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Ms. Karol Detterman, P.G.  
Alameda County Environmental Health  
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Alameda, California 94502

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Subject:  
Soil and Groundwater Investigation Report  
Former Arco Station #402  
1450 Fruitvale Avenue  
Oakland, California  
ACEH Case No. #RO0000307

ENVIRONMENT

Date:  
July 29, 2016

Contact:  
Mr. James M. Jacobsen, P.G.

Phone:  
916.865.3144

Email:  
[james.jacobsen@arcadis.com](mailto:james.jacobsen@arcadis.com)

Our ref:  
GP16BPNA.CA02

Dear Ms. Detterman:

On behalf of Atlantic Richfield, a BP-Affiliated Company, Arcadis U.S., Inc. (Arcadis) is submitting this July 29, 2016 Soil and Groundwater Investigation Report. "I declare, that to the best of my knowledge at the present time, that the information and/or recommendations contained in the attached document are true and correct."

Sincerely,

Arcadis U.S., Inc.



James M. Jacobsen, P.G.  
Project Geologist

Copies:  
File

Enclosures:  
Soil and Groundwater Investigation Report (prepared by Broadbent & Associates, Inc.)



**SOIL AND GROUNDWATER INVESTIGATION REPORT  
Former Atlantic Richfield Company Station No. 402  
1450 Fruitvale Avenue  
Oakland, Alameda County, California**

**Prepared for:**

Mr. James Jacobsen  
ARCADIS  
101 Creekside Ridge Court, Suite 200  
Roseville, CA 95678

**Prepared by:**

Broadbent & Associates, Inc.  
1370 Ridgewood Drive, Suite 5  
Chico, California 95973  
(530) 566-1400

July 29, 2016

No. 08-88-602



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**CREATING SOLUTIONS. BUILDING TRUST.**

July 29, 2016

Project No. 08-88-602

ARCADIS  
101 Creekside Ridge Court, Suite 200  
Roseville, CA 95678  
Attn.: Mr. James Jacobsen

Re: Soil and Groundwater Investigation Report, Former Atlantic Richfield Company Station  
No. 402, 1450 Fruitvale Avenue, Oakland, Alameda County, California;  
ACEH Case #RO0000307

Dear Mr. Jacobsen:

Attached is a *Soil and Groundwater Investigation Report* for Former Atlantic Richfield Company (a BP affiliated company) Station No. 402 located at 1450 Fruitvale Avenue in Oakland, Alameda County, California (the Site). This report presents results of groundwater monitoring conducted at the Site during the Second Quarter 2016 and additional soil vapor intrusion evaluation activities.

Should you have questions regarding the work performed or results obtained, please do not hesitate to contact us at (530) 566-1400.

Sincerely,  
BROADBENT & ASSOCIATES

Jason Duda  
Senior Scientist

Matt Herrick, P.G., C.HG.  
Associate Hydrogeologist



Enclosures

cc: Ms. Karol Detterman, Alameda County Environmental Health (Submitted via ACEH ftp site)  
Electronic copy uploaded to GeoTracker

**SOIL AND GROUNDWATER INVESTIGATION REPORT  
FORMER ATLANTIC RICHFIELD COMPANY STATION No. 402  
OAKLAND, CALIFORNIA**

Broadbent and Associates, Inc. (Broadbent) is pleased to present this *Soil and Groundwater Investigation Report* on behalf of Atlantic Richfield Company (ARC, a BP affiliated company) for Former Station No. 402 located at 1450 Fruitvale Avenue in Oakland, Alameda County, California (the Site). Monitoring and soil vapor intrusion evaluation activities at the Site were performed in accordance with the May 9, 2016 agency directive issued by Alameda County Environmental Health (ACEH). Details of work performed, discussion of results, and recommendations are provided below.

Facility Name / Address:	<u>Station No. 402 / 1450 Fruitvale Ave., Oakland, California; Drawing 1</u>
Client Project Manager / Title:	<u>Mr. James Jacobsen / Project Manager</u>
Broadbent Contact:	<u>Mr. Jason Duda, (530) 566-1400</u>
Broadbent Project No.:	<u>08-88-602</u>
Primary Regulatory Agency / ID No.:	<u>ACEH / Case # RO0000307</u>
Current phase of project:	<u>Monitoring / Closure Evaluation</u>
List of Acronyms / Abbreviations:	<u>See end of report text for list of acronyms/abbreviations used in report.</u>

**WORK PERFORMED THIS QUARTER (Second Quarter 2016):**

1. Submitted *First Quarter 2016 Status Report* on April 29, 2016.
2. Conducted groundwater monitoring/sampling for Second Quarter 2016 on June 8-9, 2016.
3. Conducted additional soil vapor intrusion evaluation activities as requested by ACEH.

**WORK SCHEDULED FOR NEXT QUARTER (Third Quarter 2016):**

1. Submit *Soil and Groundwater Investigation Report* (contained herein).
2. No other environmental work activities are scheduled for the Third Quarter 2016.

**MONITORING PLAN SUMMARY:**

Groundwater level gauging:	<u>MW-4, MW-5, MW-6, MW-7</u>	Upon Request During Closure Evaluation
Groundwater sample collection:	<u>MW-4, MW-5, MW-6, MW-7</u>	Upon Request During Closure Evaluation
Biodegradation indicator parameter monitoring:	<u>None</u>	

**MONITORING RESULTS SUMMARY:**

**LNAPL**

LNAPL observed this quarter:	<u>No</u>	(yes\no)
LNAPL recovered this quarter:	<u>None</u>	(gal)
Cumulative LNAPL recovered:	<u>None</u>	(gal)

**Groundwater Elevation and Gradient:**

Depth to groundwater:	<u>10.83 ft (MW-5) to 12.94 ft (MW-6)</u>	(ft below TOC)
Gradient direction:	<u>North</u>	(compass direction)
Gradient magnitude:	<u>0.006</u>	(ft/ft)
Average change in elevation:	<u>-0.75</u>	(ft since last measurement)

## Laboratory Analytical Data

### Summary:

Analytical Results are as follows:

- GRO was detected in two wells at a maximum concentration of 1,700 µg/L in well MW-4.
  - Benzene was detected in two wells at a maximum concentration of 130 µg/L in well MW-4.
  - Toluene was detected in two wells at a maximum concentration of 1.5 µg/L in well MW-4
  - Ethylbenzene was detected in two wells at a maximum concentration of 12 µg/L in well MW-4.
  - Total Xylenes were detected in two wells at a maximum concentration of 5.5 µg/L in well MW-7.
  - MTBE was detected in well MW-6 at a concentration of 12 µg/L.
  - DIPE was detected in two wells at a maximum concentration of 2.3 µg/L in MW-4.
- 

## ACTIVITIES CONDUCTED & RESULTS:

Groundwater monitoring and sampling activities were conducted between June 8-9, 2016 by Broadbent personnel, as requested by ACEH in their email correspondence dated May 9, 2016. Well MW-4 was inaccessible due to a parked car on June 8, 2016 but was able to be gauged and sampled on the following day, June 9, 2016. No other irregularities were noted during gauging. Light Non-Aqueous Phase Liquid (LNAPL) was not present in the wells monitored during this event. Depth to groundwater ranged from 10.83 ft in MW-5 to 12.94 ft in MW-6. As shown on Drawing 2, groundwater gradient on June 8-9, 2016 was 0.006 ft/ft in a northern direction. Current and historic groundwater elevations and groundwater sample analytical data are provided in Tables 1 and 2. Historical groundwater gradient information is provided in Table 3. Drawing 2 presents a groundwater elevation contour and analytical summary map for June 8-9, 2016. Drawings 3 and 4 present GRO and Benzene Isoconcentration Maps for June 8-9, 2016, respectively. Field procedures used during groundwater monitoring are provided in Appendix A. Field data sheets are included in Appendix B.

Groundwater samples were collected between June 8-9, 2016. As previously mentioned, well MW-4 was found to be inaccessible on June 8, 2016. No other irregularities were reported during sampling. Samples were submitted to Test America Laboratories, Inc. (Test America) of Irvine, California for analyses of GRO, by EPA Method 8015B; for BTEX, MTBE, ETBE, TAME, DIPE, TBA, EDB, 1,2-DCA and Ethanol by EPA Method 8260B. No irregularities were encountered during analysis of the samples. Laboratory analytical report and chain-of-custody record are provided in Appendix C. Groundwater monitoring data (GEO\_WELL) and laboratory analytical results (EDF) were uploaded to the GeoTracker AB2886 database. Upload confirmation receipts are provided in Appendix D.

Results of the sampling event are included in the laboratory analytical data summary above. These results indicate that the highest concentrations of petroleum hydrocarbons are present in well MW-4. This is consistent with previous data, but inconsistent with the most recent data collected during First Quarter 2015 which indicated that MW-7 had the highest concentrations of petroleum hydrocarbons. Further discussion of these results is presented below.

Additionally, the presence of an elevator within the onsite three-story building was confirmed during field activities, as requested by ACEH. Discussion pertaining to the bioattenuation zone and potential vapor intrusion to indoor air is provided below.

## DISCUSSION:

Review of historical groundwater elevations indicates that levels were within historical limits for all wells. Groundwater elevations yielded a potentiometric groundwater gradient to the north at 0.006 ft/ft, generally inconsistent with the historic gradient data presented in Table 3. However, the limited gradient data (six events) has been relatively variable.

Review of historical groundwater results indicate that well MW-4 has contained the highest residual petroleum compounds at the Site. Comparison of analytical results over the previous sampling events indicate that monitoring wells MW-5 and MW-6 have maintained consistently low-to-non-detect residual petroleum constituents and additives. However, concentrations in well MW-7 increased to historic maximums during the last sampling event conducted in First Quarter 2015. The concentrations observed during this sampling event returned to values within the historic range for well MW-7, which appears to indicate that the trend is not increasing but relatively stable. Slightly elevated concentrations were observed in well MW-4 during this current sampling event, with GRO, Benzene, and Toluene each reaching historic maximum values. However, these elevated concentrations are still within the general range of historic values observed in MW-4, indicating a relatively stable trend.

Based on the concentrations observed during Second Quarter 2016, the residual petroleum impacts are small, stable, and limited primarily to the former source area. An additional source area does not appear to be present based on these results and the previous elevated concentrations observed in well MW-7 appear to be anomalous.

During groundwater monitoring/sampling activities, field staff verified that an elevator is present within the commercial three-story building located onsite. However, the elevator is private and could not be accessed in order to potentially obtain the make and model of elevator. The City of Oakland building department was contacted in an effort to gain additional information related to the elevator's construction. Only one record related to an elevator was on file with the building department, which was an expired electrical permit providing no pertinent information about the elevator itself.

ACEH expressed concern regarding the extent of an adequate bioattenuation zone in their email correspondence dated May 9, 2016 due to the fact that the elevator onsite may have components that extend beneath the building and below ground surface. Although detailed information regarding the elevator's construction could not be obtained, it is presumed that the elevator pit or below ground components do not extend much deeper than five feet below the surface. Minimal petroleum impacts to shallow soil were observed during well installation activities conducted in 2013, with minor concentrations of GRO and BTEX detected above laboratory reporting limits in the sample collected from well MW-4 at 7.5 ft bgs, which were well below LTCP criteria (see Appendix E). No other constituents of concern were detected above laboratory reporting limits in the remaining soil samples collected between 0-10 ft bgs. Additionally, a minor detection of GRO in one of the six soil vapor samples collected onsite in 2013 from soil vapor probe SG-1B at approximately five ft bgs was the only constituent observed above laboratory reporting limits (Appendix E). The GRO concentration of 46,000 micrograms per cubic meter observed in SG-1B was well below the Environmental Screening Level for commercial/industrial exposure and GRO does not have an established limit within the LTCP criteria.

Based on current Site conditions and previous soil and soil vapor analytical data, the Site appears to satisfy the LTCP petroleum vapor intrusion criteria, which includes a minimum of five feet of minimally impacted soil (GRO < 100 mg/kg), Benzene concentrations within groundwater of less than 1,000 µg/L and soil vapor concentrations below the LTCP soil gas criteria. The depth to water at Former Station #402 has ranged from approximately 10-

16 ft bgs, which indicates that an adequate bioattenuation zone of a minimum of five feet between groundwater and the base of the elevator pit or its components is still present onsite even should the underground elevator components extend up to five ft bgs. Although direct soil vapor samples were not collected below approximately five ft bgs, the constituents and concentrations observed in these samples does not indicate a soil vapor issue associated with the Site and increased concentrations between 10 and 16 ft bgs are not anticipated to exceed LTCP criteria.

#### **RECOMMENDATIONS:**

Based on the recent groundwater analytical data, soil vapor intrusion research, and previous soil and soil vapor analytical data, the Site appears to be eligible for closure under the LTCP.

#### **LIMITATIONS:**

The findings presented in this report are based upon observations of field personnel, points investigated, results of laboratory tests performed by Test America, and our understanding of ACEH guidelines. Our services were performed in accordance with the generally accepted standard of practice at the time this report was written. No other warranty, expressed or implied was made. This report has been prepared for the exclusive use of ARCADIS. It is possible that variations in soil or groundwater conditions could exist beyond points explored in this investigation. Also, changes in Site conditions could occur in the future due to variations in rainfall, temperature, regional water usage, or other factors.

#### **ATTACHMENTS:**

- Drawing 1: Site Location Map
- Drawing 2: Groundwater Elevation Contour and Analytical Summary Map, June 8-9, 2016
- Drawing 3: GRO Isoconcentration Contour Map, June 8-9, 2016
- Drawing 4: Benzene Isoconcentration Contour Map, June 8-9, 2016
  
- Table 1: Summary of Groundwater Monitoring Data: Relative Water Elevations and Laboratory Analyses
- Table 2: Summary of Fuel Additives Analytical Data
- Table 3: Summary of Groundwater Gradient - Direction and Magnitude
  
- Appendix A: Field Methods
- Appendix B: Field Data Sheets
- Appendix C: Laboratory Report and Chain-of-Custody Documentation
- Appendix D: GeoTracker Upload Confirmation Receipts
- Appendix E: 2013 Soil and Soil Vapor Analytical Data

**LIST OF COMMONLY USED ACCRONYMS/ABBREVIATIONS:**

ACEH	Alameda County Environmental Health	GRO:	Gasoline Range Organics (C6-12)
ARC:	Atlantic Richfield Company	LNAPL:	Light Non-Aqueous Phase Liquid
Broadbent	Broadbent & Associates	LTCP:	Low-Threat Closure Policy
BTEX:	Benzene, Toluene, Ethylbenzene, Total Xylenes	MTBE:	Methyl Tertiary Butyl Ether
1,2-DCA:	1,2-Dichloroethane	TAME:	Tert-Amyl Methyl Ether
DIPE:	Di-Isopropyl Ether	TBA:	Tert-Butyl Alcohol
EDB:	1,2-Dibromomethane	TOC:	Top of Casing
EPA:	Environmental Protection Agency	µg/L:	Micrograms Per Liter
ETBE:	Ethyl Tert-Butyl Ether	1Q:	First Quarter
ft:	feet	3Q:	Third Quarter
ft/ft:	foot per foot	ft bgs:	Feet Below Ground Surface
gal:	gallons		



## **DRAWINGS**

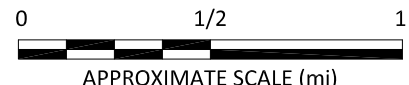
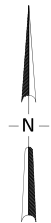
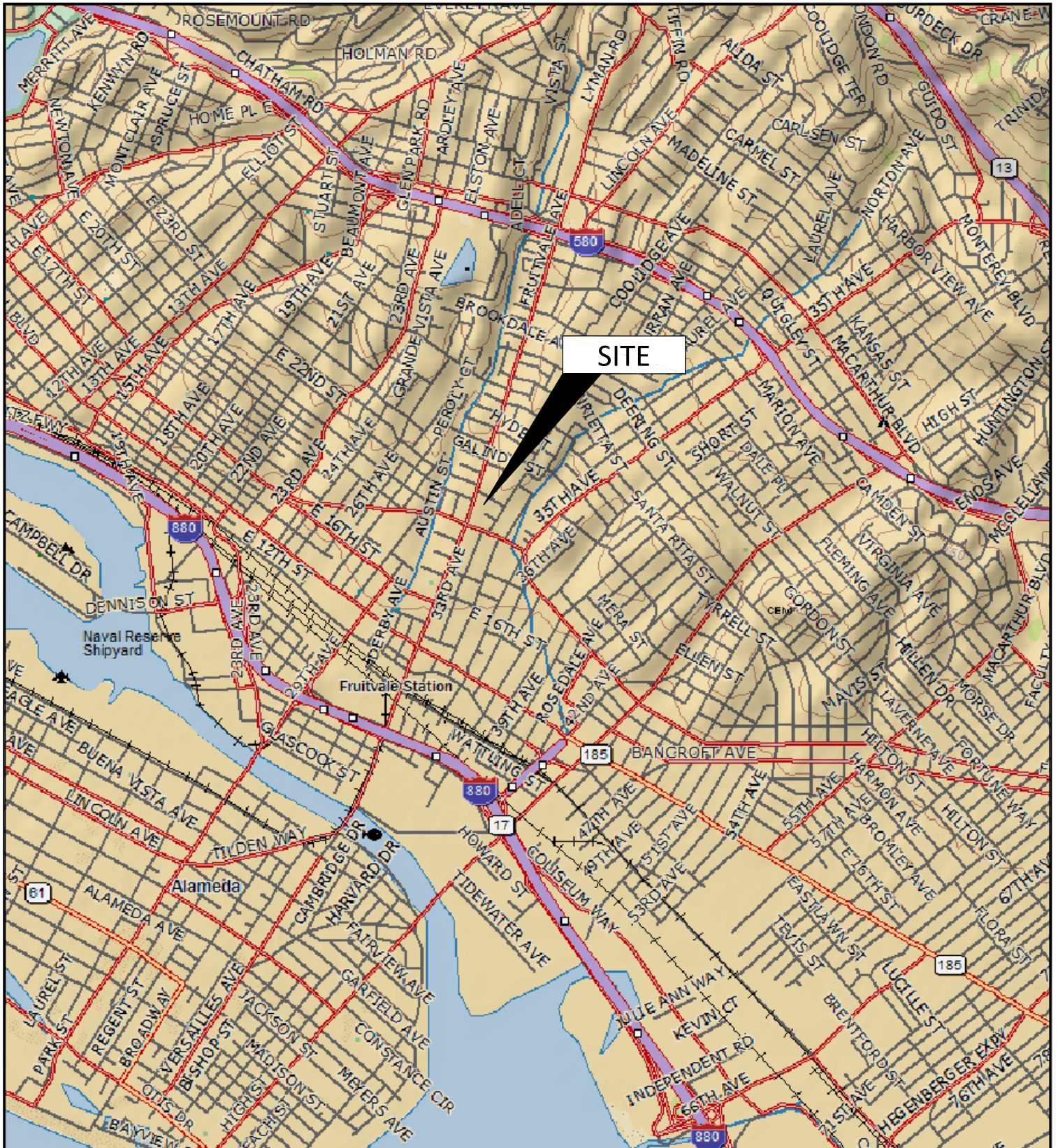


IMAGE SOURCE: DeLorme Topo USA 7.0



1370 Ridgewood Drive, Suite 5  
Chico, CA 95973

Project No.: 08-88-602 Date: 6/28/2016

Former BP Station #402  
1450 Fruitvale Avenue  
Oakland, California







Site Location Map

Drawing

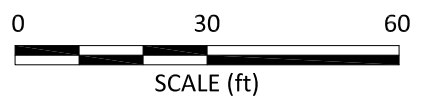
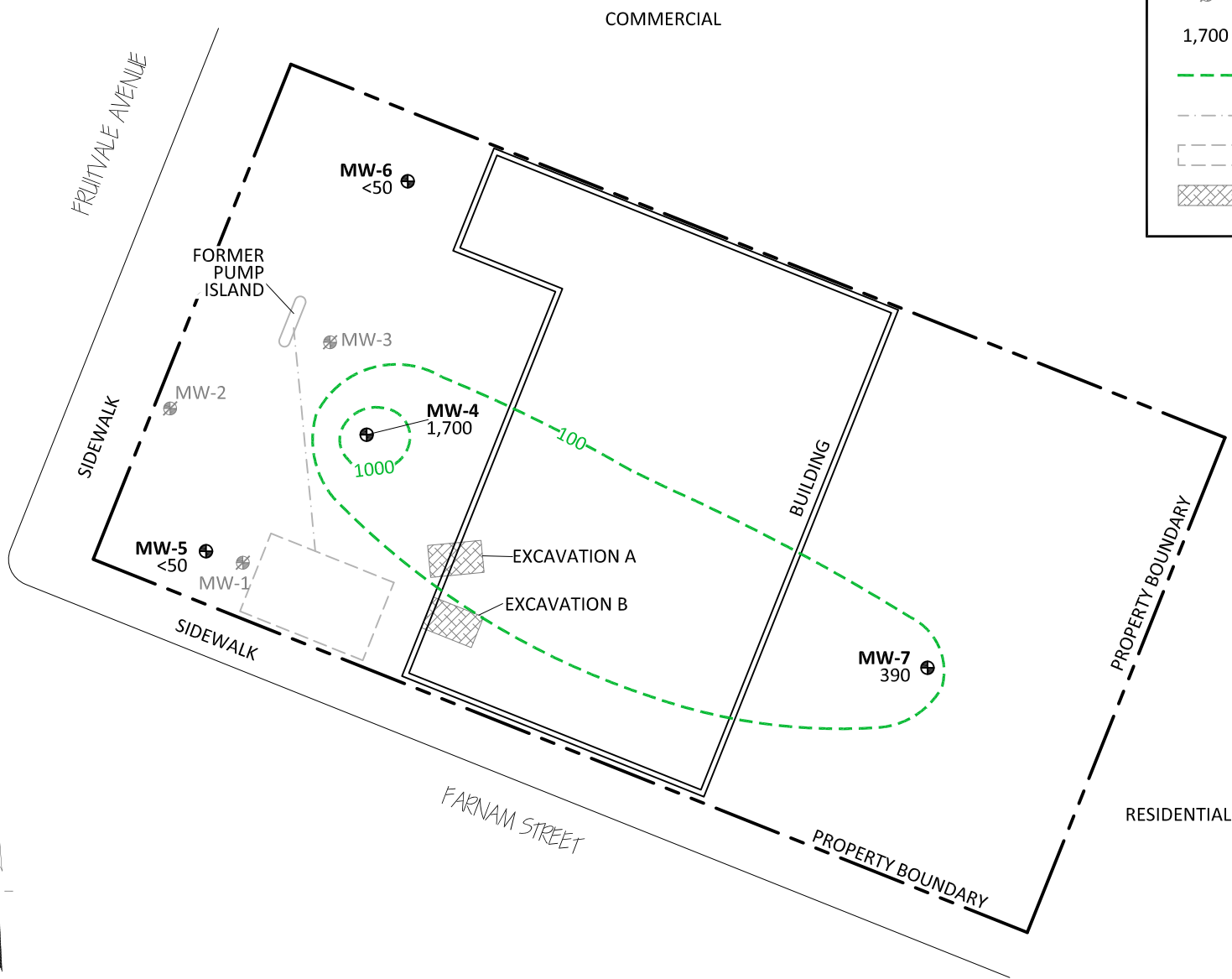
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**LEGEND**

-  Monitoring Well Location
-  Abandoned Well Location
- 1,700 GRO Concentration in  $\mu\text{g/L}$
-  GRO Isoconcentration Contour
-  Former Product Lines
-  Former UST Basin
-  Excavation

NOTE: SITE MAP ADAPTED FROM AEI CONSULTANTS. FIGURES, SITE DIMENSIONS AND FACILITY LOCATIONS NOT VERIFIED.



**BROADBENT**  
 1370 Ridgewood Drive, Suite 5  
 Chico, CA 95973  
 Project No.: 08-88-602    Date: 6/28/2016







ARCO Former Station #402  
 1450 Fruitvale Avenue  
 Oakland, California

GRO Isoconcentration Contour Map  
 June 8-9, 2016

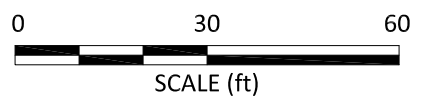
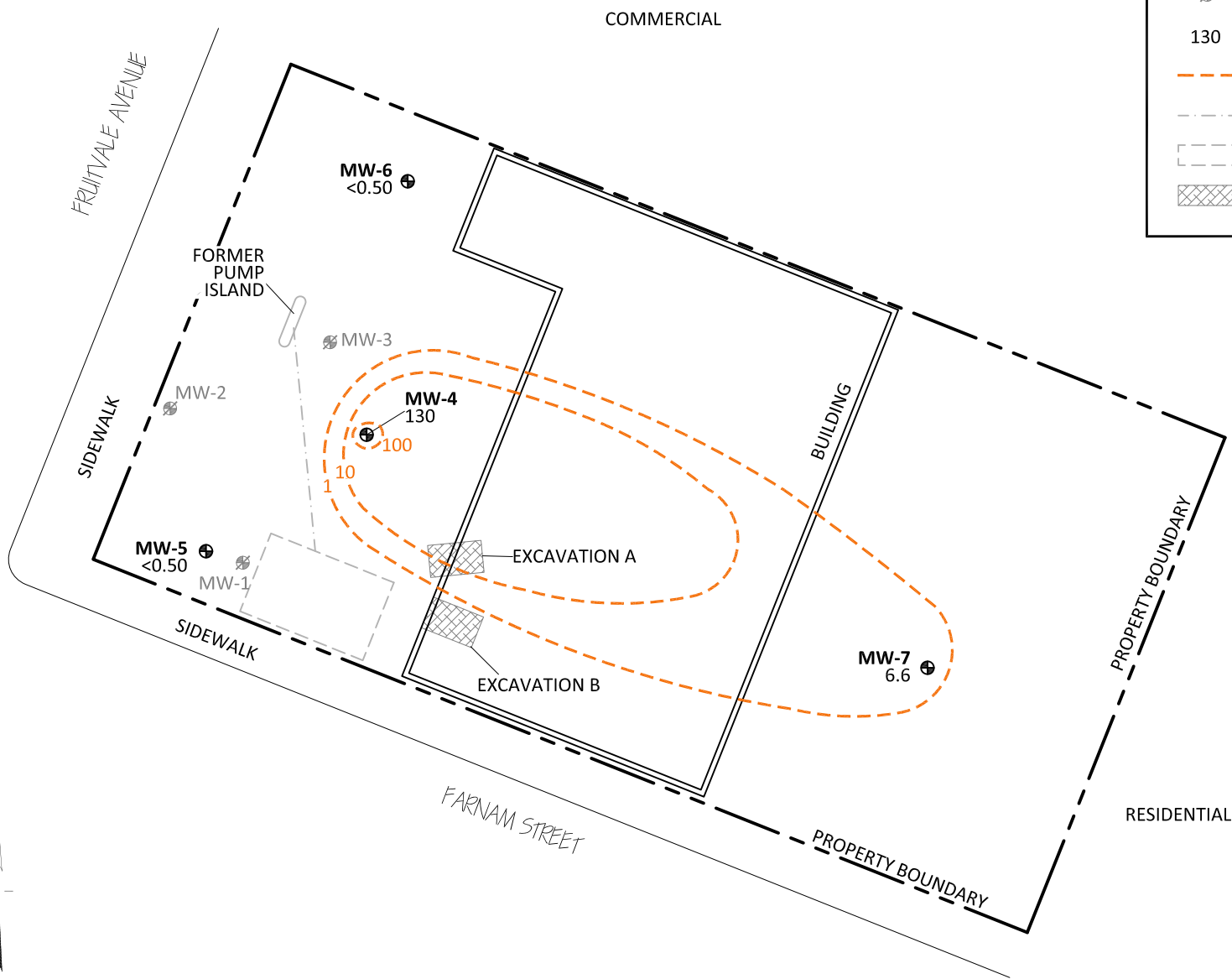
Drawing  
**3**



**LEGEND**

-  Monitoring Well Location
-  Abandoned Well Location
- 130 Benzene Concentration in  $\mu\text{g/L}$
-  Benzene Isoconcentration Contour
-  Former Product Lines
-  Former UST Basin
-  Excavation

NOTE: SITE MAP ADAPTED FROM AEI CONSULTANTS. FIGURES, SITE DIMENSIONS AND FACILITY LOCATIONS NOT VERIFIED.



**BROADBENT**  
1370 Ridgewood Drive, Suite 5  
Chico, CA 95973  
Project No.: 08-88-602    Date: 6/28/2016

ARCO Former Station #402  
1450 Fruitvale Avenue  
Oakland, California

Benzene Isoconcentration Contour Map  
June 8-9, 2016

## TABLES

**Table 1. Summary of Groundwater Monitoring Data: Water Elevations and Laboratory Analyses  
Former BP Station #402, 1450 Fruitvale Avenue, Oakland, California**

Well ID and Date Monitored	P/NP	TOC Elevation (feet)	Depth to Water (feet)	Water Level Elevation (feet)	Concentrations in µg/L						DO (mg/L)	Footnote
					GRO/TPHg	Benzene	Toluene	Ethyl-Benzene	Total Xylenes	MTBE		
<b>MW-4</b>												
12/2/2013	P	48.18	14.06	34.12	810	38	0.71	57	15	<0.50	1.60	a
3/18/2014	P		10.72	37.46	600	28	<0.50	20	4.8	<0.50	1.64	
6/26/2014	P		13.54	34.64	1,300	51	0.76	32	1.7	<0.50	1.58	
9/17/2014	P		15.37	32.81	1,100	41	<0.50	6.6	<1.0	<0.50	0.57	
3/12/2015	P		10.63	37.55	1,100	85	0.69	2.5	1.6	<0.50	1.78	
<b>6/9/2016</b>	<b>P</b>		<b>11.75</b>	<b>36.43</b>	<b>1,700</b>	<b>130</b>	<b>1.5</b>	<b>12</b>	<b>3.3</b>	<b>&lt;0.50</b>	<b>1.36</b>	
<b>MW-5</b>												
12/2/2013	P	47.62	13.67	33.95	<50	<0.50	<0.50	<0.50	<1.0	0.69	4.70	a
3/18/2014	P		10.91	36.71	<50	<0.50	<0.50	<0.50	<1.0	<0.50	3.03	
6/26/2014	P		12.52	35.10	<50	<0.50	<0.50	<0.50	<1.0	<0.50	0.76	
9/17/2014	P		14.44	33.18	58	<0.50	<0.50	<0.50	<1.0	<0.50	0.66	
3/12/2015	P		10.20	37.42	<50	<0.50	<0.50	<0.50	<1.0	0.50	2.00	
<b>6/8/2016</b>	<b>P</b>		<b>10.83</b>	<b>36.79</b>	<b>&lt;50</b>	<b>&lt;0.50</b>	<b>&lt;0.50</b>	<b>&lt;0.50</b>	<b>&lt;1.0</b>	<b>&lt;0.50</b>	<b>0.56</b>	
<b>MW-6</b>												
12/2/2013	P	48.89	15.07	33.82	<50	<0.50	<0.50	<0.50	<1.0	10	1.25	a
3/18/2014	P		11.72	37.17	<50	<0.50	<0.50	<0.50	<1.0	14	1.94	
6/26/2014	P		14.20	34.69	<50	<0.50	<0.50	<0.50	<1.0	13	0.47	
9/17/2014	P		16.10	32.79	<50	<0.50	<0.50	<0.50	<1.0	7.2	0.71	
3/12/2015	P		11.86	37.03	<50	<0.50	<0.50	<0.50	<1.0	5.0	1.66	
<b>6/8/2016</b>	<b>P</b>		<b>12.94</b>	<b>35.95</b>	<b>&lt;50</b>	<b>&lt;0.50</b>	<b>&lt;0.50</b>	<b>&lt;0.50</b>	<b>&lt;1.0</b>	<b>12</b>	<b>0.63</b>	
<b>MW-7</b>												
12/2/2013	P	48.28	15.35	32.93	96	<0.50	<0.50	1.5	<1.0	<0.50	5.35	a
3/18/2014	P		11.25	37.03	190	2.3	<0.50	2.2	<1.0	<0.50	2.63	
6/26/2014	P		13.44	34.84	530	5.0	0.63	1.9	<1.0	<0.50	1.14	
9/17/2014	P		15.75	32.53	360	2.5	<0.50	<0.50	<1.0	<0.50	0.63	
3/12/2015	P		11.33	36.95	2,200	59	9.8	87	54	<0.50	1.62	
<b>6/8/2016</b>	<b>P</b>		<b>11.51</b>	<b>36.77</b>	<b>390</b>	<b>6.6</b>	<b>1.2</b>	<b>11</b>	<b>5.5</b>	<b>&lt;0.50</b>	<b>1.59</b>	

Symbols & Abbreviations:

-- = Not analyzed/applicable/sampled/measured

< = Not detected at or above specified laboratory reporting limit

TOC = Top of casing measured in ft

NS = Well not surveyed

DO = Dissolved oxygen

GRO = Gasoline range organics

TPHg = Total petroleum hydrocarbons as gasoline

µg/L = Micrograms per liter

mg/L = Milligrams per liter

MTBE = Methyl tert-butyl ether

NP = Not purged before sampling

P = Purged before sampling

Footnotes:

a = Well surveyed 12/17/2013



**Table 2. Summary of Fuel Additives Analytical Data**  
**Former BP Station #402, 1450 Fruitvale Avenue, Oakland, California**

Well ID and Date Monitored	Concentrations in µg/L								Footnote
	Ethanol	TBA	MTBE	DIPE	ETBE	TAME	1,2-DCA	EDB	
<b>MW-4</b>									
12/2/2013	--	<10	<0.50	1.7	<0.50	<0.50	--	--	
3/18/2014	<150	<10	<0.50	1.8	<0.50	<0.50	<0.50	<0.50	
6/26/2014	<150	<10	<0.50	1.9	<0.50	<0.50	<0.50	<0.50	
9/17/2014	<150	<10	<0.50	2.3	<0.50	<0.50	<0.50	<0.50	
3/12/2015	<150	<10	<0.50	2.1	<0.50	<0.50	<0.50	<0.50	
6/9/2016	<150	<10	<0.50	2.3	<0.50	<0.50	<0.50	<0.50	
<b>MW-5</b>									
12/2/2013	--	<10	0.69	<0.50	<0.50	<0.50	--	--	
3/18/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
6/26/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
9/17/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
3/12/2015	<150	<10	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
6/8/2016	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
<b>MW-6</b>									
12/2/2013	--	<10	10	<0.50	<0.50	<0.50	--	--	
3/18/2014	<150	<10	14	<0.50	<0.50	<0.50	<0.50	<0.50	
6/26/2014	<150	<10	13	<0.50	<0.50	<0.50	<0.50	<0.50	
9/17/2014	<150	<10	7.2	<0.50	<0.50	<0.50	<0.50	<0.50	
3/12/2015	<150	<10	5.0	<0.50	<0.50	<0.50	<0.50	<0.50	
6/8/2016	<150	<10	12	1.2	<0.50	<0.50	<0.50	<0.50	
<b>MW-7</b>									
12/2/2013	--	<10	<0.50	<0.50	<0.50	<0.50	--	--	
3/18/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
6/26/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
9/17/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
3/12/2015	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
6/8/2016	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	

Symbols & Abbreviations:

TBA = Tert-butyl alcohol

MTBE = Methyl tert-butyl ether

DIPE = Diisopropyl ether

ETBE = Ethyl tert-butyl ether

TAME = Tert-amyl methyl ether

1,2-DCA = 1,2-Dichloroethane

EDB = Ethylene dibromide

ug/L = Micrograms per liter

< = Below given laboratory detection limit

-- = Not measured or analyzed

**Table 3. Summary of Groundwater Gradient - Direction and Magnitude**  
**Former BP Station #402, 1450 Fruitvale Avenue, Oakland, California**

<b>Date Measured</b>	<b>Approximate Gradient Direction</b>	<b>Approximate Gradient Magnitude (ft/ft)</b>
12/2/2013	East-Southeast	0.01
3/18/2014	Southeast	0.01
6/26/2014	South	0.01
9/17/2014	East-Northeast	0.01
3/12/2015	East	0.006
<b>6/8/2016</b>	<b>North</b>	<b>0.006</b>

**APPENDIX A**

FIELD METHODS



## **QUALITY ASSURANCE/QUALITY CONTROL FIELD METHODS**

Field methods discussed herein were implemented to provide for accuracy and reliability of field activities, data collection, sample collection, and handling. Discussion of these methods is provided below.

### **1.0 EQUIPMENT CALIBRATION**

Equipment calibration was performed per equipment manufacturer specifications before use.

### **2.0 DEPTH TO GROUNDWATER AND LIGHT NON-AQUEOUS PHASE LIQUID MEASUREMENT**

Depth to groundwater was measured in wells identified for gauging in the scope of work using a decontaminated water level indicator. The depth to water measurement was taken from a cut notch or permanent mark at the top of the well casing to which the well head elevation was originally surveyed.

Once depth to water was measured, an oil/water interface meter or a new disposable bailer was utilized to evaluate the presence and, if present, to measure the "apparent" thickness of light non-aqueous phase liquid (LNAPL) in the well. If LNAPL was present in the well, groundwater purging and sampling were not performed, unless sampling procedures in the scope of work specified collection of samples in the presence of LNAPL. Otherwise, time allowing, LNAPL was bailed from the well using either a new disposable bailer, or the disposal bailer previously used for initial LNAPL assessment. Bailing of LNAPL continued until the thickness of LNAPL (or volume) stabilized in each bailer pulled from the well, or LNAPL was no longer present. After LNAPL thickness either stabilized or was eliminated, periodic depth to water and depth to LNAPL measurements were collected as product came back into the well to evaluate product recovery rate and to aid in further assessment of LNAPL in the subsurface. LNAPL thickness measurements were recorded as "apparent." If a bailer was used for LNAPL thickness measurement, the field sampler noted the bailer entry diameter and chamber diameter to enable correction of thickness measurements. Recovered LNAPL was stored on-site in a labeled steel drum(s) or other appropriate container(s) prior to disposal.

### **3.0 WELL PURGING AND GROUNDWATER SAMPLE COLLECTION**

Well purging and groundwater sampling were performed in wells specified in the scope of work after measuring depth to groundwater and evaluating the presence of LNAPL. Purging and sampling were performed using one of the methods detailed below. The method used was noted in the field records. Purge water was stored on-site in labeled steel drum(s) or other appropriate container(s) prior to disposal or on-site treatment (in cases where treatment using an on-site system is authorized).

### 3.1 Purging a Predetermined Well Volume

Purging a predetermined well volume is performed per ASTM International (ASTM) D4448-01. This purging method has the objective of removing a predetermined volume of stagnant water from the well prior to sampling. The volume of stagnant water is defined as either the volume of water contained within the well casing, or the volume within the well casing and sand/gravel in the annulus if natural flow through these is deemed insufficient to keep them flushed out.

This purging method involves removal of a minimum of three stagnant water volumes from the well using a decontaminated pump with new disposable plastic discharge or suction tubing, dedicated well tubing, or using a new disposable or decontaminated reusable bailer. If a new disposable bailer was used for assessment of LNAPL, that bailer may be used for purging. The withdrawal rate used is one that minimizes drawdown while satisfying time constraints.

To evaluate when purging is complete, one or more groundwater stabilization parameters are monitored and recorded during purging activities until stabilization is achieved. Most commonly, stabilization parameters include temperature, conductivity, and pH, but field procedures detailed in the scope of work may also include monitoring of dissolved oxygen concentrations, oxidation reduction potential, and/or turbidity<sup>1</sup>. Parameters are considered stable when two (2) consecutive readings recorded three (3) minutes apart fall within ranges provided below in Table 1. In the event that the parameters have not stabilized and five (5) well casing volumes have been removed, purging activities will cease and be considered complete. Once the well is purged, a groundwater sample(s) is collected from the well using a new disposable bailer. If a new disposable bailer was used for purging, that bailer may be used to collect the sample(s). A sample is not collected if the well is inadvertently purged dry.

Table 1. Criteria for Defining Stabilization of Water-Quality Indicator Parameters

Parameter	Stabilization Criterion
Temperature	± 0.2°C (± 0.36°F)
pH	± 0.1 standard units
Conductivity	± 3%
Dissolved oxygen	± 10%
Oxidation reduction potential	± 10 mV
Turbidity <sup>1</sup>	± 10% or 1.0 NTU (whichever is greater)

### 3.2 Low-Flow Purging and Sampling

“Low-Flow”, “Minimal Drawdown”, or “Low-Stress” purging is performed per ASTM D6771-02. It is a method of groundwater removal from within a well’s screened interval that is intended to minimize drawdown and mixing of the water column in the well

<sup>1</sup> As stated in ASTM D6771-02, turbidity is not a chemical parameter and not indicative of when formation-quality water is being purged; however, turbidity may be helpful in evaluating stress on the formation during purging. Turbidity measurements are taken at the same time that stabilization parameter measurements are made, or, at a minimum, once when purging is initiated and again just prior to sample collection, after stabilization parameters have stabilized. To avoid artifacts in sample analysis, turbidity should be as low as possible when samples are collected. If turbidity values are persistently high, the withdrawal rate is lowered until turbidity decreases. If high turbidity persists even after lowering the withdrawal rate, the purging is stopped for a period of time until turbidity settles, and the purging process is then restarted. If this fails to solve the problem, the purging/sampling process for the well is ceased, and well maintenance or redevelopment is considered.

casing. This is accomplished by pumping the well using a decontaminated pump with new disposable plastic discharge or suction tubing or dedicated well tubing at a low flow rate while evaluating the groundwater elevation during pumping.

The low flow pumping rate is well specific and is generally established at a volume that is less than or equal to the natural recovery rate of the well. A pump with adjustable flow rate control is positioned with the intake at or near the mid-point of the submerged well screen. The pumping rate used during low-flow purging is low enough to minimize mobilization of particulate matter and drawdown (stress) of the water column. Low-flow purging rates will vary based on the individual well characteristics; however, the purge rate should not exceed 1.0 Liter per minute (L/min) or 0.25 gallon per minute (gal/min). Low-flow purging should begin at a rate of approximately 0.1 L/min (0.03 gal/min)<sup>2</sup>, or the lowest rate possible, and be adjusted based on an evaluation of drawdown. Water level measurements should be recorded at approximate one (1) to two (2) minute intervals until the low-flow rate has been established, and drawdown is minimized. As a general rule, drawdown should not exceed 25% of the distance between the top of the water column and the pump in-take.

To evaluate when purging is complete, one or more groundwater stabilization parameters are monitored and recorded during purging activities until stabilization is achieved. Most commonly, stabilization parameters include temperature, conductivity, and pH, but field procedures detailed in the scope of work may also include monitoring of dissolved oxygen concentrations, oxidation reduction potential, and/or turbidity<sup>1</sup>. The frequency between measurements will be at an interval of one (1) to three (3) minutes; however, if a flow cell is used, the frequency will be determined based on the time required to evacuate one cell volume. Stabilization is defined as three (3) consecutive readings recorded several minutes apart falling within ranges provided in Table 1. Samples will be collected by filling appropriate containers from the pump discharge tubing at a rate not to exceed the established pumping rate.

### **3.3 Minimal Purge, Discrete Depth, and Passive Sampling**

In accordance with ASTM D4448-01, sampling techniques that do not rely on purging, or require only minimal purging, may be used if a particular zone within a screened interval is to be sampled or if a well is not capable of yielding sufficient groundwater for purging. To properly use these sampling techniques, a water sample is collected within the screened interval with little or no mixing of the water column within the casing. These techniques include minimal purge sampling which uses a dedicated sampling pump capable of pumping rates of less than 0.1 L/min (0.03 gal/min)<sup>2</sup>, discrete depth sampling using a bailer that allows groundwater entry at a controlled depth (e.g. differential pressure bailer), or passive (diffusion) sampling. These techniques are based on certain studies referenced in ASTM D4448-01 that indicate that under certain conditions, natural groundwater flow is laminar and horizontal with little or no mixing within the well screen.

---

<sup>2</sup> According to ASTM D4448-01, studies have indicated that at flow rates of 0.1 L/min, low-density polyethylene (LDPE) and plasticized polypropylene tubing materials are prone to sorption. Therefore, TFE-fluorocarbon or other appropriate tubing material is used, particularly when tubing lengths of 50 feet or longer are used.

#### **4.0 DECONTAMINATION**

Reusable groundwater sampling equipment were cleaned using a solution of Alconox or other acceptable detergent, rinsed with tap water, and finally rinsed with distilled water prior to use in each well. Decontamination water was stored on-site in labeled steel drum(s) or other appropriate container(s) prior to disposal.

#### **5.0 SAMPLE CONTAINERS, LABELING, AND STORAGE**

Samples were collected in laboratory prepared containers with appropriate preservative (if preservative was required). Samples were labeled (site name, sample I.D., sampler initials, date, and time of collection) and stored chilled (refrigerator or ice chest with ice) until delivery to a certified laboratory, under chain of custody procedures.

#### **6.0 CHAIN OF CUSTODY RECORD AND PROCEDURE**

The field sampler was personally responsible for care and custody of the samples collected until they were properly transferred to another party. To document custody and transfer of samples, a Chain of Custody Record was prepared. The Chain of Custody Record provided identification of the samples corresponding to sample labels and specified analyses to be performed by the laboratory. The original Chain of Custody Record accompanied the shipment, and a copy of the record was stored in the project file. When the samples were transferred, the individuals relinquishing and receiving them signed, dated, and noted the time of transfer on the record.

#### **7.0 FIELD RECORDS**

Daily Report and data forms were completed by staff personnel to provide daily record of significant events, observations, and measurements. Field records were signed, dated, and stored in the project file.



**APPENDIX B**

FIELD DATA SHEETS









**APPENDIX C**

LABORATORY REPORT  
AND CHAIN-OF-CUSTODY DOCUMENTATION

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica Irvine

17461 Derian Ave

Suite 100

Irvine, CA 92614-5817

Tel: (949)261-1022

TestAmerica Job ID: 440-149868-1

Client Project/Site: ARCO 0402, Oakland

For:

Broadbent & Associates, Inc.

4820 Business Center Drive

#110

Fairfield, California 94534

Attn: Mr. Jason Duda



Authorized for release by:

6/21/2016 1:09:09 PM

Kathleen Robb, Project Manager II

(949)261-1022

[kathleen.robbs@testamericainc.com](mailto:kathleen.robbs@testamericainc.com)

### LINKS

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*The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.*

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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# Sample Summary

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
440-149868-1	MW-4	Water	06/09/16 13:30	06/11/16 11:10
440-149868-2	MW-5	Water	06/08/16 11:45	06/11/16 11:10
440-149868-3	MW-6	Water	06/08/16 11:20	06/11/16 11:10
440-149868-4	MW-7	Water	06/08/16 10:50	06/11/16 11:10

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# Case Narrative

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

**Job ID: 440-149868-1**

**Laboratory: TestAmerica Irvine**

## Narrative

**Job Narrative**  
**440-149868-1**

### Comments

No additional comments.

### Receipt

The samples were received on 6/11/2016 11:10 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 2.4° C.

### Receipt Exceptions

For these 3 samples, we received a broken voa for each one: MW-4 (440-149868-1), MW-6 (440-149868-3) and MW-7 (440-149868-4)

### GC/MS VOA

Method(s) 8260B: The continuing calibration verification (CCV) associated with batch 440-337112 recovered above the upper control limit for BP for Ethanol. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The following samples are impacted: MW-4 (440-149868-1), MW-5 (440-149868-2), MW-6 (440-149868-3) and (CCVIS 440-337112/2).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

### GC VOA

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

### VOA Prep

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

# Client Sample Results

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

**Client Sample ID: MW-4**  
**Date Collected: 06/09/16 13:30**  
**Date Received: 06/11/16 11:10**

**Lab Sample ID: 440-149868-1**  
**Matrix: Water**

## Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			06/17/16 15:14	1
1,2-Dichloroethane	ND		0.50	ug/L			06/17/16 15:14	1
Ethanol	ND		150	ug/L			06/17/16 15:14	1
<b>Ethylbenzene</b>	<b>12</b>		0.50	ug/L			06/17/16 15:14	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			06/17/16 15:14	1
<b>Isopropyl Ether (DIPE)</b>	<b>2.3</b>		0.50	ug/L			06/17/16 15:14	1
<b>m,p-Xylene</b>	<b>3.3</b>		1.0	ug/L			06/17/16 15:14	1
Methyl-t-Butyl Ether (MTBE)	ND		0.50	ug/L			06/17/16 15:14	1
o-Xylene	ND		0.50	ug/L			06/17/16 15:14	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			06/17/16 15:14	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			06/17/16 15:14	1
<b>Toluene</b>	<b>1.5</b>		0.50	ug/L			06/17/16 15:14	1
<b>Xylenes, Total</b>	<b>3.3</b>		1.0	ug/L			06/17/16 15:14	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	100		80 - 120		06/17/16 15:14	1
Dibromofluoromethane (Surr)	87		76 - 132		06/17/16 15:14	1
Toluene-d8 (Surr)	104		80 - 128		06/17/16 15:14	1

## Method: 8260B/5030B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
<b>Benzene</b>	<b>130</b>		5.0	ug/L			06/18/16 03:43	10

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	101		80 - 120		06/18/16 03:43	10
Dibromofluoromethane (Surr)	104		76 - 132		06/18/16 03:43	10
Toluene-d8 (Surr)	109		80 - 128		06/18/16 03:43	10

## Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
<b>GRO (C6-C12)</b>	<b>1700</b>		100	ug/L			06/17/16 23:06	2

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	120		65 - 140		06/17/16 23:06	2

**Client Sample ID: MW-5**  
**Date Collected: 06/08/16 11:45**  
**Date Received: 06/11/16 11:10**

**Lab Sample ID: 440-149868-2**  
**Matrix: Water**

## Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			06/17/16 15:43	1
1,2-Dichloroethane	ND		0.50	ug/L			06/17/16 15:43	1
Benzene	ND		0.50	ug/L			06/17/16 15:43	1
Ethanol	ND		150	ug/L			06/17/16 15:43	1
Ethylbenzene	ND		0.50	ug/L			06/17/16 15:43	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			06/17/16 15:43	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			06/17/16 15:43	1
m,p-Xylene	ND		1.0	ug/L			06/17/16 15:43	1
Methyl-t-Butyl Ether (MTBE)	ND		0.50	ug/L			06/17/16 15:43	1
o-Xylene	ND		0.50	ug/L			06/17/16 15:43	1

TestAmerica Irvine

# Client Sample Results

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Client Sample ID: MW-5

Date Collected: 06/08/16 11:45

Date Received: 06/11/16 11:10

## Lab Sample ID: 440-149868-2

Matrix: Water

### Method: 8260B/5030B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			06/17/16 15:43	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			06/17/16 15:43	1
Toluene	ND		0.50	ug/L			06/17/16 15:43	1
Xylenes, Total	ND		1.0	ug/L			06/17/16 15:43	1
Surrogate	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	102		80 - 120				06/17/16 15:43	1
Dibromofluoromethane (Surr)	89		76 - 132				06/17/16 15:43	1
Toluene-d8 (Surr)	104		80 - 128				06/17/16 15:43	1

### Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	ND		50	ug/L			06/17/16 23:32	1
Surrogate	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	95		65 - 140				06/17/16 23:32	1

## Client Sample ID: MW-6

Date Collected: 06/08/16 11:20

Date Received: 06/11/16 11:10

## Lab Sample ID: 440-149868-3

Matrix: Water

### Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			06/17/16 16:13	1
1,2-Dichloroethane	ND		0.50	ug/L			06/17/16 16:13	1
Benzene	ND		0.50	ug/L			06/17/16 16:13	1
Ethanol	ND		150	ug/L			06/17/16 16:13	1
Ethylbenzene	ND		0.50	ug/L			06/17/16 16:13	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			06/17/16 16:13	1
Isopropyl Ether (DIPE)	1.2		0.50	ug/L			06/17/16 16:13	1
m,p-Xylene	ND		1.0	ug/L			06/17/16 16:13	1
Methyl-t-Butyl Ether (MTBE)	12		0.50	ug/L			06/17/16 16:13	1
o-Xylene	ND		0.50	ug/L			06/17/16 16:13	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			06/17/16 16:13	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			06/17/16 16:13	1
Toluene	ND		0.50	ug/L			06/17/16 16:13	1
Xylenes, Total	ND		1.0	ug/L			06/17/16 16:13	1
Surrogate	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	102		80 - 120				06/17/16 16:13	1
Dibromofluoromethane (Surr)	89		76 - 132				06/17/16 16:13	1
Toluene-d8 (Surr)	102		80 - 128				06/17/16 16:13	1

### Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	ND		50	ug/L			06/17/16 23:59	1
Surrogate	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	102		65 - 140				06/17/16 23:59	1

TestAmerica Irvine

# Client Sample Results

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

**Client Sample ID: MW-7**  
**Date Collected: 06/08/16 10:50**  
**Date Received: 06/11/16 11:10**

**Lab Sample ID: 440-149868-4**  
**Matrix: Water**

## Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			06/18/16 12:19	1
1,2-Dichloroethane	ND		0.50	ug/L			06/18/16 12:19	1
<b>Benzene</b>	<b>6.6</b>		0.50	ug/L			06/18/16 12:19	1
Ethanol	ND		150	ug/L			06/18/16 12:19	1
<b>Ethylbenzene</b>	<b>11</b>		0.50	ug/L			06/18/16 12:19	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			06/18/16 12:19	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			06/18/16 12:19	1
<b>m,p-Xylene</b>	<b>5.0</b>		1.0	ug/L			06/18/16 12:19	1
Methyl-t-Butyl Ether (MTBE)	ND		0.50	ug/L			06/18/16 12:19	1
<b>o-Xylene</b>	<b>0.50</b>		0.50	ug/L			06/18/16 12:19	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			06/18/16 12:19	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			06/18/16 12:19	1
<b>Toluene</b>	<b>1.2</b>		0.50	ug/L			06/18/16 12:19	1
<b>Xylenes, Total</b>	<b>5.5</b>		1.0	ug/L			06/18/16 12:19	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	101		80 - 120		06/18/16 12:19	1
Dibromofluoromethane (Surr)	87		76 - 132		06/18/16 12:19	1
Toluene-d8 (Surr)	104		80 - 128		06/18/16 12:19	1

## Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
<b>GRO (C6-C12)</b>	<b>390</b>		100	ug/L			06/18/16 00:26	2

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	94		65 - 140		06/18/16 00:26	2

# Method Summary

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

Method	Method Description	Protocol	Laboratory
8260B/5030B	Volatile Organic Compounds (GC/MS)	SW846	TAL IRV
8015B/5030B	Gasoline Range Organics (GC)	SW846	TAL IRV

**Protocol References:**

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

**Laboratory References:**

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022



# Lab Chronicle

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Client Sample ID: MW-4

Date Collected: 06/09/16 13:30

Date Received: 06/11/16 11:10

## Lab Sample ID: 440-149868-1

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B	DL	10	10 mL	10 mL	337295	06/18/16 03:43	WC	TAL IRV
Total/NA	Analysis	8260B/5030B		1	10 mL	10 mL	337112	06/17/16 15:14	MM1	TAL IRV
Total/NA	Analysis	8015B/5030B		2	10 mL	10 mL	337286	06/17/16 23:06	JB	TAL IRV

## Client Sample ID: MW-5

Date Collected: 06/08/16 11:45

Date Received: 06/11/16 11:10

## Lab Sample ID: 440-149868-2

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		1	10 mL	10 mL	337112	06/17/16 15:43	MM1	TAL IRV
Total/NA	Analysis	8015B/5030B		1	10 mL	10 mL	337286	06/17/16 23:32	JB	TAL IRV

## Client Sample ID: MW-6

Date Collected: 06/08/16 11:20

Date Received: 06/11/16 11:10

## Lab Sample ID: 440-149868-3

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		1	10 mL	10 mL	337112	06/17/16 16:13	MM1	TAL IRV
Total/NA	Analysis	8015B/5030B		1	10 mL	10 mL	337286	06/17/16 23:59	JB	TAL IRV

## Client Sample ID: MW-7

Date Collected: 06/08/16 10:50

Date Received: 06/11/16 11:10

## Lab Sample ID: 440-149868-4

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		1	10 mL	10 mL	337337	06/18/16 12:19	TCN	TAL IRV
Total/NA	Analysis	8015B/5030B		2	10 mL	10 mL	337286	06/18/16 00:26	JB	TAL IRV

### Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022

# QC Sample Results

Client: Broadbent & Associates, Inc.  
 Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

**Lab Sample ID: MB 440-337112/4**  
**Matrix: Water**  
**Analysis Batch: 337112**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			06/17/16 07:30	1
1,2-Dichloroethane	ND		0.50	ug/L			06/17/16 07:30	1
Benzene	ND		0.50	ug/L			06/17/16 07:30	1
Ethanol	ND		150	ug/L			06/17/16 07:30	1
Ethylbenzene	ND		0.50	ug/L			06/17/16 07:30	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			06/17/16 07:30	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			06/17/16 07:30	1
m,p-Xylene	ND		1.0	ug/L			06/17/16 07:30	1
Methyl-t-Butyl Ether (MTBE)	ND		0.50	ug/L			06/17/16 07:30	1
o-Xylene	ND		0.50	ug/L			06/17/16 07:30	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			06/17/16 07:30	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			06/17/16 07:30	1
Toluene	ND		0.50	ug/L			06/17/16 07:30	1
Xylenes, Total	ND		1.0	ug/L			06/17/16 07:30	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	100		80 - 120		06/17/16 07:30	1
Dibromofluoromethane (Surr)	87		76 - 132		06/17/16 07:30	1
Toluene-d8 (Surr)	105		80 - 128		06/17/16 07:30	1

**Lab Sample ID: LCS 440-337112/5**  
**Matrix: Water**  
**Analysis Batch: 337112**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dibromoethane (EDB)	25.0	24.5		ug/L		98	70 - 130
1,2-Dichloroethane	25.0	23.0		ug/L		92	57 - 138
Benzene	25.0	23.5		ug/L		94	68 - 130
Ethanol	1000	1130		ug/L		113	50 - 149
Ethylbenzene	25.0	24.5		ug/L		98	70 - 130
Ethyl-t-butyl ether (ETBE)	25.0	24.0		ug/L		96	60 - 136
Isopropyl Ether (DIPE)	25.0	27.2		ug/L		109	58 - 139
m,p-Xylene	25.0	24.3		ug/L		97	70 - 130
Methyl-t-Butyl Ether (MTBE)	25.0	22.2		ug/L		89	63 - 131
o-Xylene	25.0	24.1		ug/L		97	70 - 130
Tert-amyl-methyl ether (TAME)	25.0	22.4		ug/L		90	57 - 139
tert-Butyl alcohol (TBA)	250	258		ug/L		103	70 - 130
Toluene	25.0	24.6		ug/L		98	70 - 130

Surrogate	LCS %Recovery	LCS Qualifier	Limits
4-Bromofluorobenzene (Surr)	100		80 - 120
Dibromofluoromethane (Surr)	90		76 - 132
Toluene-d8 (Surr)	99		80 - 128



# QC Sample Results

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Method: 8260B/5030B - Volatile Organic Compounds (GC/MS) (Continued)

**Lab Sample ID: 440-149867-C-1 MS**

**Matrix: Water**

**Analysis Batch: 337112**

**Client Sample ID: Matrix Spike**

**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dibromoethane (EDB)	ND		25.0	24.6		ug/L		98	70 - 131
1,2-Dichloroethane	ND		25.0	22.9		ug/L		91	56 - 146
Benzene	ND		25.0	23.3		ug/L		92	66 - 130
Ethanol	ND		1000	1150		ug/L		115	54 - 150
Ethylbenzene	1.3		25.0	25.7		ug/L		97	70 - 130
Ethyl-t-butyl ether (ETBE)	ND		25.0	24.1		ug/L		96	70 - 130
Isopropyl Ether (DIPE)	ND		25.0	26.9		ug/L		108	64 - 138
m,p-Xylene	4.8		25.0	29.1		ug/L		97	70 - 133
Methyl-t-Butyl Ether (MTBE)	12		25.0	35.8		ug/L		94	70 - 130
o-Xylene	1.1		25.0	25.1		ug/L		96	70 - 133
Tert-amyl-methyl ether (TAME)	ND		25.0	22.4		ug/L		90	68 - 133
tert-Butyl alcohol (TBA)	ND		250	263		ug/L		105	70 - 130
Toluene	ND		25.0	24.5		ug/L		98	70 - 130
<b>MS MS</b>									
<b>Surrogate</b>	<b>%Recovery</b>		<b>Qualifier</b>	<b>Limits</b>					
4-Bromofluorobenzene (Surr)	98			80 - 120					
Dibromofluoromethane (Surr)	88			76 - 132					
Toluene-d8 (Surr)	99			80 - 128					

**Lab Sample ID: 440-149867-C-1 MSD**

**Matrix: Water**

**Analysis Batch: 337112**

**Client Sample ID: Matrix Spike Duplicate**

**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,2-Dibromoethane (EDB)	ND		25.0	25.0		ug/L		100	70 - 131	2	25
1,2-Dichloroethane	ND		25.0	23.3		ug/L		93	56 - 146	2	20
Benzene	ND		25.0	23.8		ug/L		94	66 - 130	2	20
Ethanol	ND		1000	1110		ug/L		111	54 - 150	4	30
Ethylbenzene	1.3		25.0	26.0		ug/L		99	70 - 130	1	20
Ethyl-t-butyl ether (ETBE)	ND		25.0	24.7		ug/L		99	70 - 130	2	25
Isopropyl Ether (DIPE)	ND		25.0	27.6		ug/L		110	64 - 138	3	25
m,p-Xylene	4.8		25.0	29.4		ug/L		99	70 - 133	1	25
Methyl-t-Butyl Ether (MTBE)	12		25.0	36.9		ug/L		98	70 - 130	3	25
o-Xylene	1.1		25.0	25.3		ug/L		97	70 - 133	1	20
Tert-amyl-methyl ether (TAME)	ND		25.0	23.1		ug/L		93	68 - 133	3	30
tert-Butyl alcohol (TBA)	ND		250	261		ug/L		104	70 - 130	1	25
Toluene	ND		25.0	24.9		ug/L		100	70 - 130	2	20
<b>MSD MSD</b>											
<b>Surrogate</b>	<b>%Recovery</b>		<b>Qualifier</b>	<b>Limits</b>							
4-Bromofluorobenzene (Surr)	100			80 - 120							
Dibromofluoromethane (Surr)	90			76 - 132							
Toluene-d8 (Surr)	98			80 - 128							

TestAmerica Irvine

# QC Sample Results

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Method: 8260B/5030B - Volatile Organic Compounds (GC/MS) (Continued)

**Lab Sample ID: MB 440-337295/3**

**Matrix: Water**

**Analysis Batch: 337295**

**Client Sample ID: Method Blank**

**Prep Type: Total/NA**

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		0.50	ug/L			06/17/16 17:39	1
Surrogate	%Recovery	MB Qualifier	Limits			Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	101		80 - 120				06/17/16 17:39	1
Dibromofluoromethane (Surr)	99		76 - 132				06/17/16 17:39	1
Toluene-d8 (Surr)	110		80 - 128				06/17/16 17:39	1

**Lab Sample ID: LCS 440-337295/4**

**Matrix: Water**

**Analysis Batch: 337295**

**Client Sample ID: Lab Control Sample**

**Prep Type: Total/NA**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Benzene	25.0	24.5		ug/L		98	68 - 130
Surrogate	%Recovery	LCS Qualifier	Limits				
4-Bromofluorobenzene (Surr)	100		80 - 120				
Dibromofluoromethane (Surr)	101		76 - 132				
Toluene-d8 (Surr)	105		80 - 128				

**Lab Sample ID: 440-150131-D-3 MS**

**Matrix: Water**

**Analysis Batch: 337295**

**Client Sample ID: Matrix Spike**

**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Benzene	ND		25.0	24.9		ug/L		100	66 - 130
Surrogate	%Recovery	MS Qualifier	Limits						
4-Bromofluorobenzene (Surr)	98		80 - 120						
Dibromofluoromethane (Surr)	104		76 - 132						
Toluene-d8 (Surr)	102		80 - 128						

**Lab Sample ID: 440-150131-D-3 MSD**

**Matrix: Water**

**Analysis Batch: 337295**

**Client Sample ID: Matrix Spike Duplicate**

**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Benzene	ND		25.0	24.8		ug/L		99	66 - 130	1	20
Surrogate	%Recovery	MSD Qualifier	Limits								
4-Bromofluorobenzene (Surr)	98		80 - 120								
Dibromofluoromethane (Surr)	102		76 - 132								
Toluene-d8 (Surr)	105		80 - 128								

TestAmerica Irvine

# QC Sample Results

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Method: 8260B/5030B - Volatile Organic Compounds (GC/MS) (Continued)

**Lab Sample ID: MB 440-337337/5**  
**Matrix: Water**  
**Analysis Batch: 337337**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			06/18/16 11:20	1
1,2-Dichloroethane	ND		0.50	ug/L			06/18/16 11:20	1
Benzene	ND		0.50	ug/L			06/18/16 11:20	1
Ethanol	ND		150	ug/L			06/18/16 11:20	1
Ethylbenzene	ND		0.50	ug/L			06/18/16 11:20	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			06/18/16 11:20	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			06/18/16 11:20	1
m,p-Xylene	ND		1.0	ug/L			06/18/16 11:20	1
Methyl-t-Butyl Ether (MTBE)	ND		0.50	ug/L			06/18/16 11:20	1
o-Xylene	ND		0.50	ug/L			06/18/16 11:20	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			06/18/16 11:20	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			06/18/16 11:20	1
Toluene	ND		0.50	ug/L			06/18/16 11:20	1
Xylenes, Total	ND		1.0	ug/L			06/18/16 11:20	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	101		80 - 120		06/18/16 11:20	1
Dibromofluoromethane (Surr)	87		76 - 132		06/18/16 11:20	1
Toluene-d8 (Surr)	106		80 - 128		06/18/16 11:20	1

**Lab Sample ID: LCS 440-337337/7**  
**Matrix: Water**  
**Analysis Batch: 337337**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dibromoethane (EDB)	25.0	26.5		ug/L		106	70 - 130
1,2-Dichloroethane	25.0	23.3		ug/L		93	57 - 138
Benzene	25.0	24.5		ug/L		98	68 - 130
Ethanol	1000	1130		ug/L		113	50 - 149
Ethylbenzene	25.0	26.7		ug/L		107	70 - 130
Ethyl-t-butyl ether (ETBE)	25.0	24.4		ug/L		98	60 - 136
Isopropyl Ether (DIPE)	25.0	27.5		ug/L		110	58 - 139
m,p-Xylene	25.0	26.5		ug/L		106	70 - 130
Methyl-t-Butyl Ether (MTBE)	25.0	23.2		ug/L		93	63 - 131
o-Xylene	25.0	25.7		ug/L		103	70 - 130
Tert-amyl-methyl ether (TAME)	25.0	23.0		ug/L		92	57 - 139
tert-Butyl alcohol (TBA)	250	277		ug/L		111	70 - 130
Toluene	25.0	26.8		ug/L		107	70 - 130

Surrogate	LCS %Recovery	LCS Qualifier	Limits
4-Bromofluorobenzene (Surr)	100		80 - 120
Dibromofluoromethane (Surr)	85		76 - 132
Toluene-d8 (Surr)	100		80 - 128

TestAmerica Irvine

# QC Sample Results

Client: Broadbent & Associates, Inc.  
 Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Method: 8260B/5030B - Volatile Organic Compounds (GC/MS) (Continued)

**Lab Sample ID: 440-149868-4 MS**

**Matrix: Water**

**Analysis Batch: 337337**

**Client Sample ID: MW-7**

**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits	
1,2-Dibromoethane (EDB)	ND		25.0	25.3		ug/L		101	70 - 131	
1,2-Dichloroethane	ND		25.0	23.2		ug/L		93	56 - 146	
Benzene	6.6		25.0	29.9		ug/L		93	66 - 130	
Ethanol	ND		1000	1140		ug/L		114	54 - 150	
Ethylbenzene	11		25.0	35.0		ug/L		95	70 - 130	
Ethyl-t-butyl ether (ETBE)	ND		25.0	24.8		ug/L		99	70 - 130	
Isopropyl Ether (DIPE)	ND		25.0	27.9		ug/L		112	64 - 138	
m,p-Xylene	5.0		25.0	29.5		ug/L		98	70 - 133	
Methyl-t-Butyl Ether (MTBE)	ND		25.0	23.5		ug/L		94	70 - 130	
o-Xylene	0.50		25.0	25.0		ug/L		98	70 - 133	
Tert-amyl-methyl ether (TAME)	ND		25.0	23.6		ug/L		95	68 - 133	
tert-Butyl alcohol (TBA)	ND		250	267		ug/L		107	70 - 130	
Toluene	1.2		25.0	25.9		ug/L		99	70 - 130	
<b>MS MS</b>										
<b>Surrogate</b>	<b>%Recovery</b>		<b>Qualifier</b>	<b>Limits</b>						
4-Bromofluorobenzene (Surr)	101			80 - 120						
Dibromofluoromethane (Surr)	87			76 - 132						
Toluene-d8 (Surr)	98			80 - 128						

**Lab Sample ID: 440-149868-4 MSD**

**Matrix: Water**

**Analysis Batch: 337337**

**Client Sample ID: MW-7**

**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,2-Dibromoethane (EDB)	ND		25.0	25.6		ug/L		102	70 - 131	1	25
1,2-Dichloroethane	ND		25.0	23.6		ug/L		94	56 - 146	2	20
Benzene	6.6		25.0	29.7		ug/L		92	66 - 130	1	20
Ethanol	ND		1000	1070		ug/L		107	54 - 150	6	30
Ethylbenzene	11		25.0	34.8		ug/L		94	70 - 130	1	20
Ethyl-t-butyl ether (ETBE)	ND		25.0	25.1		ug/L		100	70 - 130	1	25
Isopropyl Ether (DIPE)	ND		25.0	28.0		ug/L		112	64 - 138	0	25
m,p-Xylene	5.0		25.0	29.6		ug/L		98	70 - 133	0	25
Methyl-t-Butyl Ether (MTBE)	ND		25.0	23.7		ug/L		95	70 - 130	1	25
o-Xylene	0.50		25.0	24.9		ug/L		98	70 - 133	0	20
Tert-amyl-methyl ether (TAME)	ND		25.0	23.9		ug/L		96	68 - 133	1	30
tert-Butyl alcohol (TBA)	ND		250	270		ug/L		108	70 - 130	1	25
Toluene	1.2		25.0	26.0		ug/L		99	70 - 130	0	20
<b>MSD MSD</b>											
<b>Surrogate</b>	<b>%Recovery</b>		<b>Qualifier</b>	<b>Limits</b>							
4-Bromofluorobenzene (Surr)	100			80 - 120							
Dibromofluoromethane (Surr)	88			76 - 132							
Toluene-d8 (Surr)	98			80 - 128							

TestAmerica Irvine

# QC Sample Results

Client: Broadbent & Associates, Inc.  
 Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Method: 8015B/5030B - Gasoline Range Organics (GC)

**Lab Sample ID: MB 440-337286/5**  
**Matrix: Water**  
**Analysis Batch: 337286**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	ND		50	ug/L			06/17/16 18:13	1
Surrogate	%Recovery	MB Qualifier	Limits			Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	104		65 - 140				06/17/16 18:13	1

**Lab Sample ID: LCS 440-337286/4**  
**Matrix: Water**  
**Analysis Batch: 337286**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
GRO (C4-C12)	800	819		ug/L		102	80 - 120
Surrogate	LCS %Recovery	LCS Qualifier	Limits				
4-Bromofluorobenzene (Surr)	110		65 - 140				

**Lab Sample ID: 440-149867-D-3 MS**  
**Matrix: Water**  
**Analysis Batch: 337286**

**Client Sample ID: Matrix Spike**  
**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
GRO (C4-C12)	ND		800	787		ug/L		98	65 - 140
Surrogate	MS %Recovery	MS Qualifier	Limits						
4-Bromofluorobenzene (Surr)	104		65 - 140						

**Lab Sample ID: 440-149867-D-3 MSD**  
**Matrix: Water**  
**Analysis Batch: 337286**

**Client Sample ID: Matrix Spike Duplicate**  
**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
GRO (C4-C12)	ND		800	780		ug/L		97	65 - 140	1	20
Surrogate	MSD %Recovery	MSD Qualifier	Limits								
4-Bromofluorobenzene (Surr)	97		65 - 140								

# QC Association Summary

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## GC/MS VOA

### Analysis Batch: 337112

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
440-149867-C-1 MS	Matrix Spike	Total/NA	Water	8260B/5030B	
440-149867-C-1 MSD	Matrix Spike Duplicate	Total/NA	Water	8260B/5030B	
440-149868-1	MW-4	Total/NA	Water	8260B/5030B	
440-149868-2	MW-5	Total/NA	Water	8260B/5030B	
440-149868-3	MW-6	Total/NA	Water	8260B/5030B	
LCS 440-337112/5	Lab Control Sample	Total/NA	Water	8260B/5030B	
MB 440-337112/4	Method Blank	Total/NA	Water	8260B/5030B	

### Analysis Batch: 337295

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
440-149868-1 - DL	MW-4	Total/NA	Water	8260B/5030B	
440-150131-D-3 MS	Matrix Spike	Total/NA	Water	8260B/5030B	
440-150131-D-3 MSD	Matrix Spike Duplicate	Total/NA	Water	8260B/5030B	
LCS 440-337295/4	Lab Control Sample	Total/NA	Water	8260B/5030B	
MB 440-337295/3	Method Blank	Total/NA	Water	8260B/5030B	

### Analysis Batch: 337337

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
440-149868-4	MW-7	Total/NA	Water	8260B/5030B	
440-149868-4 MS	MW-7	Total/NA	Water	8260B/5030B	
440-149868-4 MSD	MW-7	Total/NA	Water	8260B/5030B	
LCS 440-337337/7	Lab Control Sample	Total/NA	Water	8260B/5030B	
MB 440-337337/5	Method Blank	Total/NA	Water	8260B/5030B	

## GC VOA

### Analysis Batch: 337286

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
440-149867-D-3 MS	Matrix Spike	Total/NA	Water	8015B/5030B	
440-149867-D-3 MSD	Matrix Spike Duplicate	Total/NA	Water	8015B/5030B	
440-149868-1	MW-4	Total/NA	Water	8015B/5030B	
440-149868-2	MW-5	Total/NA	Water	8015B/5030B	
440-149868-3	MW-6	Total/NA	Water	8015B/5030B	
440-149868-4	MW-7	Total/NA	Water	8015B/5030B	
LCS 440-337286/4	Lab Control Sample	Total/NA	Water	8015B/5030B	
MB 440-337286/5	Method Blank	Total/NA	Water	8015B/5030B	

# Definitions/Glossary

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

# Certification Summary

Client: Broadbent & Associates, Inc.  
Project/Site: ARCO 0402, Oakland

TestAmerica Job ID: 440-149868-1

## Laboratory: TestAmerica Irvine

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska	State Program	10	CA01531	06-30-16 *
Arizona	State Program	9	AZ0671	10-13-16
California	LA Cty Sanitation Districts	9	10256	01-31-17 *
California	State Program	9	CA ELAP 2706	06-30-16 *
Guam	State Program	9	Cert. No. 12.002r	01-23-17
Hawaii	State Program	9	N/A	01-29-17
Kansas	NELAP Secondary AB	7	E-10420	07-31-16
Nevada	State Program	9	CA015312016-2	07-31-16
New Mexico	State Program	6	N/A	01-29-17
Northern Mariana Islands	State Program	9	MP0002	01-29-17
Oregon	NELAP	10	4028	01-29-17
USDA	Federal		P330-09-00080	07-08-18
Washington	State Program	10	C900	09-03-16

\* Certification renewal pending - certification considered valid.

TestAmerica Irvine





# Login Sample Receipt Checklist

Client: Broadbent & Associates, Inc.

Job Number: 440-149868-1

**Login Number: 149868**

**List Source: TestAmerica Irvine**

**List Number: 1**

**Creator: Chavez, Yonny 1**

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	



**APPENDIX D**

**GEOTRACKER UPLOAD CONFIRMATION RECEIPTS**

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STATE WATER RESOURCES CONTROL BOARD  
**GEOTRACKER ESI**

UPLOADING A GEO\_WELL FILE

**SUCCESS**

Processing is complete. No errors were found!  
Your file has been successfully submitted!

<b><u>Submittal Type:</u></b>	<b>GEO_WELL</b>
<b><u>Report Title:</u></b>	<b>Second Quarter 2016 Groundwater Monitoring Report</b>
<b><u>Facility Global ID:</u></b>	<b>T06019734265</b>
<b><u>Facility Name:</u></b>	<b>ARCO #0402 / PARKING LOT</b>
<b><u>File Name:</u></b>	<b>geo_well.zip</b>
<b><u>Organization Name:</u></b>	<b>Broadbent &amp; Associates, Inc.</b>
<b><u>Username:</u></b>	<b>BROADBENT-C</b>
<b><u>IP Address:</u></b>	<b>104.6.25.23</b>
<b><u>Submittal Date/Time:</u></b>	<b>7/22/2016 2:08:25 PM</b>
<b><u>Confirmation Number:</u></b>	<b>9422996222</b>

---

STATE WATER RESOURCES CONTROL BOARD  
**GEOTRACKER ESI**

UPLOADING A EDF FILE

**SUCCESS**

Processing is complete. No errors were found!  
Your file has been successfully submitted!

<b><u>Submittal Type:</u></b>	EDF
<b><u>Report Title:</u></b>	Second Quarter 2016 Groundwater Monitoring Report
<b><u>Report Type:</u></b>	Monitoring Report - Semi-Annually
<b><u>Facility Global ID:</u></b>	T06019734265
<b><u>Facility Name:</u></b>	ARCO #0402 / PARKING LOT
<b><u>File Name:</u></b>	440-149868-1_21 Jun 16 1406_EDF.zip
<b><u>Organization Name:</u></b>	Broadbent & Associates, Inc.
<b><u>Username:</u></b>	BROADBENT-C
<b><u>IP Address:</u></b>	104.6.25.23
<b><u>Submittal Date/Time:</u></b>	7/22/2016 2:11:50 PM
<b><u>Confirmation Number:</u></b>	<b>2152823090</b>

[VIEW QC REPORT](#)

[VIEW DETECTIONS REPORT](#)

**APPENDIX E**

2013 Soil and Soil Vapor Analytical Data

**Table 1**  
**Soil Analytical Results**  
November 2013  
Former ARC Station No. 402  
1450 Fruitvale Avenue, Oakland, California

Well Identification	Soil Sample Depth (feet bgs)	Date Collected	GRO (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes* (mg/kg)	MTBE (mg/kg)	ETBE (mg/kg)	TAME (mg/kg)	TBA (mg/kg)	DIPE (mg/kg)	EDB (mg/kg)	Ethanol (mg/kg)	Naphthalene (mg/kg)
MW-4	3.5	11/14/2013	ND<0.39	ND<0.0010	ND<0.0010	ND<0.0010	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.051	ND<0.0020	ND<0.0010	ND<0.20	ND<0.0020
MW-4	6.5	11/14/2013	ND<0.40	ND<0.00095	ND<0.00095	ND<0.00095	ND<0.0019	ND<0.0019	ND<0.0019	ND<0.0019	ND<0.047	ND<0.0019	ND<0.00095	ND<0.19	ND<0.0019
MW-4	7.5	11/18/2013	0.99	0.0095	0.0057	0.26	0.06	ND<0.0052	ND<0.0052	ND<0.0052	ND<0.13	ND<0.0052	ND<0.0026	ND<0.52	0.21
MW-4	19.5	11/18/2013	1.8	ND<0.10	ND<0.10	0.66	ND<0.20	ND<0.25	ND<0.25	ND<0.25	ND<5.0	ND<0.25	ND<0.10	ND<15	ND<0.25
MW-5	7.5	11/18/2013	ND<0.37	ND<0.0010	ND<0.0010	ND<0.0010	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.050	ND<0.0020	ND<0.0010	ND<0.20	ND<0.0020
MW-5	15.5	11/18/2013	1.3	ND<0.00099	ND<0.00099	ND<0.00099	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.050	ND<0.0020	ND<0.00099	ND<0.20	ND<0.0020
MW-5	19.5	11/18/2013	ND<0.39	ND<0.00099	ND<0.00099	ND<0.00099	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.050	ND<0.0020	ND<0.00099	ND<0.20	ND<0.0020
MW-6	7.5	11/19/2013	ND<0.38	ND<0.00099	ND<0.00099	ND<0.00099	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.049	ND<0.0020	ND<0.00099	ND<0.20	ND<0.0020
MW-6	15.5	11/19/2013	16	ND<0.0010	ND<0.0010	ND<0.0010	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.050	ND<0.0020	ND<0.0020	ND<0.20	ND<0.0020
MW-7	7.5	11/19/2013	ND<0.38	ND<0.00099	ND<0.00099	ND<0.00099	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.049	ND<0.0020	ND<0.00099	ND<0.20	ND<0.0020
MW-7	15.5	11/19/2013	39	ND<0.00099	ND<0.00099	0.0053	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.050	ND<0.0020	ND<0.00099	ND<0.20	ND<0.0020
LTCP Criteria - 0 to 5 feet bgs			NA	<b>8.2</b>	NA	<b>89</b>	NA	NA	NA	NA	NA	NA	NA	NA	<b>45</b>
LTCP Criteria - 5 to 10 feet bgs			NA	<b>12</b>	NA	<b>134</b>	NA	NA	NA	NA	NA	NA	NA	NA	<b>45</b>
LTCP Criteria -Utility Worker			NA	<b>14</b>	NA	<b>314</b>	NA	NA	NA	NA	NA	NA	NA	NA	<b>219</b>

**Notes:**

feet bgs = feet below ground surface  
mg/kg = milligrams per kilogram  
GRO = gasoline range organics (C6-C12)  
MTBE = methyl tert-butyl ether  
ETBE = ethyl tert-butyl ether  
TAME = tert-amyl methyl ether  
TBA = tert butyl alcohol  
DIPE = di isopropyl ether  
1,2-DCA = 1,2-dichloroethane  
EDB = 1,2-dibromomethane

ND<X.XX = not detected above reporting limit of X.XX  
NA = not analyzed  
LTCP = Low Threat UST Closure Policy, California State Water Resources Control Board (SWRCB), August 17, 2012  
LTCP Criteria listed in Table 1, page 8 of the LTCP for a commercial/industrial exposure scenario

**Table 4**  
**Soil Vapor Analytical Results**  
December 17, 2013  
Former ARC Station No. 402  
1450 Fruitvale Avenue, Oakland, California

Soil Vapor Probe Identification	Probe Sample Depth (feet bgs)	Date Collected	GRO ( $\mu\text{g}/\text{m}^3$ )	Benzene ( $\mu\text{g}/\text{m}^3$ )	Toluene ( $\mu\text{g}/\text{m}^3$ )	Ethylbenzene ( $\mu\text{g}/\text{m}^3$ )	Total Xylenes* ( $\mu\text{g}/\text{m}^3$ )	MTBE ( $\mu\text{g}/\text{m}^3$ )	Naphthalene ( $\mu\text{g}/\text{m}^3$ )	Carbon Dioxide (%)	Methane (%)	Oxygen (%)
SG-1A	3-3.5	12/17/2013	ND<8,100	ND<13	ND<15	ND<17	ND<17	ND<14	ND<21	1.7	0.00035	18.0
SG-1B	5-5.5	12/17/2013	46,000	ND<13	ND<15	ND<17	ND<17	ND<14	ND<21	1.1	0.0042	8.0
SG-2A	3-3.5	12/18/2013	ND<8,000	ND<13	ND<15	ND<17	ND<17	ND<14	ND<21	<0.98	0.0038	28.0
SG-2B	5-5.5	12/18/2013	ND<7,800	ND<13	ND<15	ND<17	ND<17	ND<14	ND<21	1.1	0.00076	20.0
SG-3A	3-3.5	12/17/2013	ND<8,000	ND<13	ND<15	ND<17	ND<17	ND<14	ND<21	1.0	0.00029	19.0
SG-3B	5-5.5	12/17/2013	ND<7,600	ND<13	ND<15	ND<17	ND<17	ND<14	ND<21	2.1	0.00027	18.0
ESLs			<b>2,500,000</b>	<b>420.0</b>	<b>1,300,000</b>	<b>4,900</b>	<b>440,000</b>	<b>47,000</b>	<b>360</b>	NA	NA	NA

**Notes:**

feet bgs = feet below ground surface  
 $\mu\text{g}/\text{m}^3$  = micrograms per cubic meter  
GRO = gasoline range organics (C6-C12)  
MTBE = methyl tert-butyl ether

ND<X.XX = not detected above reporting limit of X.XX  $\mu\text{g}/\text{m}^3$

NA = not analyzed

ESLs - Tier 1 Environmental Screening Levels, *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater*, California Regional Water Quality Control Board (CRWQCB), Interim Final, December 2013. Commercial/Industrial exposure scenario; Table E-2