

## TECHNICAL MEMORANDUM

**DATE** April 20, 2018

**Project No.** 1520304.401

**TO** Washington State Department of Ecology (Ecology)  
Public Health – Seattle & King County  
(see transmittal for complete distribution list)

**CC** Holcim (US) Inc.

**FROM** Gary Zimmerman and Frank Shuri, PE, LG, LEG (Golder)

### RE: BAJA PROPERTY WATER WELL SAMPLING

This technical memorandum provides a summary of the sampling of the BAJA Property water well performed on April 4, 2018. The sampling was completed by Golder Associates Inc. (Golder) on behalf of Holcim (US) Inc. (Holcim). The sampling was overseen by representatives from the Washington State Department of Ecology (Ecology) and Public Health – Seattle & King County (Public Health).

Golder met with Tim O'Connor (Ecology) and Darshan Dhillon (Public Health) at the Reserve Silica office and proceeded to the BAJA property. The pump house is located just off the first shoulder on the property access road, immediately after entering the property. The well is located approximately 100 feet northeast of the pump house, at a latitude/longitude of 47.344848°N, 121.996294°W. The well is approximately 350 feet southwest of the infiltration ponds.

Golder was able to locate a State of Washington Water Well Report on a well associated with the Tax Parcel ID of the BAJA property. This report is provided in Attachment 1.

Golder completed the water well sampling using the following approach:

- The well was purged at a rate of approximately 5 gallons per minute from a garden hose located immediately outside the pump house while monitoring water quality parameters, which include pH, conductivity, temperature, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity. The garden hose directed water away from the pump house and well head during purging.
- Once parameters stabilized, Golder shut down purging water from the hose, and sampled well water from a port located inside the pump house. Samples were collected from this port after water had been purged from the short lengths of pump house piping to remove several pipe volumes.
- Water from the port was collected into a 1-liter polyethylene container provided by the analytical testing laboratory. The water was then pumped using a peristaltic pump and new tubing into laboratory-provided sampling containers (500 milliliter polyethylene containers with nitric acid preservative). This setup was required to allow field-filtering of the sample with a 0.45 micron in-line filter.
- An equipment blank was collected by pumping laboratory-provided deionized water into laboratory-provided sampling containers. New polyethylene and flexible Tygon tubing was used for preparing the equipment blank.

The samples collected from the well were analyzed for total metals and dissolved arsenic, cadmium, chromium, lead, iron, and manganese at Analytical Resources Inc. (ARI) in Tukwila, Washington. Field pH readings were between 6.3 and 6.6.

Lab analytical results indicate that all metals results were below primary drinking water standards. A summary of the field parameters at the time of sampling and the laboratory analytical results is provided in Table 1, and the full laboratory analytical report is provided in Attachment 2.

Tables: Table 1 – BAJA Water Well Field Parameters and Lab Analytical Data

Attachments: Attachment 1 – State of Washington Water Well Report

Attachment 2 – Laboratory Analytical Report

Tables

**Table 1 - BAJA Water Well Field Parameters and Lab Analytical Data**

Sample Area	Sample Location ID	Date Sampled	Field Parameters						Total Metals (mg/L)						Dissolved Metals (mg/L)					
			Temperature (°C)	Conductivity (µmhos/cm)	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (Rel mV)	Turbidity (NTU)	pH (standard units)	Arsenic	Cadmium	Chromium	Iron	Lead	Manganese	Arsenic	Cadmium	Chromium	Iron	Lead	Manganese
BAJA Property	BAJA Water Well	4/4/2018	12.7	296.7	6.74	832.3	0.89	6.36	0.000249	0.000036 J	0.000146 J	0.115	0.00157	0.115	0.000221	<0.0001	<0.0005	0.0111 J	0.000489	0.0413
Primary Drinking Water Standard <sup>a</sup>									0.005	0.005	0.05	-	0.015	-	0.005	0.005	0.05	-	0.015	-
Secondary Drinking Water Standard <sup>b</sup>									-	-	-	0.3	-	0.05	-	-	-	0.3	-	0.05

Notes:

a - MTCA Method A

b - EPA Secondary Maximum Contaminant Level (SMCL). SMCLs are not enforced, and provide drinking water guidelines on aesthetics, such as taste, odor, or color.

J - Data validation code; estimated value

"-" - Standard not available

Attachment 1 - State of Washington  
Water Well Report

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

# WATER WELL REPORT

Original & 1st copy - Ecology, 2nd copy - owner, 3rd copy - driller

Construction/Decommission ("x" in circle) 138518

- Construction  
 Decommission ORIGINAL CONSTRUCTION Notice of Intent Number \_\_\_\_\_

PROPOSED USE:  Domestic  Industrial  Municipal  
 DeWater  Irrigation  Test Well  Other \_\_\_\_\_

TYPE OF WORK: Owner's number of well (if more than one) \_\_\_\_\_  
 New Well  Reconditioned Method  Dug  Bored  Driven  
 Deepened  Cable  Rotary  Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 260 ft  
 Depth of completed well 57 ft

CONSTRUCTION DETAILS  
 Casing  Welded 6" Diam from 0 ft to 57 ft  
 Installed:  Liner installed \_\_\_\_\_" Diam from \_\_\_\_\_ ft to \_\_\_\_\_ ft  
 Threaded \_\_\_\_\_" Diam from \_\_\_\_\_ ft to \_\_\_\_\_ ft

Perforations:  Yes  No  
 Type of perforator used \_\_\_\_\_  
 SIZE of perfs \_\_\_\_\_ in by \_\_\_\_\_ in and no of perfs \_\_\_\_\_ from \_\_\_\_\_ ft to \_\_\_\_\_ ft

Screens:  Yes  No  K-Pac Location \_\_\_\_\_  
 Manufacturer's Name \_\_\_\_\_  
 Type \_\_\_\_\_ Model No \_\_\_\_\_  
 Diam \_\_\_\_\_ Slot Size \_\_\_\_\_ from \_\_\_\_\_ ft to \_\_\_\_\_ ft  
 Diam \_\_\_\_\_ Slot Size \_\_\_\_\_ from \_\_\_\_\_ ft to \_\_\_\_\_ ft

Gravel/Filter packed:  Yes  No  Size of gravel/sand \_\_\_\_\_  
 Materials placed from \_\_\_\_\_ ft to \_\_\_\_\_ ft

Surface Seal:  Yes  No To what depth? 18 ft  
 Materials used in seal Bentonite  
 Did any strata contain unusable water?  Yes  No  
 Type of water? \_\_\_\_\_ Depth of strata \_\_\_\_\_  
 Method of sealing strata off \_\_\_\_\_

PUMP: Manufacturer's Name \_\_\_\_\_  
 Type \_\_\_\_\_ HP \_\_\_\_\_

WATER LEVELS: Land-surface elevation above mean sea level \_\_\_\_\_ ft  
 Static level 50 ft below top of well Date 9-11-03  
 Artesian pressure \_\_\_\_\_ lbs per square inch Date \_\_\_\_\_  
 Artesian water is controlled by \_\_\_\_\_ (cap, valve, etc)

WELL TESTS: Drawdown is amount water level is lowered below static level  
 Was a pump test made?  Yes  No If yes, by whom? \_\_\_\_\_  
 Yield: \_\_\_\_\_ gal/min with \_\_\_\_\_ ft drawdown after \_\_\_\_\_ hrs  
 Yield: \_\_\_\_\_ gal/min with \_\_\_\_\_ ft drawdown after \_\_\_\_\_ hrs  
 Yield: \_\_\_\_\_ gal/min with \_\_\_\_\_ ft drawdown after \_\_\_\_\_ hrs

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test \_\_\_\_\_  
 Bailer test 1/4 gal/min with 7 ft drawdown after 3 1/2 hrs  
 Airtest \_\_\_\_\_ gal/min with stem set at \_\_\_\_\_ ft for \_\_\_\_\_ hrs  
 Artesian flow \_\_\_\_\_ g p m Date \_\_\_\_\_  
 Temperature of water \_\_\_\_\_ Was a chemical analysis made?  Yes  No

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Driller  Engineer  Trainee Name (Print) Brad Johnson Drilling Company Johnson Drilling Co, Inc  
 Driller/Engineer/Trainee Signature Brad Johnson Address 19415 108th Ave SE  
 Driller or Trainee License No. 0233

If trainee, licensed driller's \_\_\_\_\_  
 Signature and License no. \_\_\_\_\_

CURRENT Notice of Intent No. W127779

Unique Ecology Well ID Tag No. ABO-584

Water Right Permit No. \_\_\_\_\_

Property Owner Name C. J. Construction

Well Street Address 28750 Bl. Diamond Ridge Dr

City Ravensdale County: King RD SE

Location SE 1/4 - 1/4 SE 1/4 Sec 35 Twn 22 R 6  WWM circle or one

Lat/Long: (s, t, r still REQUIRED) Lat Deg \_\_\_\_\_ Lat Min/Sec \_\_\_\_\_

Long Deg \_\_\_\_\_ Long Min/Sec \_\_\_\_\_

Tax Parcel No. 3522069046

CONSTRUCTION OR DECOMMISSION PROCEDURE  
 Formation Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information Indicate all water encountered (USE ADDITIONAL SHEETS IF NECESSARY)

MATERIAL	FROM	TO
Surface	0	3
Sand-gravel-brown	3	7
Hardpan-brown	7	53
Sand-gravel-seepage brown	53	57
Sandstone-gray	57	85
Coal	85	90
Sandstone-gray	90	230
Decayed rock-coal	230	260

Bentonite placed from 75' - 260'

RECEIVED

SEP 17 2003

DEPT OF ECOLOGY

Start Date 9-5-03 Completed Date 9-11-03

City, State, Zip Renton, WA 98055  
 Contractor's Registration No. 50445DC207QM Date 9-11-03

**APPENDIX A**

**Attachment 2 - Laboratory  
Analytical Report**



**Analytical Resources, Incorporated**  
Analytical Chemists and Consultants

16 April 2018

Gary Zimmerman  
Golder Associates  
18300 NE Union Hill Road Suite 200  
Redmond, WA 98052-3333

RE: Ravensdale

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

<u>Associated Work Order(s)</u>	<u>Associated SDG ID(s)</u>
18D0064	N/A

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I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclosed Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, Inc.



*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*



# Chain of Custody Record & Laboratory Analysis Request



**Analytical Resources, Incorporated**  
 Analytical Chemists and Consultants  
 4611 South 134th Place, Suite 100  
 Tukwila, WA 98168  
 206-695-6200 206-695-6201 (fax)  
 www.arilabs.com

ARI Assigned Number: <b>1800064</b>	Turn-around Requested: <b>Standard 10 DA/</b>	Page: <b>1</b> of <b>1</b>
ARI Client Company: <b>Golder</b>	Phone: <b>832 411 3888</b>	Date: <b>4/4/18</b>
Client Contact: <b>Jing Song Xi</b>	<b>JXIC@GOLDER.COM</b>	Ice Present? <b></b>
Client Project Name: <b>Ravens data</b>		No. of Coolers: <b></b>
Client Project #: <b>1520304.400</b>	Samplers: <b>Jing Song Xi</b>	Cooler Temps: <b></b>

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested							Notes/Comments	
					Total Metals Arsenic, Cadmium, Chromium, Lead, Iron, Manganese	Dissolved Metals Arsenic, Cadmium, Chromium, Lead, Iron, Manganese							
<b>BASA Well</b>	<b>4/4/18</b>	<b>1416</b>	<b>W</b>	<b>2</b>	<b>X</b>	<b>X</b>							<b>- Reg. A to MDL - Client specific EPD - As MDL = 0.00076 mg/L</b>
<b>EB</b>	<b>4/4/18</b>	<b>1440</b>	<b>↓</b>	<b>2</b>	<b>X</b>	<b>X</b>							
Comments/Special Instructions <b>In Accordance w/ Master Services Agreement</b>	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)									
	Printed Name: <b>Jing Song Xi</b>	Printed Name: <b>Brandon Fisk</b>	Printed Name:	Printed Name:									
	Company: <b>Golder</b>	Company: <b>ARI</b>	Company:	Company:									
	Date & Time: <b>4/4/18 1623</b>	Date & Time: <b>4/4/18 1623</b>	Date & Time:	Date & Time:									

**Limits of Liability:** ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, notwithstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.

**Sample Retention Policy:** All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.



Golder Associates  
18300 NE Union Hill Road Suite 200  
Redmond WA, 98052-3333

Project: Ravensdale  
Project Number: Ravensdale  
Project Manager: Gary Zimmerman

Reported:  
16-Apr-2018 14:29

**ANALYTICAL REPORT FOR SAMPLES**

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
BAJA Well	18D0064-01	Water	04-Apr-2018 14:16	05-Apr-2018 16:23
BAJA Well	18D0064-02	Water	04-Apr-2018 14:16	05-Apr-2018 16:23
EB	18D0064-03	Water	04-Apr-2018 14:40	05-Apr-2018 16:23
EB	18D0064-04	Water	04-Apr-2018 14:40	05-Apr-2018 16:23



Golder Associates  
18300 NE Union Hill Road Suite 200  
Redmond WA, 98052-3333

Project: Ravensdale  
Project Number: Ravensdale  
Project Manager: Gary Zimmerman

**Reported:**  
16-Apr-2018 14:29

## Case Narrative

### Total and Dissolved Metals -

The sample(s) were digested and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.



WORK ORDER

18D0064

<b>Client:</b> Golder Associates	<b>Project Manager:</b> Kelly Bottem
<b>Project:</b> Ravensdale	<b>Project Number:</b> Ravensdale

Report To:

Golder Associates  
Gary Zimmerman  
18300 NE Union Hill Road Suite 200  
Redmond, WA 98052-3333  
Phone: 425-883-0777  
Fax: -

Invoice To:

Golder Associates  
Gary Zimmerman  
18300 NE Union Hill Road Suite 200  
Redmond, WA 98052-3333  
Phone :425-883-0777  
Fax: -

Date Due: 20-Apr-2018 18:00 (10 day TAT)

Received By: Brandon Fisk

Date Received: 05-Apr-2018 16:23

Logged In By: Jacob Walter

Date Logged In: 05-Apr-2018 11:26

Samples Received at: 1.9°C

Intact, properly signed and dated custody seals attached to outside of cooler(s).....No	Custody papers included with the cooler.....	Yes
Custody papers properly filled out (in, signed, analyses requested, etc).....Yes	Was a temperature blank included in the cooler.....	No
Was sufficient ice used (if appropriate).....Yes	All bottles sealed in individual plastic bags.....	No
All bottles arrived in good condition (unbroken).....Yes	All bottle labels complete and legible.....	Yes
Number of containers listed on COC match number received.....Yes	Bottle labels and tags agree with COC.....	Yes
Correct bottles used for the requested analyses.....Yes	All VOC vials free of air bubbles.....	No
Analyses/bottles require preservation (attach preservation sheet excluding VOC)..Yes	Sufficient amount of sample sent in each bottle.....	Yes
Sample split at ARI.....No		



WORK ORDER

18D0064

<b>Client:</b> Golder Associates	<b>Project Manager:</b> Kelly Bottem
<b>Project:</b> Ravensdale	<b>Project Number:</b> Ravensdale

Analysis	Due	TAT	Expires	Comments
<b>18D0064-01 BAJA Well [Water] Sampled 04-Apr-2018 14:16</b>				
Met 200.8 - As UCT	04/20/2018	10	10/1/2018	
Met 200.8 - Cd UCT	04/20/2018	10	10/1/2018	
Met 200.8 - Cr	04/20/2018	10	10/1/2018	
Met 200.8 - Pb	04/20/2018	10	10/1/2018	
Met 6010C - Fe	04/20/2018	10	10/1/2018	
Met 6010C - Mn	04/20/2018	10	10/1/2018	
<b>18D0064-02 BAJA Well [Water] Sampled 04-Apr-2018 14:16</b>				
Met Diss 200.8 - As UCT	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 200.8 - Cd UCT	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 200.8 - Pb	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 6010C - Fe	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 200.8 - Cr	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 6010C - Mn	04/20/2018	10	10/1/2018	Field Filtered
<b>18D0064-03 EB [Water] Sampled 04-Apr-2018 14:40</b>				
Met 200.8 - Cd UCT	04/20/2018	10	10/1/2018	
Met 200.8 - As UCT	04/20/2018	10	10/1/2018	
Met 200.8 - Cr	04/20/2018	10	10/1/2018	
Met 200.8 - Pb	04/20/2018	10	10/1/2018	
Met 6010C - Fe	04/20/2018	10	10/1/2018	
Met 6010C - Mn	04/20/2018	10	10/1/2018	
<b>18D0064-04 EB [Water] Sampled 04-Apr-2018 14:40</b>				
Met Diss 200.8 - As UCT	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 200.8 - Cd UCT	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 200.8 - Cr	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 200.8 - Pb	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 6010C - Fe	04/20/2018	10	10/1/2018	Field Filtered
Met Diss 6010C - Mn	04/20/2018	10	10/1/2018	Field Filtered

**Preservation Confirmation**

Container ID	Container Type	pH	
18D0064-01 A	HDPE NM, 500 mL, 1:1 HNO3	7.2	Pass
18D0064-02 A	HDPE NM, 500 mL, 1:1 HNO3 (FF)	7.2	Pass
18D0064-03 A	HDPE NM, 500 mL, 1:1 HNO3	7.2	Pass
18D0064-04 A	HDPE NM, 500 mL, 1:1 HNO3 (FF)	7.2	Pass

\_\_\_\_\_  
Preservation Confirmed By

\_\_\_\_\_  
Date



# Cooler Receipt Form

ARI Client: Golden

Project Name: \_\_\_\_\_

COC No(s): \_\_\_\_\_ NA

Delivered by: Fed-Ex UPS Courier Hand Delivered Other: \_\_\_\_\_

Assigned ARI Job No: 18D0064

Tracking No: \_\_\_\_\_ NA

**Preliminary Examination Phase:**

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES NO

Were custody papers included with the cooler? ..... YES NO

Were custody papers properly filled out (ink, signed, etc.) ..... YES NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)

Time: 1623 1.9

Temp Gun ID#: P002565

If cooler temperature is out of compliance fill out form 00070F

Cooler Accepted by: BT Date: \_\_\_\_\_ Time: 1623

*Complete custody forms and attach all shipping documents*

**Log-In Phase:**

Was a temperature blank included in the cooler? ..... YES NO

What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: \_\_\_\_\_

Was sufficient ice used (if appropriate)? ..... NA YES NO

Were all bottles sealed in individual plastic bags? ..... YES NO

Did all bottles arrive in good condition (unbroken)? ..... YES NO

Were all bottle labels complete and legible? ..... YES NO

Did the number of containers listed on COC match with the number of containers received? ..... YES NO

Did all bottle labels and tags agree with custody papers? ..... YES NO

Were all bottles used correct for the requested analyses? ..... YES NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... NA YES NO

Were all VOC vials free of air bubbles? ..... NA YES NO

Was sufficient amount of sample sent in each bottle? ..... YES NO

Date VOC Trip Blank was made at ARI..... NA

Was Sample Split by ARI : NA YES Date/Time: \_\_\_\_\_ Equipment: \_\_\_\_\_ Split by: \_\_\_\_\_

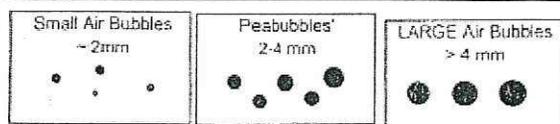
Samples Logged by: ISW Date: 04/05/18 Time: 1037

**\*\* Notify Project Manager of discrepancies or concerns \*\***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

**Additional Notes, Discrepancies, & Resolutions:**

By: \_\_\_\_\_ Date: \_\_\_\_\_



- Small → "sm" (< 2 mm)
- Peabubbles → "pb" (2 to < 4 mm)
- Large → "lg" (4 to < 6 mm)
- Headspace → "hs" (> 6 mm)



Golder Associates  
18300 NE Union Hill Road Suite 200  
Redmond WA, 98052-3333

Project: Ravensdale  
Project Number: Ravensdale  
Project Manager: Gary Zimmerman

Reported:  
16-Apr-2018 14:29

**BAJA Well**  
**18D0064-01 (Water)**

**Metals and Metallic Compounds**

Method: EPA 200.8

Sampled: 04/04/2018 14:16

Instrument: ICPMS2

Analyzed: 09-Apr-2018 16:20

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO<sub>3</sub> matrix  
Preparation Batch: BGD0119 Sample Size: 25 mL  
Prepared: 09-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection	Reporting	Result	Units	Notes
			Limit	Limit			
Chromium	7440-47-3	1	0.130	0.500	<b>0.146</b>	ug/L	J
Lead	7439-92-1	1	0.0680	0.100	<b>1.57</b>	ug/L	



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Reported:  
16-Apr-2018 14:29

**BAJA Well**  
**18D0064-01 (Water)**

**Metals and Metallic Compounds**

Method: EPA 200.8 UCT-KED

Sampled: 04/04/2018 14:16

Instrument: ICPMS2

Analyzed: 09-Apr-2018 16:20

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO<sub>3</sub> matrix  
Preparation Batch: BGD0119 Sample Size: 25 mL  
Prepared: 09-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection	Reporting	Result	Units	Notes
			Limit	Limit			
Arsenic	7440-38-2	1	0.0220	0.200	<b>0.249</b>	ug/L	
Cadmium	7440-43-9	1	0.0300	0.100	<b>0.0360</b>	ug/L	J



Golder Associates  
18300 NE Union Hill Road Suite 200  
Redmond WA, 98052-3333

Project: Ravensdale  
Project Number: Ravensdale  
Project Manager: Gary Zimmerman

Reported:  
16-Apr-2018 14:29

**BAJA Well**  
**18D0064-01 (Water)**

**Metals and Metallic Compounds**

Method: EPA 6010C

Sampled: 04/04/2018 14:16

Instrument: ICP2

Analyzed: 09-Apr-2018 12:52

Sample Preparation: Preparation Method: TWC EPA 3010A  
Preparation Batch: BGD0118 Sample Size: 25 mL  
Prepared: 06-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Iron	7439-89-6	1	0.0013	0.0500	<b>0.115</b>	mg/L	
Manganese	7439-96-5	1	0.0003	0.0010	<b>0.115</b>	mg/L	



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Project: Ravensdale  
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Project Manager: Gary Zimmerman

**Reported:**  
16-Apr-2018 14:29

**BAJA Well**  
**18D0064-02 (Water)**

**Metals and Metallic Compounds (dissolved)**

Method: EPA 200.8

Sampled: 04/04/2018 14:16

Instrument: ICPMS2

Analyzed: 11-Apr-2018 12:51

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO3 matrix  
Preparation Batch: BGD0186 Sample Size: 25 mL  
Prepared: 10-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Chromium, Dissolved	7440-47-3	1	0.130	0.500	ND	ug/L	U
Lead, Dissolved	7439-92-1	1	0.0680	0.100	<b>0.489</b>	ug/L	



Golder Associates  
18300 NE Union Hill Road Suite 200  
Redmond WA, 98052-3333

Project: Ravensdale  
Project Number: Ravensdale  
Project Manager: Gary Zimmerman

Reported:  
16-Apr-2018 14:29

**BAJA Well**  
**18D0064-02 (Water)**

**Metals and Metallic Compounds (dissolved)**

Method: EPA 200.8 UCT-KED

Sampled: 04/04/2018 14:16

Instrument: ICPMS2

Analyzed: 11-Apr-2018 12:51

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO<sub>3</sub> matrix  
Preparation Batch: BGD0186 Sample Size: 25 mL  
Prepared: 10-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection	Reporting	Result	Units	Notes
			Limit	Limit			
Arsenic, Dissolved	7440-38-2	1	0.0220	0.200	<b>0.221</b>	ug/L	
Cadmium, Dissolved	7440-43-9	1	0.0300	0.100	ND	ug/L	U



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Project Manager: Gary Zimmerman

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**BAJA Well**  
**18D0064-02 (Water)**

**Metals and Metallic Compounds (dissolved)**

Method: EPA 6010C

Sampled: 04/04/2018 14:16

Instrument: ICP2

Analyzed: 13-Apr-2018 15:04

Sample Preparation: Preparation Method: WMN (No Prep)  
Preparation Batch: BGD0220  
Prepared: 11-Apr-2018

Sample Size: 25 mL  
Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Iron, Dissolved	7439-89-6	1	0.0013	0.0500	<b>0.0111</b>	mg/L	J
Manganese, Dissolved	7439-96-5	1	0.0003	0.0010	<b>0.0413</b>	mg/L	



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**EB**  
**18D0064-03 (Water)**

**Metals and Metallic Compounds**

Method: EPA 200.8 Sampled: 04/04/2018 14:40

Instrument: ICPMS2 Analyzed: 09-Apr-2018 17:18

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO3 matrix  
Preparation Batch: BGD0119 Sample Size: 25 mL  
Prepared: 09-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Chromium	7440-47-3	1	0.130	0.500	<b>0.516</b>	ug/L	
Lead	7439-92-1	1	0.0680	0.100	ND	ug/L	U



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**EB**  
**18D0064-03 (Water)**

**Metals and Metallic Compounds**

Method: EPA 200.8 UCT-KED

Sampled: 04/04/2018 14:40

Instrument: ICPMS2

Analyzed: 09-Apr-2018 17:18

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO<sub>3</sub> matrix  
Preparation Batch: BGD0119 Sample Size: 25 mL  
Prepared: 09-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Arsenic	7440-38-2	1	0.0220	0.200	ND	ug/L	U
Cadmium	7440-43-9	1	0.0300	0.100	ND	ug/L	U



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**EB**  
**18D0064-03 (Water)**

**Metals and Metallic Compounds**

Method: EPA 6010C

Sampled: 04/04/2018 14:40

Instrument: ICP2

Analyzed: 09-Apr-2018 12:56

Sample Preparation: Preparation Method: TWC EPA 3010A  
Preparation Batch: BGD0118 Sample Size: 25 mL  
Prepared: 06-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Iron	7439-89-6	1	0.0013	0.0500	<b>0.0018</b>	mg/L	J
Manganese	7439-96-5	1	0.0003	0.0010	ND	mg/L	U



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**EB**  
**18D0064-04 (Water)**

**Metals and Metallic Compounds (dissolved)**

Method: EPA 200.8 Sampled: 04/04/2018 14:40

Instrument: ICPMS2 Analyzed: 11-Apr-2018 12:56

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO3 matrix  
Preparation Batch: BGD0186 Sample Size: 25 mL  
Prepared: 10-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Chromium, Dissolved	7440-47-3	1	0.130	0.500	ND	ug/L	U
Lead, Dissolved	7439-92-1	1	0.0680	0.100	ND	ug/L	U



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**EB**  
**18D0064-04 (Water)**

**Metals and Metallic Compounds (dissolved)**

Method: EPA 200.8 UCT-KED

Sampled: 04/04/2018 14:40

Instrument: ICPMS2

Analyzed: 11-Apr-2018 12:56

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO3 matrix  
Preparation Batch: BGD0186 Sample Size: 25 mL  
Prepared: 10-Apr-2018 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Arsenic, Dissolved	7440-38-2	1	0.0220	0.200	ND	ug/L	U
Cadmium, Dissolved	7440-43-9	1	0.0300	0.100	ND	ug/L	U



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**EB**  
**18D0064-04 (Water)**

**Metals and Metallic Compounds (dissolved)**

Method: EPA 6010C

Sampled: 04/04/2018 14:40

Instrument: ICP2

Analyzed: 13-Apr-2018 15:08

Sample Preparation: Preparation Method: WMN (No Prep)  
Preparation Batch: BGD0220  
Prepared: 11-Apr-2018

Sample Size: 25 mL  
Final Volume: 25 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Iron, Dissolved	7439-89-6	1	0.0013	0.0500	ND	mg/L	U
Manganese, Dissolved	7439-96-5	1	0.0003	0.0010	ND	mg/L	U



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**Metals and Metallic Compounds - Quality Control**

**Batch BGD0118 - TWC EPA 3010A**

Instrument: ICP2 Analyst: MCB

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BGD0118-BLK1)</b>						Prepared: 06-Apr-2018 Analyzed: 09-Apr-2018 11:58					
Iron	0.0032	0.0013	0.0500	mg/L							J
Manganese	ND	0.0003	0.0010	mg/L							U
<b>LCS (BGD0118-BS1)</b>						Prepared: 06-Apr-2018 Analyzed: 09-Apr-2018 12:31					
Iron	2.10	0.0013	0.0500	mg/L	2.00		105	80-120			
Manganese	0.503	0.0003	0.0010	mg/L	0.500		101	80-120			



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**Metals and Metallic Compounds - Quality Control**

**Batch BGD0119 - REN EPA 600/4-79-020 4.1.4 HNO3 matrix**

Instrument: ICPMS2 Analyst: TCH

QC Sample/Analyte	Isotope	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BGD0119-BLK1)</b>						Prepared: 06-Apr-2018 Analyzed: 09-Apr-2018 11:58						
Chromium	52	ND	0.130	0.500	ug/L							U
Chromium	53	ND	0.0700	0.500	ug/L							U
Lead	208	ND	0.0680	0.100	ug/L							U
Arsenic	75a	ND	0.0220	0.200	ug/L							U
Cadmium	111	ND	0.0300	0.100	ug/L							U
Cadmium	114	ND	0.0400	0.100	ug/L							U
<b>LCS (BGD0119-BS1)</b>						Prepared: 06-Apr-2018 Analyzed: 09-Apr-2018 12:40						
Chromium	52	28.0	0.130	0.500	ug/L	25.0		112	80-120			
Chromium	53	26.7	0.0700	0.500	ug/L	25.0		107	80-120			
Lead	208	29.4	0.0680	0.100	ug/L	25.0		118	80-120			
Arsenic	75a	26.6	0.0220	0.200	ug/L	25.0		107	80-120			
Cadmium	111	26.7	0.0300	0.100	ug/L	25.0		107	80-120			
Cadmium	114	27.4	0.0400	0.100	ug/L	25.0		110	80-120			



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**Metals and Metallic Compounds (dissolved) - Quality Control**

**Batch BGD0186 - REN EPA 600/4-79-020 4.1.4 HNO3 matrix**

Instrument: ICPMS2 Analyst: TCH

QC Sample/Analyte	Isotope	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BGD0186-BLK1)</b>						Prepared: 10-Apr-2018 Analyzed: 10-Apr-2018 13:26						
Chromium, Dissolved	52	ND	0.130	0.500	ug/L							U
Chromium, Dissolved	53	ND	0.0700	0.500	ug/L							U
Lead, Dissolved	208	ND	0.0680	0.100	ug/L							U
Arsenic, Dissolved	75a	ND	0.0220	0.200	ug/L							U
Cadmium, Dissolved	111	ND	0.0300	0.100	ug/L							U
Cadmium, Dissolved	114	ND	0.0400	0.100	ug/L							U
<b>LCS (BGD0186-BS1)</b>						Prepared: 10-Apr-2018 Analyzed: 10-Apr-2018 14:08						
Chromium, Dissolved	52	25.3	0.130	0.500	ug/L	25.0		101	80-120			
Chromium, Dissolved	53	25.1	0.0700	0.500	ug/L	25.0		101	80-120			
Lead, Dissolved	208	26.2	0.0680	0.100	ug/L	25.0		105	80-120			
Arsenic, Dissolved	75a	25.2	0.0220	0.200	ug/L	25.0		101	80-120			
Cadmium, Dissolved	111	25.0	0.0300	0.100	ug/L	25.0		100	80-120			
Cadmium, Dissolved	114	25.1	0.0400	0.100	ug/L	25.0		101	80-120			



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**Metals and Metallic Compounds (dissolved) - Quality Control**

**Batch BGD0220 - WMN (No Prep)**

Instrument: ICP2 Analyst: MCB

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BGD0220-BLK1)</b>						Prepared: 11-Apr-2018 Analyzed: 11-Apr-2018 12:06					
Iron, Dissolved	ND	0.0013	0.0500	mg/L							U
Manganese, Dissolved	ND	0.0003	0.0010	mg/L							U
<b>LCS (BGD0220-BS1)</b>						Prepared: 11-Apr-2018 Analyzed: 11-Apr-2018 12:31					
Iron, Dissolved	1.98	0.0013	0.0500	mg/L	2.00		98.8	80-120			
Manganese, Dissolved	0.469	0.0003	0.0010	mg/L	0.500		93.8	80-120			



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### Certified Analyses included in this Report

Analyte	Certifications
<b>EPA 200.8 in Water</b>	
Chromium-52	NELAP,WADOE,WA-DW,DoD-ELAP
Chromium-53	NELAP,WADOE,WA-DW,DoD-ELAP
Lead-208	NELAP,WADOE,WA-DW,DoD-ELAP
Chromium-52	NELAP,WADOE,WA-DW,DoD-ELAP
Chromium-53	NELAP,WADOE,WA-DW,DoD-ELAP
Lead-208	NELAP,WADOE,WA-DW,DoD-ELAP
<b>EPA 200.8 UCT-KED in Water</b>	
Arsenic-75a	NELAP,WADOE,WA-DW,DoD-ELAP
Cadmium-111	NELAP,WADOE,WA-DW,DoD-ELAP
Cadmium-114	NELAP,WADOE,WA-DW,DoD-ELAP
Arsenic-75a	NELAP,WADOE,WA-DW,DoD-ELAP
Cadmium-111	NELAP,WADOE,WA-DW,DoD-ELAP
Cadmium-114	NELAP,WADOE,WA-DW,DoD-ELAP
<b>EPA 6010C in Water</b>	
Iron	WADOE,NELAP,DoD-ELAP
Manganese	WADOE,NELAP,DoD-ELAP
Iron	WADOE,NELAP
Manganese	WADOE,NELAP

Code	Description	Number	Expires
ADEC	Alaska Dept of Environmental Conservation	UST-033	05/11/2018
CALAP	California Department of Public Health CAELAP	2748	06/30/2018
DoD-ELAP	DoD-Environmental Laboratory Accreditation Program	66169	02/07/2019
NELAP	ORELAP - Oregon Laboratory Accreditation Program	WA100006	05/11/2018
WADOE	WA Dept of Ecology	C558	06/30/2018
WA-DW	Ecology - Drinking Water	C558	06/30/2018



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### Notes and Definitions

- U This analyte is not detected above the applicable reporting or detection limit.
- J Estimated concentration value detected below the reporting limit.
- D The reported value is from a dilution
- B This analyte was detected in the method blank.
- DET Analyte DETECTED
- ND Analyte NOT DETECTED at or above the reporting limit
- NR Not Reported
- dry Sample results reported on a dry weight basis
- RPD Relative Percent Difference
- [2C] Indicates this result was quantified on the second column on a dual column analysis.