TO:	Christer Loftenius, Washington State Department of Ecology
FROM:	Ryan Reich, LG
DATE:	June 26, 2018
RE:	Groundwater Sampling – Chlorine and Sulfide Screening Hamilton Street Bridge Site Spokane, Washington Project No. 0236042.043.041

## **Introduction and Background**

This technical memorandum summarizes the results of chlorine and sulfide screening performed on groundwater samples ATC7-020, MW02-20, MW-02-40, MW07-90, and MW04-20 collected March 12, 2018 at the Hamilton Street Bridge site in Spokane, Washington (site). Samples are collected and analyzed semiannually for polycyclic aromatic hydrocarbons (PAHs), carcinogenic PAHs (cPAHs), mercury, total and dissolved arsenic, and weak acid dissociable (WAD) cyanide in accordance with the Compliance Monitoring Plan (LAI 2003).

The purpose of the groundwater screening was to evaluate whether chlorine and sulfide are present at concentrations that could cause matrix interferences and impact (WAD) cyanide analysis using method SM 4500 CN I. Chlorine in groundwater is known to cause decomposition of cyanide complexes, limiting detection at the time of analysis (BC, 2018). In high-pH conditions, sulfide in groundwater may bind with free cyanide to form thiocyanate. This conversion could occur after a sample has been field-preserved with sodium hydroxide, the standard-method preservative, limiting detection at the time of analysis. Potential chlorine or sulfide presence could be due to road surface runoff containing de-icer, or the byproducts of historical industrial operations at the site, such as coal gas manufacturing.

## **Screening Procedures**

#### Chlorine

After purging three well volumes from each monitoring well, groundwater samples were fieldscreened for chlorine using LaMotte chlorine test papers provided by TestAmerica Laboratories, Inc. of Spokane, Washington. The chlorine test papers have a detection limit of 10 parts per million (ppm). The intent of the screening was to identify the presence of chlorine and, if present, use laboratory-provided sodium thiosulfate to dechlorinate samples prior to submittal for WAD cyanide analysis.



#### Sulfide

All samples submitted for WAD cyanide analysis were first screened by the laboratory for sulfide according to standard laboratory practice. The laboratory used lead acetate paper, which has a detection limit of 5 ppm, to conduct the screening (Arrington 2018). If sulfide was detected by the laboratory prior to analysis, technicians were to treat the pre-preserved sample with bismuth nitrate to precipitate out sulfide from thiocyanate, if present, freeing cyanide for detection.

# **Screening Results**

#### Chlorine

Based on field screening, chlorine was not detected in groundwater samples collected at any of the monitoring locations; therefore, none of the samples were treated with sodium thiosulfate. All samples were preserved with sodium hydroxide, the standard-method preservative. Screening results were recorded on the March 12, 2018 sample collection forms. Copies of the collection forms are included in Attachment 1.

### Sulfide

Per the laboratory report job narrative for the March 12, 2018 semiannual monitoring event (LAI 2018), sulfide was not detected by screening in any of the groundwater samples. Furthermore, cyanide spike recoveries in the laboratory quality control matrix spike and matrix spike duplicate samples collected from monitoring well ATC7-20 were within control limits and showed no evidence of matrix interferences.

# Future Sample Screening

The presence of chlorine or sulfide in groundwater can cause matrix interferences, resulting in cyanide analytical results with negative bias. To rule out the possibility of such interferences, future sampling events will include the following screening and preparation:

- Groundwater samples will be field-screened for chlorine using LaMotte test paper. When chlorine is identified above the test paper detection limit (10 ppm), samples will be dechlorinated with sodium thiosulfate. The results of the field-screening (including detection limits) and dechlorinating processes will be reported on the sample collection forms.
- If necessary, groundwater samples may be field-screened for sulfide using test paper, such as Sigma-Aldrich<sup>®</sup> lead acetate paper. The results of the field screening (including detection limits) would be reported on sample collection forms.
- Prior to WAD cyanide analysis, laboratory testing for sulfide will be conducted using either lead acetate test paper or U.S. Environmental Protection Agency Method 376.1 or 376.2. Test results (including detection limits) will be included in the laboratory analytical report.

If sulfide is detected and treatment with bismuth nitrate is required, the treatment method will be described in the laboratory report job narrative.

The screening approach described above will continue through 2020 when the results will be reevaluated during the Third 5-year Periodic Review.

If you have questions regarding the content of this technical memorandum, please contact Ryan Reich at (509) 327-9737 or rreich@landauinc.com.

LANDAU ASSOCIATES, INC.

KmReich

Ryan Reich, LG Senior Project Geologist

RRR/TDB/mcs [A:\236-AVISTA\042-HAMILTON ST\R\MONITORING\REPORTS\2018\MARCH 2018 REPORT\HAMILTON STREET BRIDGE SITE SUMMARY OF GROUNDWATER SCREENING.DOCX]

## References

- Arrington, R. 2018. "Hamilton Street Bridge Site, March 12, 2018 Groundwater Samples, Sulfide Screening Method." TestAmerica Laboratories, Inc. June 14.
- BC, 2018. Analysis of Cyanide (Total, Weak Acid Dissociable, and Free) PBM. British Columbia, Canada. Environmental Protection & Sustainability, Approved Water Quality Guidelines. <u>https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-</u> <u>reporting/monitoring/emre/methods/bc moe cyanide analysis method pbm 08mar2017 d</u> <u>raft.pdf</u>. Accessed June 22, 2018.
- LAI. 2003. Compliance Monitoring Plan, Hamilton Street Bridge Site, Spokane, Washington. Landau Associates, Inc.
- LAI. 2018. Semiannual Monitoring Report, March 12, 2018 Sampling Event, Hamilton Street Bridge Site, Spokane, Washington. Landau Associates, Inc. May 30.

Attachments: Attachment 1. Groundwater Sample Collection Forms – March 12, 2018

ATTACHMENT 1

# Groundwater Sample Collection Forms March 12, 2018

#### Summary of Groundwater Monitoring Well Measurements Avista Hamilton Street Bridge Spokane, Washington

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	· · · · · · · · · · · · · · · · · · ·	
Date Measured:	3/12/15	
Field Personnel:	ماي '	une kostka
		3
	~ · · · · ·	Depth to Groundwater - below
Well Number	Time	PVC casing (feet)
ATC7-20	9:25	14.70
MW2-20	5:50	17.02
MW2-40	5 45	16-76
MW4-20	9:10	15.48
MW7-90	9:05	15,14
MW8-20	8:30	20.34
MW8-90	8:35	23.22
MW9-20	5:10	13.85
MW9-100	6 20	14.52
River Stage	9:20	3.76
AIA.d		

NM = not measured

LANDAU ASSOCIATES	PROJECT EVENT	March 2018 (	J. NO. <u>236042</u> 5 L
Groundwater/Surface Water	SAMPLE NO.	AT( 7-20-031. COLLECTED 3/12/16	TIME (0:55
Sample Collection Form	WEATHER		
	WEATHER	COLLE	CTOR Shane Kostka
WATER LEVELWELL/PURGE DATA Sample Type:			
Depth to Water (ft) 14.68 Time: 9:55 Meas. From:	Top of Protect	ive Casing	f Well Casing
Well Casing Type: I PVC Stainless Steel Fibergla		Casing/Well Diameter (", whole no	-
Well Condition: Secure (YES or NO) Damaged (YES or NO)	Describe	Above ground monument	
Sample Location: ATC7-20			
Begin Purge: Date/Time 3/12/14, 10:03 Casing Volume (gal): 1.3		VOLUME OF SCHEDULE 40 PVC	PIPE
End Purge: Date/Time 3/12/14 10:50 Purge Volume (gal): 3.9	Diameter	O.D. I.D. Volu	
	(inch)	(inch) (inch) (gal/i	n ft) (lbs/in ft)
Total Depth of Well (ft. below top of well casing) 22.3	1.25	1.660 1.380 0.0 2.375 2.067 0.1	
Casing Volume Calculation (22.3 - 14.66 )(0.17) = 1.3	4	4.500 4.026 0.6	6 5.51
Purge Water Disposal to: 🗴 55-gal drum Storage Tank	Ground	1,4	7 12.24
Vol. Purged Temp. Cond. DO pH ORP Turbidity	DTW		
(gal) (°C) (uS/cm) (mg/L) (SU) (mV) (NTU) $(\cdot, 3)$ (0.96 SSO 6.60 6.10 75.6 3.61	(ft)	Comments/Observations	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	- 19.67		
39 11.05 550 6.74 794 74.5 0.00	14.65		
SAMPLE COLLECTION DATA			
Sample Collected With: Bailer Bailer Pump/Type	I - Diama	· · · · · · · · · · · · · · · · · · ·	
Made of: Stainless Steel PVC Teflon Polyethyle		X Dedicated Ot	
	DI Water	Dedicated     Oth     Oth     Oth     Oth	
Sample Description (color, turbidity, odor, sheen, etc.): <u>Cleur Colorist</u> No on			
		<u>47641</u>	
Chlorine (measured with test strips)			
Initial concentration: <10 PDm Spdium Thiosulfate added			
Initial concentration:Ppm Sodium Thiosulfate added:	_(drops)	Sodium Thiosulfate added:	(drops)
Concentration:	_(ppm)	Concentration;	(ppm)
Sodium Thiosulfate added:	(drops)	Sodium Thiosulfate added	(drops)
Concentration:	(ppm)	Concentration:	(ppm)
Containers ANALYSIS			Preservative
3 8270 PAH			None
3 WAD cyanide With O drops of % Sodiu	um Thiosulfate		NaOH
Total Metals (As) (Hg)			NO3
Dissolved Metals (As)			Lab Filtered
Duplicate Sample No(s): MS/ MSD			
	manamin		
	Arth Martin Liv	·······	
Signature:		2 / 1 - 1 - 1	
		Date 3/12/15	·

EANDOU       EVENT       Trac.ch. 2019       Gww         Groundwater/Surface Water       Sample Collection Form       Sample Collection Form       WEATHER 9°C/Sun Collectors Share Keel         WERT LEVENDELEDURGE DATA       Baintes Stell       Other       Top of Protective Casing       Top of Wel Casing Train         Sample Location:       Bernae With Water       Other       Top of Protective Casing       Top of Wel Casing Train         Sample Location:       Bernae Gar value       Describe       Top of Protective Casing       Top of Wel Casing         Sample Location:       Bernae Gar value       Describe       Top of Wel Casing       Top of Wel Casing         Sample Location:       MW2-40       Describe       Acros ground monument         Sample Location:       MW2-40       Describe       Sample Location:       MW2-40         Sample Location:       MW2-40       Describe       Sample Location:       MW2-40         Sample Location:       Sample Location:       MW2-40       Describe       Sample Location:       Sample Location:         Code Proge:       Deactrine \$1/12116_115_12_12_0_       Proge Volume (sal):       Top       Sample Location:       Doit 1000       Volume WitWeer         Code Proge:       Sample Location:       (a casing Volume Casing Traning)       Sample Location:				PROJECT	Avista HSB	PROJ. I	NO. 236042
Summer: No. At +3 - 10 - 0 121 θ Dort COLLECTED S/(1/μ)       Twe: [13:25 Dort COLLECTED S/(1/μ)         Summer: No. At +3 - 10 - 0 121 θ Dort COLLECTED S/(1/μ)       Twe: [13:25 WEATHER -9°C / Sun COLLECTOR Street Kost WEATHER -9°C / Sun Collector Weather -9°C / Sun Collector Collector WW2-40 Bagin Purge: DataChine J [12] 1(b, 115: 20 Purge Volume (gal): U.S Bagin Purge: DataChine J [12] 1(b, 115: 20 Purge Volume (gal): U.S Bagin Purge: DataChine J [12] 1(b, 115: 20 Purge Volume (gal): U.S Bagin Purge: DataChine J [12] 1(b, 115: 20 Purge Volume (gal): U.S Bagin Purge: DataChine J [12] 1(b, 115: 20 Purge Volume (gal): U.S Bagin Purge: DataChine J [12] 1(b, 115: 20 Purge Volume (gal): U.S Bagin Purge: Purge				EVENT			
Sample Collection Form         WEATHER $9^{2} ( \int M A $ COLLECTOR Share Keell         ATTRE LEVELNELLPURGE DATA         Collection Form         Collection Cosing         Staintees Steel         Other Collection Cosing Well Casing         Collection Form         MV2-40         Staintees Steel       Describe       Above ground monument         Sample Location:       MV2-40         Staintees Steel       Describe       Volume 0(a):       VI.S         Costand Value for Well Casing         Costand Value for Value		55000000		SAMPLE NO.	MW2-4	0-031218	
ATER LEVELAPELLPURGE DATA         ampon Type:          X Groundwater          iampon Location:          MW2-40          asegin Purge:          DataTrime 3/12/16, 1/3:20           Purge volume (gal)           4/5          Groundwater          (k below top of wait casing)           4.0           X Or            Deconfigure          Starting Volume Calculation:          (k below top of wait casing)           Association:           Association:           Diameter           ODD          Val. Purged           Concentralion:           Startiness Startimes           Startimes	Ground	dwater/Surface Wate	r	DAT		<u>5/12/18</u> T	ME 13:25
Sample Type:         Strate Water         Other         Other         Top of Protective Casing         Top of Well Casing           Secure (EVer NO)         Staintess Steel         Fiberglass         Top of Protective Casing         X Top of Well Casing           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing/Well Diameter (*, whole no.):         2           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing Volume (gal):         4.5           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing Volume (gal):         4.5           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing Volume (gal):         4.5           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing Volume (gal):         4.5           Secure Of Well         (if) below top of well casing)         430         122         2.375         2.057         0.071         1.46           Storage Tank         Ground Well         (if) 17         Y(if) 17         Y(if) 16         1.47         12.24           Parge Water Disposal to:         X Storage Tank         Ground Cother         Ground Cother         0.017         1.46           Y(if) Y Y(if) Y         Y Y Y Y         Y Y Y Y         Y Y Y Y         1.67 </td <td>Sample</td> <td>e Collection Form</td> <td></td> <td>WEATHE</td> <td>R 9°C/S</td> <td>un COLLECT</td> <td>OR Shane Kostk</td>	Sample	e Collection Form		WEATHE	R 9°C/S	un COLLECT	OR Shane Kostk
Sample Type:         Strate Water         Other         Other         Top of Protective Casing         Top of Well Casing           Secure (EVer NO)         Staintess Steel         Fiberglass         Top of Protective Casing         X Top of Well Casing           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing/Well Diameter (*, whole no.):         2           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing Volume (gal):         4.5           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing Volume (gal):         4.5           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing Volume (gal):         4.5           Secure (EVer NO)         Staintess Steel         Fiberglass         Casing Volume (gal):         4.5           Secure Of Well         (if) below top of well casing)         430         122         2.375         2.057         0.071         1.46           Storage Tank         Ground Well         (if) 17         Y(if) 17         Y(if) 16         1.47         12.24           Parge Water Disposal to:         X Storage Tank         Ground Cother         Ground Cother         0.017         1.46           Y(if) Y Y(if) Y         Y Y Y Y         Y Y Y Y         Y Y Y Y         1.67 </td <td>WATER LEVE</td> <td>L/WELL/PURGE DATA</td> <td></td> <td></td> <td></td> <td></td> <td></td>	WATER LEVE	L/WELL/PURGE DATA					
Verification (verify)       PVC       Stainless Steel       Damaged (VES verify)       Describe       Above ground manument         Sample Location:       MW2-40         Seque (verify)       Damaged (VES verify)       Describe       Above ground manument         Seque (verify)       Distributes Steel       Casing Volume (gal):       4/.5         Seque verify)       Distributes (gal):       4/.5       Volume OF SCHEDULE 40 PVC PIPE         Seque verify)       Distributes (gal):       4/.5       Volume OF SCHEDULE 40 PVC PIPE         Staing Volume (gal):       1/.5       Purge volume (gal):       1/.5       Volume OF SCHEDULE 40 PVC PIPE         Staing Volume Calculation:       (the lew top of well casing)       40       2       2.75       1.660       1.30       0.64         Auge Water Disposal to:       (the lew top of well casing)       (so)       1.67       1.47       1.224         Vel. Purged       Cond.       DO       pH       ORP       Turbidity       DTW       (the lew top of well casing)         (saing Volume (Gal):       (So)       1.67.1       1.67.4       1.67.4       1.67.4       1.67.4       1.67.4       1.67.4       1.67.4       1.67.4       1.67.7       1.67.7       1.67.7       1.67.7       1.67.7       1.6	Sample Type:					_	
Well Condition:         Secure (EP or NO)         Damaged (YES (C))         Describe         Above ground monument           Sample Location:         MW2-40	Depth to Wate			Top of Protec			Vell Casing
Bample Location:         MW2-40           Bagin Purge:         Date/Time         3/12/16, 1/32         Casing Volume (gal):         4.5         VOLUME OF SCHEDULE 40 PVC PIPE           End Purge:         Date/Time         3/12/16, 1/3: 20         Purge Volume (gal):         1/35         Date/Time         0.0, 1.0, (rech)         (rech) <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td>2</td>					-		2
Bagin Purge:       Date/Time       3/12/16, 1/3       Casing Volume (gal):       4.5         Srd Purge:       Date/Time       3/12/16, 1/3:20       Purge Volume (gal):       1/3       Vol.UWE OF SCHEDULE 40 PVC PIPE         Diameter       O.D.       I.D.       Volume (gal):       1/3       Volume (gal):       1/3         Total Depth of Well       (it. below top of well casing)       43.0       1/25       1.660       (inch)	Well Condition	-	Damaged (YES or NO)	Describe	Above ground i	monument	
Jogen J Jogen J Jiel III         Jiel III         Jiel IIII         Jiel IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Sample Locati	on: MW2-40					
Total Depth of Weil (It, below top of weil casing)       43.0       (inch)	Begin Purge:	Date/Time 3/12/16, 11:50	Casing Volume (gal): 4.5	_	VOLUME OF S	CHEDULE 40 PVC PIP	E
Total Depth of Weil (it, below top of weil casing)       43.0       (inch)	End Purge:	Date/Time 3/12/18, 13:20	Purge Volume (gal): 13-5	Diameter	O.D.	I.D. Volume	Wt. Water
Casing Volume Calculation; (43.0.       / 6.75       yo.17.= Y.S       2       2.375       2.067       0.17       1.46         Purge Water Disposal to:       X       55-gal drum       Storage Tank       Ground       Other	·			the second se	(inch)	(inch) (gal/In fi	t) (lbs/in ft)
Burge Watter Disposal to:	Total Depth of	1.82	115				
Purged Water Disposal to:	Casing Volum	e Calculation: ( 43.0 - 16.75	)(0.17) = (.)		4.500		
(a)       (C)       (u3(cm))       (mgL)       (SU)       (mV)       (ITU)       (Ib.76)       Comments/Observations         (g,0)       (10.73)       (JS3)       (L14)       7.83       79.5       5.10       16.76       (Ib.76)       Comments/Observations         (g,0)       (10.73)       (JS3)       (L14)       7.83       7.85       7.10       16.76       (Ib.76)         (JS5)       (I0.74)       (JS3)       (L14)       7.85       7.85       7.10       16.76       (Ib.76)         (JS5)       (I0.74)       (JS3)       (L14)       7.85       7.10       16.76       (Ib.76)         Sample Collected With:       Bailer       Bailer       PumpType       Pcn - Pump       X       Dedicated       Other       (Ib.76)         Made of:       Istainless Steel       PVC       Tetton       Polyethylene       X       Dedicated       Other       (Ib.76)         Sample Description (color, turbidity, odor, stheen, etc.):       C (Can Color/(L)), No Odor Dr Sheen       Sodium Thiosulfate added:       Concentration:       Concen	Purge Water D	Disposal to: 🗴 55-gal drum	Storage Tank		Other	1.47	12.24
(a)       (a)       (a)       (a)       (b)       (a)       (b)       (c)	Vol. Purged	Temp. Cond. DO	pH ORP Turbidi	y DTW	_		
$\overrightarrow{q}$ $\overrightarrow{l}$		(°C) (uS/cm) (mg/L)			Comments/Ob:	servations	
13.5       10.41       453       13.5       17.9       3.56       16.75         SAMPLE COLLECTION DATA         Sample Collected With:         Bailer       Stainless Steel       PVC       Teflon       Polyethylene       Stainless Steel       Other         Decon Procedure:       Stainless Steel       PVC       Teflon       Polyethylene       Dedicated       Other         Sample Description (color, turbidity, odor, sheen, etc.):       C (cur Color(c)), No Odor Or Sheen       Other         Chlorine (messured with test strips)       Sodium Thiosulfate added:       Concentration:       Sodium Thiosulfate added:         Concentration:       Sodium Thiosulfate added:       Sodium Thiosulfate added:       Preservalive         1       8270 PAH       Oncentration:       Concentration:       Preservalive         1       8270 PAH       MAD cyanide       With O drops of       None         1       B270 PAH       None       NOH         2       Total Metals (As)       Lab Filtered         Duplicate Sample No(s):       Comments:       Comments:       Lab Filtered	$\frac{9.5}{a^{0}}$	10.13 453 D.U	7.04 77.3 7.10	11 111			
Sample Collected With:   Bailer   Pump/Type  Chi - Pump/  Bailer   Pump/Type  Poich - Pump/  Decon Procedure:   Stainless Steel  PVC  Tellon  Tap Rinse  DI Water  Decon Procedure:  Cl (cur (c) lorl()), no older or sheen  Chier  Chier  Chier  Concentration:  Concentration: Concentration: Concentration: Concentration:	13.5	10.91 453 6.13	7 35 71.9 356	16.73			-
Sample Collected With:   Bailer   Pump/Type  Chi - Pump/  Bailer   Pump/Type  Poich - Pump/  Decon Procedure:   Stainless Steel  PVC  Tellon  Tap Rinse  DI Water  Decon Procedure:  Cl (cur (c) lorl()), no older or sheen  Chier  Chier  Chier  Concentration:  Concentration: Concentration: Concentration: Concentration:							
Made di: Stainless Steel PVC Teflon Polysthylene X Dedicated Other     Decon Procedure: X Liquinox Wash Tap Rinse X DI Water X Dedicated Other   Sample Description (color, turbidity, odor, sheen, etc.):   Chlorine (measured with test strips)   Initial concentration:   Chlorine (measured with test strips)   Initial concentration:   Concentration:   Concentration:   Sodium Thiosulfate added:   Sodium Thiosulfate added:   Sodium Thiosulfate added:   Concentration:	SAMPLE COL	LECTION DATA					
Decon Procedure:       I Liquinox Wash       Tap Rinse       D Water       D Dedicated       Other         Sample Description (color, turbidity, odor, sheen, etc.):       C ( ( a < C ( lo < ( )), no 0 dor 0 < sheen	Sample Collec	cted With: 🔲 Bailer	Pump/Type	- Pump			
Sample Description (color, turbidity, odor, sheen, etc.):  Clear Colorles), No odor or Sheen  Chlorine (measured with test strips)  Initial concentration:  Co	Made of:	Stainless Steel	C Teflon Dolyeth	lene	X Dedicate	ed 🔲 Other	
Chlorine (measured with test strips)         Initial concentration:       Sodium Thiosulfate added:         Concentration:       Concentration:         Sodium Thiosulfate added:       Sodium Thiosulfate added:         Concentration:       Concentration:         Sodium Thiosulfate added:       Sodium Thiosulfate added:         Concentration:       Concentration:         Concentration:       Concentration:         Concentration:       Concentration:         Concentration:       Concentration:         1       8270 PAH         1       8270 PAH         1       WAD cyanide         Vith       drops of         2       Total Metals (As) (Hg)         1       Dissolved Metals (As)         Lab Filtered         Duplicate Sample No(s):       Comments:	Decon Proced	lure: X Liquinox Wa		X DI Water	X Dedicate	ed Other	
Initial concentration: $400 \text{ pp}$ Sodium Thiosulfate added: Sodium Thiosulfate added: Concentration: Concentration: Sodium Thiosulfate added: Sodium Thiosulfate added: Sodium Thiosulfate added: Concentration: Concentration: Concentration: Concentration: Concentration: Preservative 1 & 8270 PAH None NoneNO3	Sample Descr	ription (color, turbidity, odor, sheen, etc.):	clear colorles)	no odor	or she	en	
Initial concentration: $400 \text{ pp}$ Sodium Thiosulfate added: Sodium Thiosulfate added: Concentration: Concentration: Sodium Thiosulfate added: Sodium Thiosulfate added: Sodium Thiosulfate added: Concentration: Concentration: Concentration: Concentration: Concentration: Preservative 1 & 8270 PAH None NoneNO3							
Concentration:       Concentration:         Sodium Thiosulfate added:       Sodium Thiosulfate added:         Concentration:       Concentration:         Concentration:       Concentration:         1       8270 PAH         1       WAD cyanide         With       drops of         X% Sodium Thiosulfate       None         1       WAD cyanide         Vith       drops of         X% Sodium Thiosulfate       NaOH         2       Total Metals (As) (Hg)         1       Dissolved Metals (As)         Lab Filtered         Duplicate Sample No(s):         Comments:	Chlorine (mea	asured with test strips)		100			
Concentration:       Concentration:         Sodium Thiosulfate added:       Sodium Thiosulfate added:         Concentration:       Concentration:         Concentration:       Concentration:         1       8270 PAH         1       WAD cyanide         2       Total Metals (As) (Hg)         1       Dissolved Metals (As)         1       Dissolved Metals (As)         1       Dissolved Metals (As)         1       Dissolved Metals (As)         0       Comments:	Initial concent	ration: <u>LIU ppm</u>	Sodium Thiosulfate added:		Sodium Thiosu	Ifate added:	
Sodium Thiosulfate added:     Sodium Thiosulfate added:       Concentration:     Concentration:       1     8270 PAH       1     WAD cyanide       With     Ordeps of       2     Total Metals (As) (Hg)       1     Dissolved Metals (As)       1     Lab Filtered		<u></u>	Concentration		Concentration		
Concentration:       Concentration:         1       8270       PAH         1       WAD cyanide       With O drops of Sodium Thiosulfate       NaOH         2       Total Metals (As) (Hg)       NO3         1       Dissolved Metals (As)       Lab Filtered         0       Comments:       Comments:				-			_
Containers       ANALYSIS       Preservative         1       8270       PAH       None         1       WAD cyanide       With       drops of       X% Sodium Thiosulfate       NaOH         2       Total Metals (As) (Hg)       NO3       NO3       NO3         1       Dissolved Metals (As)       Lab Filtered       None         Duplicate Sample No(s):			Sodium Thiosulfate added:	-	Sodium Thiosu	lfate added:	-
Containers       ANALYSIS         1       8270       PAH         1       WAD cyanide       With Ordeps of Sodium Thiosulfate       NaOH         2       Total Metals (As) (Hg)       NO3         1       Dissolved Metals (As)       Lab Filtered         0       Duplicate Sample No(s):       Comments:	-		Concentration:	_	Concentration:		_
1     WAD cyanide     With	Containers	ANALYSIS	10				Preservative
2     Total Metals (As) (Hg)     NO3       1     Dissolved Metals (As)     Lab Filtered       Duplicate Sample No(s):	1	8270 PAH			_		
1     Dissolved Metals (As)     Lab Filtered       0     0     0			With drops of% Soc	lium Thiosulfate		_	
Duplicate Sample No(s):							
Comments:		Dissolved Metals (As)		_	~		Lab Fillered
Comments:	Duplicate Ser			2			
	Comments:						
Signature: Date 3/12/16			<u> </u>			-1:	
	Signature:	AT AT			Date _	3/12/16	
	le	1					

LANDAU ASSOCIATES	PROJECT Avista HSB PROJ. NO. 236042 EVENT March 2018 6 W
	SAMPLE NO. MW2-20 -031218
Groundwater/Surface Water	DATE COLLECTED 3/12/16 TIME 14:25
Sample Collection Form	WEATHER 12°C/Sun COLLECTOR Shane Kostka
WATER LEVEL/WELL/PURGE DATA	
Sample Type Surface Water Other	
Depth to Water (ft) 16-94 Time: 13:30 Meas. From:	Top of Protective Casing
Well Casing Type: X PVC Stainless Steel Fibergl	ass Casing/Well Diameter (", whole no.): 2
Well Condition: Secure (YES or NO) Damaged (YES or NO)	Describe Above ground monument
Sample Location: MW2-20	
Begin Purge: Date/Time 3/12/14, 13:40 Casing Volume (gal): 1.0	VOLUME OF SCHEDULE 40 PVC PIPE
End Purge: Date/Time 3/12/18, 14:20 Purge Volume (gal): 3.0	Diameter O.D. I.D. Volume Wt. Water
Total Depth of Well (ft. below top of well casing) 22.5	(inch) (inch) (inch) (gal/In ft) (lbs/ln ft) 1.25 1.660 1.380 0.08 0.64
	2 2.375 2.067 <u>0.17</u> 1.45
Casing Volume Calculation: (22.5 - 16.94 )(0.17) = 1.0	4 4.500 4.026 0.66 5.51 6 1.47 12.24
Purge Water Disposal to: Storage Tank	Ground Other
Vol. Purged Temp. Cond. DO pH ORP Turbidi	Y DTW
(gal) (°C) (uS/cm) (mg/L) (SU) (mV) (NTU)	(ft) Comments/Observations
$\frac{10}{20}  \frac{5.35}{35}  \frac{43}{92}  \frac{453}{920}  \frac{7.75}{729}  \frac{37.2}{-11}  \frac{514}{232}$	<u><u><u></u><u></u><u><u></u><u></u><u></u><u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u></u></u></u>
$\frac{20}{3.0}  \frac{5.35}{5.39}  \frac{9a}{92}  \frac{9.30}{9.52}  \frac{7.79}{7.85}  \frac{-1.1}{5.11}  \frac{a23}{6.11}$	<u> </u>
<u></u>	
SAMPLE COLLECTION DATA	
Sample Collected With: Bailer Pump/Type	ri-pump
Made of: Stainless Steel PVC Teflon Dolyeth	
	X DI Water X Dedicated Other
Sample Description (color, turbidity, odor, sheen, etc.): <u>Clear, Color less</u> n	
Chlorine (measured with test strips)	
Initial concentration: $\angle 10  pm$ Sodium Thiosulfate added:	Sodium Thiosulfate added:
Concentration:	Concentration:
Sodium Thiosulfate added:	Sodium Thiosulfate added:
Concentration:	Concentration:
Containers ANALYSIS	Preservative
1 8270 PAH	None
1 WAD cyanide With O drops of Soc	ium Thiosulfate NaOH
2 Total Metals (As) (Hg)	NO3
1 Dissolved Metals (As)	Lab Filtered
Duplicate Sample No(s):	
Comments:	
Signature:	Date 3/12/19
M //	

LANDAU ASSOCIATES	PROJECT	Avista HSB March 2016	PROJ. NO. <u>236042</u> GW
Groundwater/Surface Water	SAMPLE NO.	<u>MW7-90-0</u> E COLLECTED 3/13/18	3/2/9 TIME 15:30
Sample Collection Form			COLLECTOR Shane Kostka
WATER LEVEL/WELL/PURGE DATA			
Sample Type: X Groundwater Surface Water Other			
Depth to Water (ft) 15.11 Time: 14:56 Meas. From:	Top of Protec	tive Casing	Top of Well Casing
Well Casing Type: I PVC Stainless Steel Fibergla	SS	Casing/'Well Diameter (*, w	-
Well Condition: Secure (YES) or NO) Damaged (YES (NO)	Describe	Above ground monument	
Sample Location: MW7-90			
Begin Purge: Date/Time 3/12/14 14:56 Casing Volume (gal): 13.2		VOLUME OF SCHEDULE 4	0 PVC PIPE
End Purge: Date/Time 3/12/14, 15:25 Purge Volume (gal): 39.6	Diameter	0.D. I.D.	Volume Wt. Water
Total Depth of Well (ft. below top of well casing) 92.7	(inch) 1.25	(inch) (inch) 1.660 1.380	(gal/in ft) (lbs/ln ft) 0.08 0.64
	2	2.375 2.067	0.08 0.64 0.17 1.45
Casing Volume Calculation: (92.7 - 13.11 )(0.17) = 13.2	4	4.500 4.026	0.66 5.51 1.47 12.24
Purge Water Disposal to: Storage Tank	Ground	Other	16127
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		Comments/Observations	
SAMPLE COLLECTION DATA			
		X     Dedicated       X     Dedicated	Other
Chlorine (measured with test strips)			
Initial concentration: <u>LIDpp</u> Sodium Thiosulfate added: Concentration: Sodium Thiosulfate added:	-	Sodium Thiosulfate added: Concentration: Sodium Thiosulfate added: Concentration:	
Containers ANALYSIS	65		Preservative
2 8270 PAH			None
a WAD cyanide With drops of X4 Sodiu	m Thiosulfate		NaOH
Total Metals (As) (Hg)			NO3
Dissolved Metals (As)			Lab Filtered
Duplicate Sample No(s): MW20-60 (9:50) Comments: Signature:	·	Date 3/12	118

LANDAU	PROJECT	Avista HSB Murch 2018	PROJ. NO. GW	236042
ASSOCIATES	-			
Groundwater/Surface Water	SAMPLE NO.	MW4-20-03		11103
	DATE	ECOLLECTED 3/12/18	TIME	6:50
Sample Collection Form	WEATHER	17°C/sun	COLLECTOR	Shane Kostka
WATER LEVEL/WELL/PURGE DATA				
Sample Type: X Groundwater Surface Water Other	-	_		
Depth to Water (ft) Time: 16:20 Meas. From:	Top of Protect	-	Top of Well	Casing
Well Casing Type:     PVC     Stainless Steel     Fiberglass       Well Condition:     Secure (YES) or NO)     Damaged (YES or NO)		Casing/Well Diameter (", w	hole no.):	2
	Describe	Above ground monument		
Sample Location: MW4-20				
Begin Purge: Date/Time 3/12/16:22 Casing Volume (gal): 1.0		VOLUME OF SCHEDULE 4	0 PVC PIPE	
End Purge: Date/Time 3/12/14/16:46 Purge Volume (gal): 3.0	Diameter	O.D. I.D.	Volume	Wt. Water
Total Depth of Well (ft. below top of well casing) 21.8	(inch) 1.25	(inch) (inch) 1.660 1.380	(gal/In ft) 0.08	(lbs/ln ft) 0.64
Casing Volume Calculation: $(21.8 - 15.4)$ $(0.17) = 1.0$	2	2.375 2.067	0.17	1.45
	6	4.500 4.026	0.66 1.47	5.51 12.24
Purge Water Disposal to: Storage Tank	Ground	Other		
Vol. Purged Temp. Cond. DO pH ORP Turbidity				
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	15.44	Comments/Observations		
2.0 10.33 540 2.62 7.31 105.6 1.98	5.44			_
<u>3.0 10.30 340 2.57 7.35 105.5 2.11</u>	5.44			
SAMPLE COLLECTION DATA				
Sample Collected With: Bailer Pump/Type	ni - Pum	0		
Made of: Stainless Steel PVC Teflon Polyethyle		X Dedicated	Other	
Decon Procedure: X Liquinox Wash Tap Rinse	_	X Dedicated	Other	
Sample Description (color, turbidity, odor, sheen, etc.): <u>clear</u> , colorles), n	vo odor c	or sheen		
Chlorine (measured with test strips)				
Initial concentration: <u>210 ppm</u> Sodium Thiosulfate added:		Sodium Thiosulfate added:		
0	-			
Concentration:	_	Concentration:		
Sodium Thiosulfate added:	-	Sodium Thiosulfate added:_		
Concentration:	<u> </u>	Concentration: _		
Containers ANALYSIS				Preservative
1 8270 PAH				None
1         WAD cyanide         With         drops of         % S odiu           2         Total Metals (As) (Hg)	um Thiosulfate			NaOH NO3
1 Dissolved Metals (As)				Lab Filtered
Duplicate Sample No(s):				
Comments:				
Signature:		21.	114	
		Data ///	(17)	
		Date	0/10	

Spokane	
TestAmerica	11922 East 1st Ave

**Chain of Custody Record** 



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Client Information	Sampler: Sh un		Kestha	Lab PM: Arringt	on, Rande	ш g		3	Carrier Tracking No(s)	:(8)	COC No: 590-3489-808.1	
Clerk Contact: Mr. Rown Reich	Phone: 20 8 -	319-	1465	E-Mail: randee	E-Mail: tandee.aminoton@testamericainc.com	@testan	ericainc.c	E			Page: Page 1 of 2	
Company:						0					Job #:	
Landau & Associates, Inc.	1			1		ł	Analysis	sis Requested	isted		;	
Address: 10 North Post Street, Suite 218	Due Date Requested:						_	_	_		Preservation Codes:	ode#: M - Havena
City. Spokane	TAT Requested (days):	:(8)			1.5				_		B - NaOH C - Zn Acetate	
State, Zip: WA, 99201	1				ep		snoch		_		D - Nitric Acid E - NaHSO4 E • 44:014	P - Na204S Q - Na2S03 P - Na2S03
Phone: 509-995-1665(Tel)	PO #: Purchase Order not required	not required			a desp		acorb	_			G - Amchior H - Ascontic Act	
Emai: Treich@landauinc.com	MO #				(0)		(H oite	-				
Project Name: Avista Harmilton St. Bridge	Project #: 59000367				1.30 00	-	monA :					W - pH 4-5 Z + other (specify)
Site	SSOWE				A) as	_	AcAcık				B Oth NO	Sodium
Generale (Handildon	at an at a second se	Sample	Sample Type (C=comp,		ICOD <sup>®</sup> CA <sup>®</sup> I - AA®	- 11 CMV TFF	12700_SiM - Pol 12700_SiM - Pol				Thiu Chaled	Thiusultate ided &
Sampre ruenunicaum		X	Preservation Code:	1	X	100	- 12					monionana an
MWJn-60-031214	3/12/14	9:50		Water	X	××					JA 24 S	=) Mg/L
1		55:01		Water	-	-	-				I NG QL	=) 0,2 200/L
- 0h - 2		Stift		Water	E		_				PAN al	70.1 Male
MW3-20-031218		Srifi	-	Water							Cyanède	21=7 10 male
MW7-90-031218		15:30		Water					_		I.I.I.I	11
a12120-02-4 m W		05:91		Water							Ą	
ATC 7-20-031215 K	•	9:50		Water	>	3	アラ		_		0	
				Water								
				Water				-		_	698	
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	0			Water								
Possible Hazard Identification			Dadintonical		Sample	le Disposal ( A l Beturn To Client	al (A fee Client	may be ass	assessed if sam Dismeal By Leb	ples are ret	Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month) Down To Cliant  More May I about the More May I about I	t month) Months
ssted: I, II, III, IV, Other (specify)			-		Special	Instructi	ons/QC F	Special Instructions/OC Requirements:	N X	MIS	0	
Empty Kit Relinquished br:	Г	Date:			Time:	1	112		Method of Sh	-		
Reinquistred by:	m	13/18.81	B 130 C	Company L A	H Rece	- H	MA			Date/Time: 3-13-15	F 830	Company ->PD
Reingustruge	Data/Time:	L		Company	Rec	owed by:			-	Date/Time:		
Reinquished by:	Date/Time:		ð	Company	Rec	Received by:				Date/Time:		Company
Custody Seals Intact: Custody Seal No.:	031			12	ð	ler Temper	aturre(s) <sup>o</sup> C :	Cooler Temperature(s) °C and Other Remarks	artes:	1.1		
											)	Ver 08/04/2016