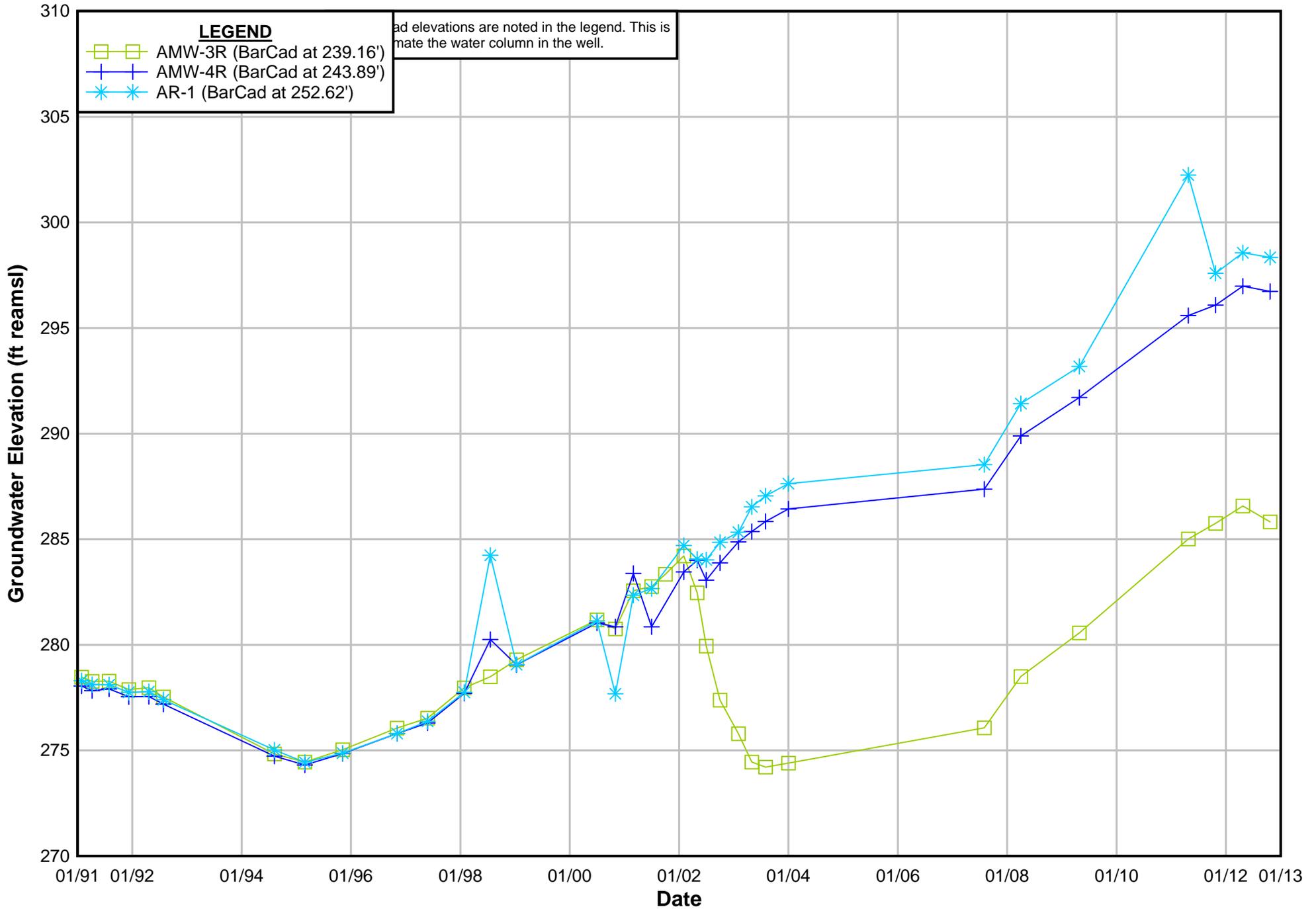
Graph D5: Groundwater Elevations (A-Zone)

PWA Series Wells



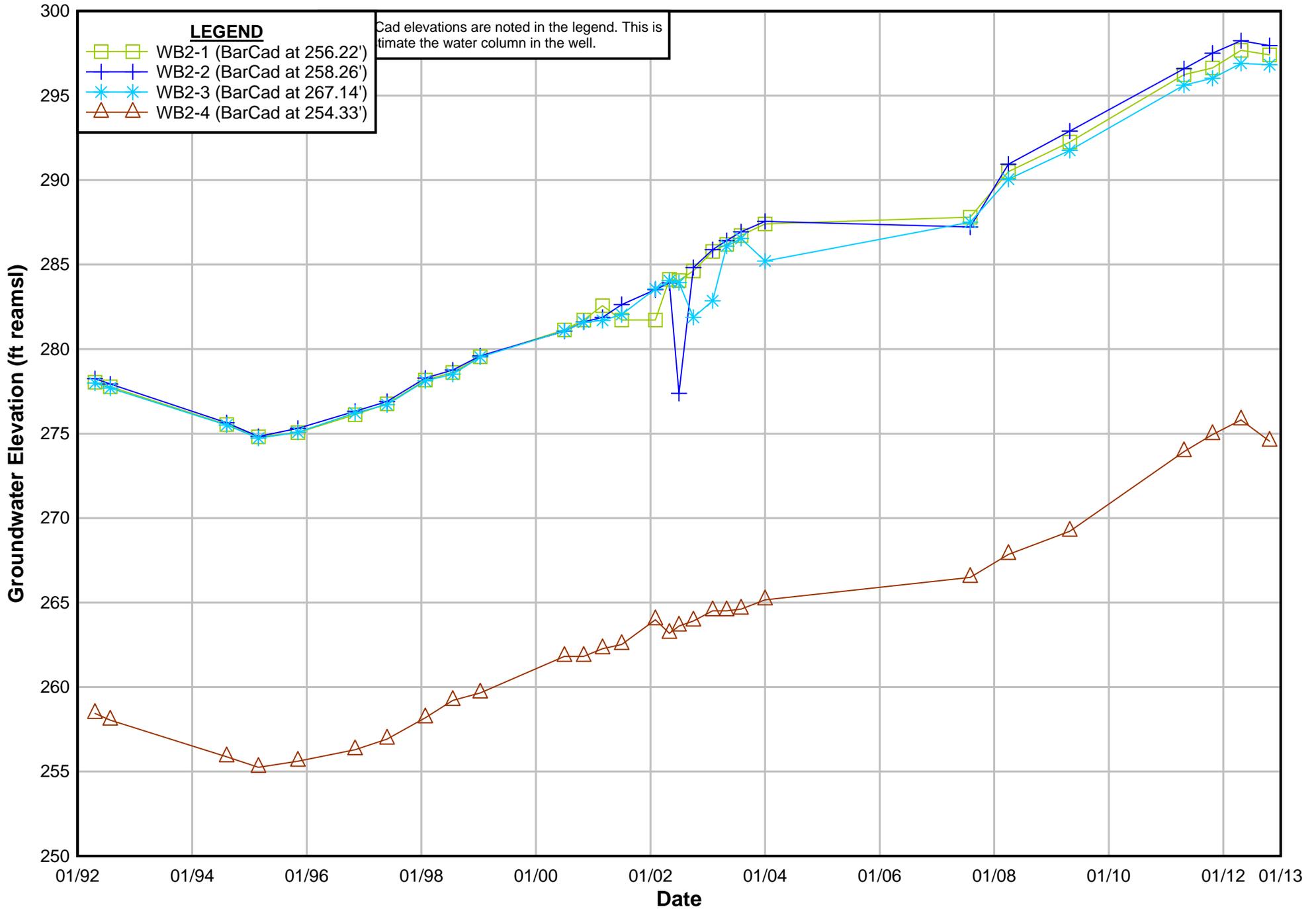
Graph D6: Groundwater Elevations (B-Zone)

AMW-AR Series Wells



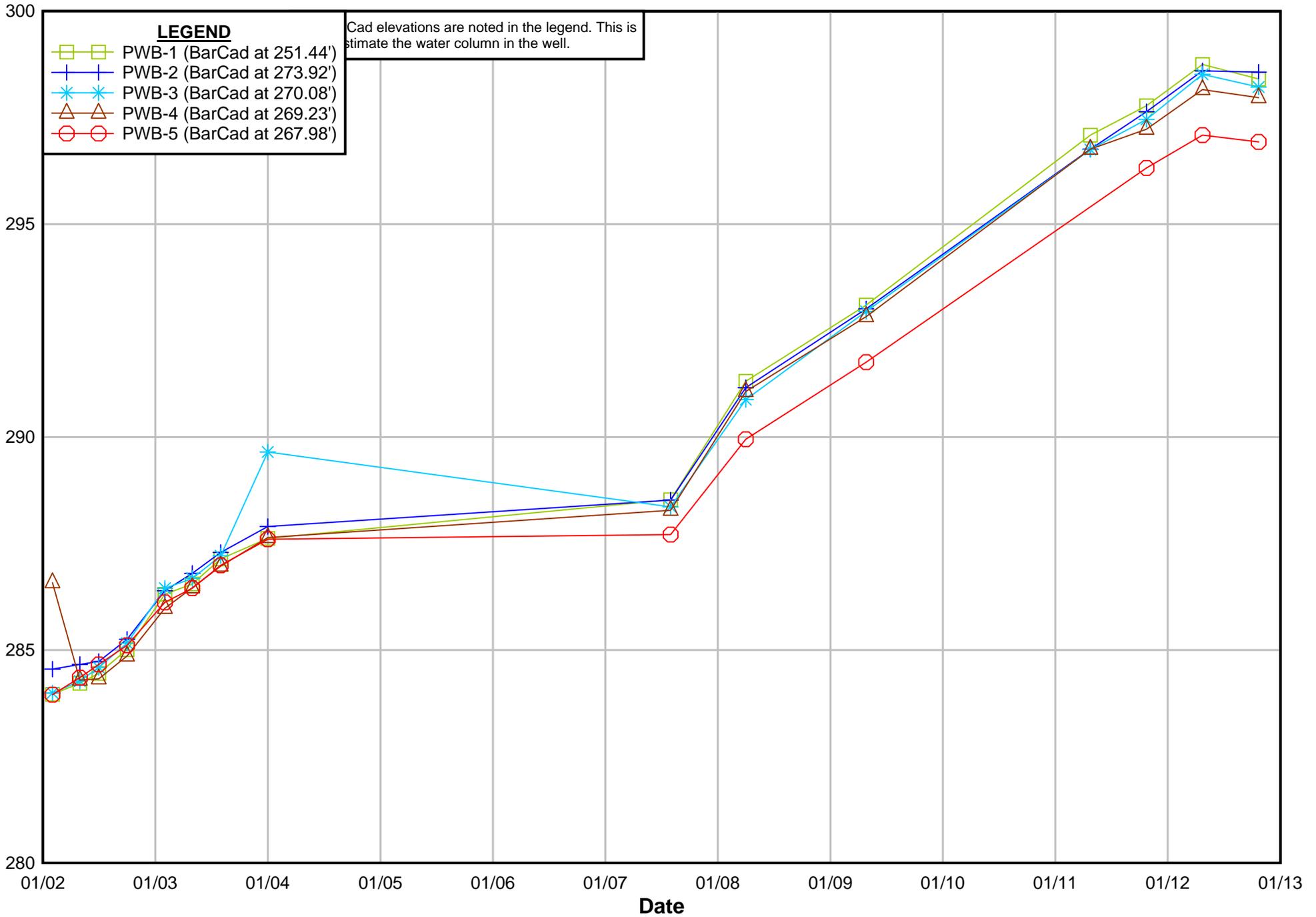
Graph D7: Groundwater Elevations (B-Zone)

WB Series Wells



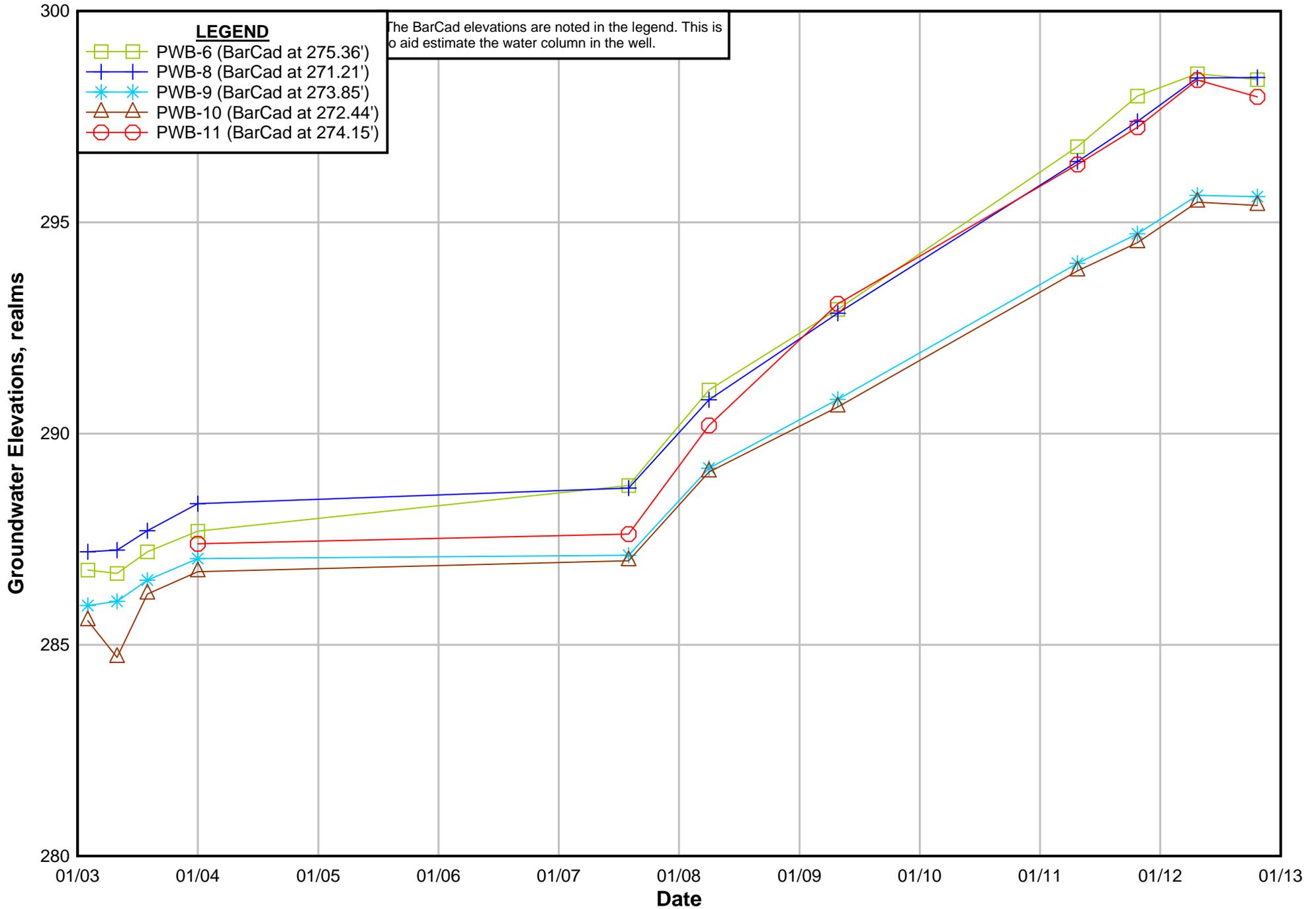
Graph D8: Groundwater Elevations (B-Zone)

PWB Series (Part 1)



Graph D9: Groundwater Elevations (B-Zone)

PWB Series (Part 2)



Graph D10: Groundwater Elevations (B-Zone)

PWB Series (Part 3)

