COLORADO LEGACY LAND
4601 DTC Boulevard, Suite 120, Denver, CO 80237
T. (303) 862-3928

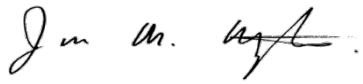
January 17, 2019

Mr. Michael Cunningham
Division of Reclamation, Mining, and Safety (DRMS)
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, CO 80203

Subject: Response to Adequacy Review #2, Technical Revision #27:
Streamlined Groundwater Sampling Methodology and Reporting
Mine Land Reclamation Permit M-1977-300, Schwartzwalder Mine, Golden, Colorado

Dear Mr. Cunningham

Thank you for reviewing and providing comments on the proposed Technical Revision #27. Colorado Legacy Land (CLL) has provided a response to each comment below in italic text, which corresponds to the attached (and revised) Technical Revision #27 . Thank you again for reviewing.



Jim Harrington, Managing Director

COLORADO LEGACY LAND
Jim@ColoradoLegacy.Land

cc: Paul Newman – CLL, Managing Director, paul@coloradolegacy.land
Eric Williams – CLL, Managing Director, eric@coloradolegacy.land
Billy Ray – Alexco Water & Environment Inc, Project Manager, bray@alexcoresource.com

TECHCNIAL REVESION 27, RESPONSE TO COMMENTS:

Comment 1: The Operator is proposing to sample the various groundwater sumps as an aggregate sample, rather than as individual samples, as has been the past practice. The Division is concerned that by sampling the sumps in aggregate, it may prevent the detection of trends in the alluvial groundwater quality. Please provide a technical justification for changing the sampling methodology on the groundwater sumps.

Response: The true test of successful reclamation will be determined when Ralston Creek can naturally flow across the property. This is a cumulative and binary criterion. Individually sampling the sumps does not contribute to evaluating this criterion. Furthermore, one or more of the sumps may be removed during excavation work, and ultimately all of the sumps onsite will be removed during reclamation. Trends in alluvial groundwater quality will continue to be monitored by groundwater wells upgradient and downgradient of the sumps onsite. Analytical data obtained by sampling groundwater monitoring wells are more representative of environmental site conditions, whereas sump water is influenced by the dewatering pumps. For these reasons a cumulative "Sumps" sample is recommended to monitor the chemical concentration and geochemical properties of the sump capture system.

Comment 2: The new submersible pump location will require the installation of a 5" High Density Polyethylene Pipe. The pipe will convey untreated water from the mine pool to the water treatment plant. As required by Rule 6.4.21(7)(e), describe any release response procedures, redundancies, and "backup" measures necessary, appropriate, and economically reasonable to control, prevent and mitigate releases of the toxic materials from the containment facility (pipeline) outside the permit area during reclamation operations.

Response: As part of the automation design an emergency shut down will be programmed to control the new mine pump without operator intervention. The emergency condition will be initiated from two inputs that will be wired directly to the mine pump Programable Logic Control (PLC) and correspond directly with the mine pump effluent line process. The designed inputs will relay back to the PLC, data that is indicative of a properly controlled system and adequate flowing water. The first input will be a pressure reading transducer that will be installed at the well head / vent shaft head and will register an operational pressure. Should the pressure deviate due to lack of water in the line the mine pump will go into a shutdown situation. The second operational constraint will be determined from a flow meter that will be installed to monitor the collection tank inlet flow rate. Should the flow rate drop to a value that is less than what is required for system operation the pump will go into a shutdown situation.

In addition to the direct emergency shut down associated with mine pump process, an indirect emergency control will be latched to the Mine Pump operation by using the reverse osmosis (RO) system shutdown. Due to input programming that is used to control the RO integral PLCs, both RO skids will completely shut down if the overall Water Treatment Plant system parameters fall outside of proper operational criteria. The two key indicators are Low pressure and High pressure. Although this feature is dedicated to preserve the RO equipment it will be used to protect all other Water Treatment equipment and spill potential by controlling the mine pump PLC run command. In this scenario, feed water loss will be demonstrated by a rapid decrease in pressure and this will trigger the mine pump to shut down.

The proposed emergency controls are similar to the automation design that is currently in place on both 10 horsepower (HP) and 25 HP pumps. The conceptual design for the Automation controls has proved successful in real time application in both quarterly testing and in real time shut down situations. As part of the commissioning plan for the 60 HP pump all safety mechanisms will assessed by real world tests and once confirmed for proper operation then the system will be used.

To address a line spill that could potentially occur outside of the permitted area, the operator proposes installing a secondary containment around the mine water effluent pipe. The primary 5-inch HDPE will be installed inside of a larger diameter 8-inch HDPE pipe and then routed to the collection tank secondary containment. In the event of a line rupture the untreated mine water will be controlled by the 8-inch containment line into the tank battery containment located on the mesa and to the immediate east of the RO water treatment plant. The quantity of water will be limited to a single water column due to the emergency shut down programming that is described in the previous paragraphs.

As part of the on-going due diligence for system integrity the operator proposes two physical inspections to be performed on a quarterly basis. It is recommended that the operator conduct a physical pipeline walk to visually inspect the total run of the mine pump effluent line in to witness any type of small leak or potential weak spot that could become a leak. It is also recommended that the operator conduct a compressed air pressure test that will determine pipeline pressure integrity and in turn a break in the line. In both instances these steps will assist in eliminating line inadequacies not witnessed in the previously mentioned instrumentation controls.

Comment 3: Table 1. Proposed Quarterly Sampling Suite indicates total Boron is not a part of the approved surface water sampling suite. A review of the Environmental Protection Plan (EPP) shows that total Boron is to be included in the surface water sampling suite. Please ensure that surface water sampling events includes analysis for total Boron.
Response: The requested revision has been made. Table 1 of Technical Revision 27 has been revised to include analysis for total Boron, consistent with the EPP.

Comment 4: Table 1. Proposed Quarterly Sampling Suite indicates dissolved uranium is not a part of the groundwater sampling suite. A review of the EPP shows that dissolved uranium is to be included in the groundwater sampling suite. Please ensure that groundwater sampling events include analysis for dissolved uranium.
Response: The requested revision has been made. Table 1 of Technical Revision 27 has been revised to include analysis for dissolved uranium, consistent with the EPP.

Comment 5: The Operator is proposing to eliminate certain analytes from the surface and groundwater sampling suites. The Operator's technical justification for eliminating certain analytes includes duplication of analytes between sampling suites, non-detect analytical results, and analytical results which are below applicable surface or groundwater standards. The Schwartzwalder Mine is a dynamic site with respect to water quality treatment and the mine pool chemistry. Upon approval of this Technical Revision the Operator will proceed to manage the mine pool in a different manner than it was historically managed. In addition, the Operator is currently excavating waste rock from the valley floor. The Division expects to see changes to the surface and groundwater quality as a result of these activities.

A condition of the transferring the Reclamation Permit from Cotter Corporation to Colorado Legacy Land, requires the submittal of an amendment application which includes the site wide conceptual model and provides a plan addressing the physical and chemical stabilization of the mine pool and specifically addresses the concentrations of dissolved uranium and other constituents as required under the conditions of the permit. The condition also requires notification to Denver Water and the City of Arvada, who have an interest in participating in the review of the site wide conceptual model.

Therefore, the Division believes that it would be premature to remove any analytes from the sampling suite at this time for the above stated reasons. A reduction of the sampling suite would be warranted upon approval of the required amendment or upon a demonstration the site is stable with respect to surface and groundwater quality. In order to approve the proposed Technical Revision, the Division requests the Operator withdraw the modifications to the sampling suites from consideration under TR27. Please respond.

Response: The requested revision has been made. Technical Revision 27 have been revised so that no groundwater or surface water sample analyses are removed. Quarterly surface water and groundwater samples will be collected for analytes show in Table 1.

COLORADO LEGACY LAND
4601 DTC Boulevard, Suite 120, Denver, CO 80237
T. (303) 862-3928

January 17, 2019

Mr. Michael Cunningham
Division of Reclamation, Mining, and Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, CO 80203

Subject: Technical Revision #27: Streamlined Groundwater Sampling Methodology and Reporting
Mine Land Reclamation Permit M-1977-300, Schwartzwalder Mine, Golden, Colorado

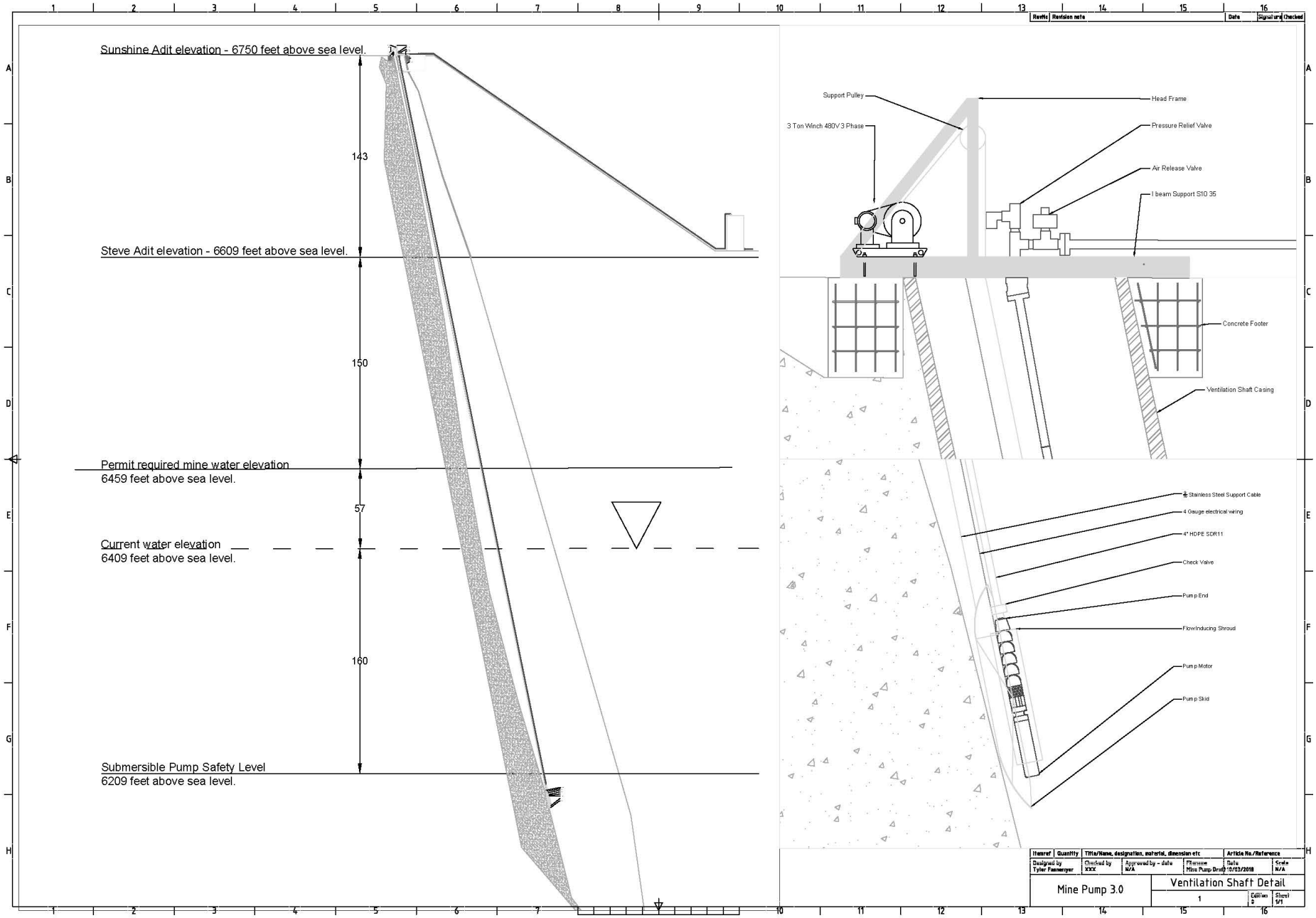
Dear Mr. Cunningham:

Colorado Legacy Land, LLC (CLL) is pleased to submit Technical Revision #27 to document the Schwartzwalder Mine Pool Dewatering Pump Upgrade and to propose streamlined compliance sampling and reporting practices.

Mine Pool Dewatering Pump Upgrade
In an effort to meet the site's long-term water management objectives, CLL would like to revise *Land Reclamation Permit M-1977-300* to promote a more sustainable approach to dewatering the mine pool by relocating and upgrading the dewatering pump. This request will only change the location from which the mine water will be pumped, there will be no other process or treatment changes because of this upgrade.

An alternate pumping location was identified and on August 31, 2018. A down-hole camera inspection was conducted in the Jeffrey Air Shaft to approximately 488-feet below the Sunshine Adit (approximately 348 feet below the Steve Adit). The successful camera inspection supports relocating the mine pool dewatering pump to the air shaft. The new submersible pump (50HP Goulds Model 7CSLC) will be lowed to approximately 550 feet below the Sunshine Adit (approximately 410 feet below the Steve Adit) on a custom fabricated housing shed via a winch system. The housing sled will protect and support the pump during installation. The dedicated winch system will be installed adjacent to the vent shaft on a concrete footer. The new winch system allows above-ground access to the pump for maintenance and repair, which supports the long-term health and safety goal of eliminating all underground work onsite. The construction and installation of the new dewatering pump will take place in fourth quarter 2018, a schematic of the design is shown on the following page for reference.

[1]*The Environmental Protection Plan, Revision 1.0* (Wheatstone 2016) states that MW-4 and MW-5 were removed during reclamation activities in 2008, however additional details regarding monitoring well abandonment or removal are not available.


Sunshine Adit elevation - 6750 feet above sea level.
143
Steve Adit elevation - 6609 feet above sea level.
150
Permit required mine water elevation
6459 feet above sea level.
57
Current water elevation
6409 feet above sea level.
160
Submersible Pump Safety Level
6209 feet above sea level.
Support Pulley
3 Ton Winch 480V 3 Phase
Head Frame
Pressure Relief Valve
Air Release Valve
I beam Support S10 35
Concrete Footer
Ventilation Shaft Casing
Stainless Steel Support Cable
4 Gauge electrical wiring
4" HDPE SDR11
Check Valve
Pump End
Flow Inducing Shroud
Pump Motor
Pump Skid
Mine Pump 3.0
Ventilation Shaft Detail

Streamlined Groundwater Sampling Methodology and Reporting

In an effort to streamline field work and reporting practices, CLL would like to revise *Land Reclamation Permit M-1977-300* to promote pragmatic compliance sampling as well as clear communication and reporting.

1. Streamlined Reporting and Analytical Sampling Suite:

   Currently CLL collects surface water and groundwater samples for DRMS in accordance with *Mine Land Reclamation Permit M-1977-300, Technical Revision 11 Environmental Protection Plan* (Whetstone, 2016). Table 1 summarizes the proposed quarterly sampling suite for all surface water and groundwater sample locations. Table 1 also lists the current surface water and groundwater sampling requirements, and water quality criteria.

   Beginning January 1, 2019, CLL's subcontractor Alexco intends to conduct a quarterly surface water and groundwater sampling event for analytes identified in Table 1. Surface water and groundwater samples will be collected from locations identified in the *Mine Land Reclamation Permit M-1977-300, Environmental Protection Plan* (Whetstone, 2016). These required locations are listed below for reference:

   - Surface Water Sample Locations: SW-AWD, SW-NWRP, SW-A001, SW-BDIS, SW-PL, SW-OS, SW-BOS, SW-GS, SW-BPL, SW-FBRG, SW-ARH, SW-LLHG, and SW-WEIR.
   - Groundwater Sample Locations: MW-00, MW-0, MW-1, MW-2, MW-3A, MW-6, MW-7, MW-12, MW-13 (Previous Sample ID = L1), MW-14 (Previous Sample ID = L2), MW-15 (Previous Sample ID = L3), MW-17 (Previous Sample ID = L5), MW-18 (Previous Sample ID = L6), MW-19 (Previous Sample ID = L7), MW-20, Raw Feed, and Sumps,. (Note: MW-4 and MW-5 are not sampled because they were removed during reclamation activities in 2008.[1] MW-8 is not sampled because it was replaced with MW-12, MW-9 is not sampled because it is tied into the sumps, MW-10 is not sampled because bentonite has fouled the screen and MW-13 was installed to replace it, MW-11 is not sampled because bentonite has fouled the screen and MW-14 was installed to replace it, and MW-16 [Previous Sample ID = L4]is not sampled because of poor casing construction.)

   Results of the quarterly sampling event will be provided to DRMS as one quarterly sampling report. Attachment A contains an example/template of the proposed deliverable. Highlighted text (e.g. "TBD") is used to indicate site-specific data that will be presented in the quarterly report.

2. Streamlined Groundwater Sampling Methodology:

   Current, *Mine Land Reclamation Permit M-1977-300* permits four different groundwater sampling methods: low flow sampling, PVC-bailer, air-driven bladder pump or piston pumps, and dedicated submersible pump. Below are the specific sections that reference each approved method:

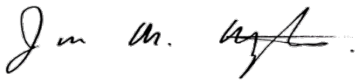
   - *Application Amendment 4, Mine Permit M-1977-300, Schwartzwalder Mine, Attachment 1 – Water Quality Monitoring Plan* (Cotter, May 2012) and Technical Revision 11*Environmental Protection Plan, Section 12 Water Quality Monitoring Plan* (Whetstone Associates, 2016) describe a well - volume purge method which may be implemented with PVC-bailer, air-driven bladder pumps or piston pumps, and dedicated submersible pumps.
   - *Technical Revision 19, Standard Operating Procedure for Low-Flow Groundwater Sampling at the Schwartzwalder Mine* (Whetstone Associates, 2013) describes the low-flow sampling process used at deep, bed-rock wells MW13-MW19.

   Beginning in January 1, 2019 and in accordance with *Technical Revision 19*, CLL intends to sample all groundwater wells onsite using low-flow sampling methods. Utilizing a consistent sampling method will improve the comparability between results from alluvial and deep bedrock groundwater wells. Deep bedrock wells will continue to be sampled using the method described in *Technical Revision 19*. Attachment B contains Alexco's Standard Operating Procedure (SOP) for low-flow groundwater sampling that will be utilized by the field staff onsite for the alluvial wells. This SOP was developed in accordance with United States Environmental Protection Agency (USEPA) guidance document, *Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (September 2017). The Colorado Department of Public Health and Environment does not currently maintain an SOP for low-flow groundwater sampling. Additionally, Alexco has conducted a desktop study of published low-flow SOPs to

[1]*The Environmental Protection Plan, Revision 1.0* (Wheatstone 2016) states that MW-4 and MW-5 were removed during reclamation activities in 2008, however additional details regarding monitoring well abandonment or removal are not available.

identify pertinent stabilization parameters and ensure that a representative sample is collected by field staff. A summary of this evaluation is included in Attachment B for reference.

If you have any questions regarding this notification, please don't hesitate to contact me. Sincerely,



Jim Harrington, Managing Director
COLORADO LEGACY LAND
Jim@ColoradoLegacy.Land

cc: Paul Newman – CLL, Managing Director, paul@coloradolegacy.land
Eric Williams – CLL, Managing Director, eric@coloradolegacy.land
Billy Ray – Alexco Water & Environment Inc, Project Manager, bray@alexcoresource.com

Table 1. Proposed Quarterly Sampling Suite						
Analyte	Units	Included in Current Surface Water Sample Suite(s)?	Surface Water Quality Standard, Segment 17b, Ralston Creek (CDPHE 2018)		Included in Current Groundwater Sample Suite?	Domestic Water Supply - Drinking Water Standards (CDPHE 2016)
			Acute	Chronic		
General Properties and Field Parameters						
Total Dissolved Solids	mg/L	Yes, Table 1	none	none	Yes, Table 2	none
Total Suspended Solids	mg/L	Yes, Table 1	none	none	Yes, Table 5 (Mine Pool Only, Sample ID = RAW FEED)	none
Field Parameter - Temperature	°C	Yes, Table 1	-	-	Yes, Table 2	none
Field Parameter - Conductivity	µS / cm	Yes, Table 1	none	none	Yes, Table 2	none
Field Parameter - pH	unitless	Yes, Table 1	6.5 - 9.0		Yes, Table 2	6.5 - 8.5
Field Parameter - ORP	mV	No	none	none	No	none
Field Parameter - Dissolved Oxygen	mg/L	No	none	none	No	none
Major Ions						
Total Alkalinity (as CaCO3)	µg/L	Yes, Table 1	none	none	Yes, Table 2	none
Bicarbonate (as CaCO3)	µg/L	Yes, Table 1	none	none	Yes, Table 2	none
Calcium	µg/L	Yes, Table 1	none	none	Yes, Table 2	none
Chloride	µg/L	Yes, Table 1	-	250,000	Yes, Table 2	250,000
Fluoride	µg/L	Yes, Table 1	none	none	Yes, Table 5 (Mine Pool Only, Sample ID = RAW FEED)	4,000
Magnesium	µg/L	Yes, Table 1	none	none	Yes, Table 2	none
Potassium	µg/L	Yes, Table 1	none	none	Yes, Table 2	none
Sodium	µg/L	Yes, Table 1	none	none	Yes, Table 2	none
Sulfate	µg/L	Yes, Table 1	-	250	Yes, Table 2	250,000
Nutrients						
Nitrate + Nitrite	µg/L	Yes, Table 1	Nitrate = 10,000	Nitrite = 50	Yes, Table 2	
Phosphate	mg/L	Yes, Table 1	none	none	No	
Phosphorus	mg/L	Yes, Table 1	-	11	Yes, Table 2	

Table 1. Proposed Quarterly Sampling Suite						
Analyte	Units	Included in Current Surface Water Sample Suite(s)?	Surface Water Quality Standard, Segment 17b, Ralston Creek (CDPHE 2018)		Included in Current Groundwater Sample Suite?	Domestic Water Supply - Drinking Water Standards (CDPHE 2016)
			Acute	Chronic		
Metals Total						
Aluminum	µg/L	Yes, Table 1	-	-	Yes, Table 2	
Antimony	µg/L	Yes, Table 1	none	none	Yes, Table 2	
Arsenic	µg/L	Yes, Table 1 and Code 3	0.02	-	Yes, Table 2	
Boron	µg/L	Yes, Table 1	-	750	Yes, Table 5	
Chromium	µg/L	Yes, Table 1	Chromium III = 50	-	Yes, Table 5 (Mine Pool Only, Sample ID = RAW FEED)	
Copper	µg/L	Yes, Table 1	21.3	13.6	Yes, Table 2	1,000
Iron	µg/L	Yes, Table 1	--	1,000	Yes, Table 2	300
Lead	µg/L	Yes, Table 1	50	--	Yes, Table 2	50
Manganese	µg/L	Yes, Table 1	3,513.36	1,941.14	Yes, Table 2	50
Mercury	µg/L	Yes, Table 1	--	0.01	Yes, Table 2	Non-Detect
Molybdenum	µg/L	Yes, Table 1	none	150	No	210
Silver	µg/L	Yes, Table 1	4.7	0.17	Yes, Table 2	50
Thallium	µg/L	Yes, Table 1	none	none	Yes, Table 2	2
Uranium	µg/L	Yes, Code 1 and Code 3	4,115.95 USEPA MCL = 30	2,570.93 USEPA MCL = 30	No	30
Zinc	µg/L	Yes, Table 1	249.51	188.98	Yes, Table 2	5,000
Dissolved Metals						
Aluminum	µg/L	Yes, Table 1	--	--	Yes, Table 2	5,000
Antimony	µg/L	Yes, Table 1	none	none	Yes, Table 2	6
Arsenic	µg/L	Yes, Code 3	0.02	---	Yes, Table 5 (Mine Pool Only, Sample ID = RAW FEED)	100
Boron	mg/L	Yes, Table 1	---	0.75	No	750
Chromium	mg/L	No	Chromium VI = 16	Chromium III = 110.58 Chromium VI = 11	No	100

Table 1. Proposed Quarterly Sampling Suite						
Analyte	Units	Included in Current Surface Water Sample Suite(s)?	Surface Water Quality Standard, Segment 17b, Ralston Creek (CDPHE 2018)		Included in Current Groundwater Sample Suite?	Domestic Water Supply - Drinking Water Standards (CDPHE 2016)
			Acute	Chronic		
Copper	µg/L	Yes, Table 1	21.3	13.6	Yes, Table 2	1,000
Cyanide (weak acid dissociable)	µg/L	Yes, Table 1	5	---	No	200
Iron	µg/L	Yes, Table 1	---	300	Yes, Table 2	300
Lead	mg/L	No	109.46	4.27	No	50
Manganese	µg/L	Yes, Table 1	3,513.36	1,941.14	Yes, Table 2	50
Mercury	mg/L	No	--	0.01	Yes, Table 2	2
Silver	µg/L	Yes, Table 1	4.7	0.17	Yes, Table 5 (Mine Pool Only, Sample ID = RAW FEED)	50
Thallium	µg/L	Yes, Table 1	none	none	Yes, Table 2	2
Uranium	µg/L	Table 1, Code 1, Code 3	4,115.95 USEPA MCL = 30	2,570.93 USEPA MCL = 30	Yes, Table 2	30
Zinc	µg/L	Yes, Table 1	249.51	188.98	Yes, Table 2	5,000
Radionuclides						
Gross Alpha	pCi/L	Yes, Table 1	none	none	Yes, Table 2	15
Gross Beta	pCi/L	Yes, Table 1	none	none	Yes, Table 2	--
Radium - 226, Total	pCi/L	Yes, Code 3	none	none	Yes, Table 2	--
Radium - 226, Dissolved	pCi/L	Yes, Table 1 and Code 3	none	none	No	--
Combined Radium (Radium 226+228)	pCi/L	Yes, Table 1	none	none	No	5

References:

Colorado department of Public Health and Environment (CDPHE). 2018. 5 CCR 1002-38, Regulation Number 38, Classification and Numeric Standards for South Platte Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin, Appendix 38-1: Stream Classifications and Water Quality Standards Tables. Water Quality Control Division. June.

CDPHE. 2006. 5 CCR 1002-41, Regulation No. 41. – The Basic Standards for Ground Water. Water Quality Control Division. December.

CDPHE. 2011. Notice of Violation (NOV) / Cease and Desist Order (CDO), Number IO-100601-1. Water Quality Control Division. September.

Wheatstone Associates (Whetstone). 2016. Schwartzwalder Mine, Environmental Protection Plan, Revision 1.0. Table 11-6 Comparison of Water Quality in Ralston Creek to Aquatic Toxicity Standards. September.

Notes:

Grey-shaded cells highlight analytes that are retained for quarterly analysis.
The CDPHE does not maintain Domestic Water Supply standards for aluminum and boron, therefor Agricultural Standard is shown.
µg/L = micrograms per liter
EPP = Environmental Protection Plan, Technical Revision 11 (Wheatstone Associates, 2016)
mg/L = milligrams per liter
ND = Non-detect
NOV/CDO = Notice of Violation / Cease and Desist Order (CDPHE, 2011)
ORP = Oxidization Reduction Potential
pCi/L = picocuries per liter
USEPA MCL = United States Environmental Protection Agency Maximum Contaminant Level

Attachment A: Example DRMS Quarterly Deliverable

This page intentionally left blank.

COLORADO LEGACY LAND
4601 DTC Boulevard, Suite 130, Denver, CO 80237
T. (303) 862-3928

March XXX, 2019

Mr. Michael Cunningham
Division of Reclamation, Mining, and Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, CO 80203

Subject: Schwartzwalder Mine, Permit No. M-1977-300, First Quarter 2019 Sampling Results

Dear Mr. Cunningham:

The first quarter sampling event at the Schwartzwalder Mine was conducted by Alexco Water and Environment (Alexco) field staff on January TBD-TBD, 2019.

- **Surface Water Data:** There are thirteen quarterly surface water (SW) sampling locations. Figure 1 shows the location of each surface water sample locations along Ralston Creek. Table 1 summarizes surface water field parameters. The analytical laboratory data report and the chain of custody are attached to this report.

- **Groundwater Data:** There are twenty-four quarterly groundwater monitoring well (MW) sampling locations. Figure 2 shows the location of each MW. Table 2 summarizes groundwater field parameters. The analytical laboratory data report and the chain of custody are attached to this report.

- **Mine Pool Elevations:** Table 3 summarize the mine pool elevations for the quarter.

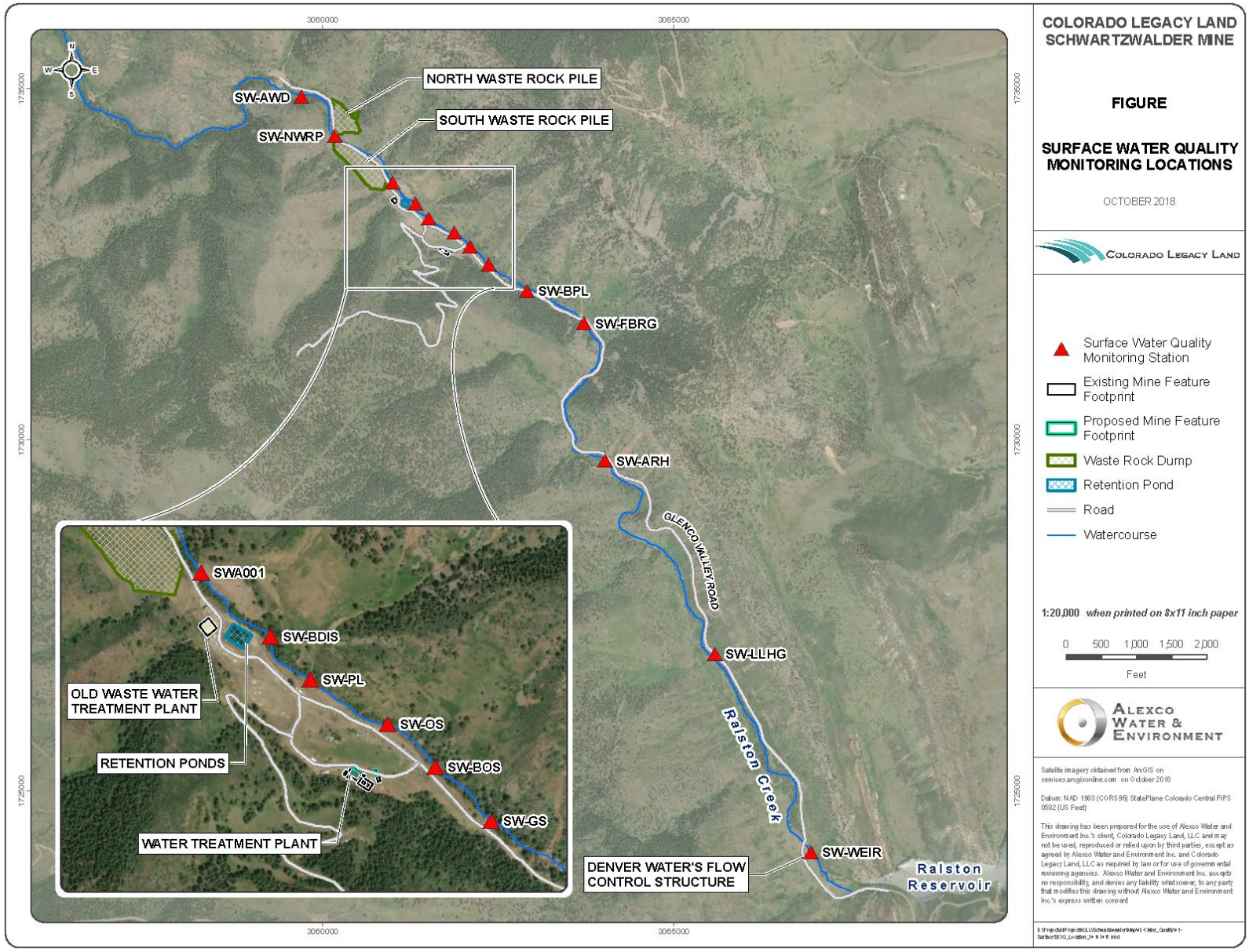

3060000
3065000
1735000
1730000
1725000
N
W
E
S
SW-AWD
NORTH WASTE ROCK PILE
SOUTH WASTE ROCK PILE
SW-NWRP
SW-BPL
SW-FBRG
SW-ARH
GLENCO VALLEY ROAD
SW-LLHG
Ralston Creek
SW-WEIR
Ralston Reservoir
DENVER WATER'S FLOW CONTROL STRUCTURE
SWA001
SW-BDIS
SW-PL
SW-OS
SW-BOS
SW-GS
OLD WASTE WATER TREATMENT PLANT
RETENTION PONDS
WATER TREATMENT PLANT
COLORADO LEGACY LAND
SCHWARTZWALDER MINE
FIGURE
SURFACE WATER QUALITY MONITORING LOCATIONS
OCTOBER 2018
COLORADO LEGACY LAND
Surface Water Quality Monitoring Station
Existing Mine Feature Footprint
Proposed Mine Feature Footprint
Waste Rock Dump
Retention Pond
Road
Watercourse
1:20,000 when printed on 8x11 inch paper
0 500 1,000 1,500 2,000
Feet
ALEXCO WATER & ENVIRONMENT
Satellite imagery obtained from ArcGIS on services.arcgisonline.com on October 2018
Datum: NAD 1983 (CORS96) StatePlane Colorado Central FIPS 0502 (US Feet)
This drawing has been prepared for the use of Alexco Water and Environment Inc.'s client, Colorado Legacy Land, LLC and may not be used, reproduced or relied upon by third parties, except as agreed by Alexco Water and Environment Inc. and Colorado Legacy Land, LLC as required by law or for use of governmental reviewing agencies. Alexco Water and Environment Inc. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Alexco Water and Environment Inc.'s express written consent

TABLE 1. SURFACE WATER SAMPLE FIELD PARAMETERS							
Location ID / Sample ID	Location Description	Sample Date	Field Parameters				
			pH (unitless)	Temperature (°C)	Conductivity (µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)
SW-AWD	Upstream sample location. Above waste dump (AWD). Onsite.	TBD	TBD	TBD	TBD	TBD	TBD
SW-NWRP	Downstream of the North Waster Rock Pile (NWRP).	TBD	TBD	TBD	TBD	TBD	TBD
SW-A001	Above former discharge point. Onsite. Directly below the west waste rock pile.	TBD	TBD	TBD	TBD	TBD	TBD
SW-BDIS	Below former discharge (BDIS). Onsite. Below former concrete containment structure.	TBD	TBD	TBD	TBD	TBD	TBD
SW-PL	Former parking lot (PL) location. Onsite.	TBD	TBD	TBD	TBD	TBD	TBD
SW-OS	Former ore sorter (OS) location. Onsite.	TBD	TBD	TBD	TBD	TBD	TBD
SW-BOS	Below former ore sorter (BOS) location. Onsite.	TBD	TBD	TBD	TBD	TBD	TBD
SW-GS	Former guard shack (GS) location. Onsite.	TBD	TBD	TBD	TBD	TBD	TBD
SW-BPL	Below property line (BPL). Downstream sample location, just below entrance gate. Offsite.	TBD	TBD	TBD	TBD	TBD	TBD
SW-FBRG	First bridge (FBRG) after leaving site. Offsite.	TBD	TBD	TBD	TBD	TBD	TBD
SW-ARH	Above red hill (ARH). Near the large red boulders in the creek bed. Offsite.	TBD	TBD	TBD	TBD	TBD	TBD
SW-LLHG	Long lake head gate (LLHG). Just above head gate. Offsite.	TBD	TBD	TBD	TBD	TBD	TBD
SW-WEIR	Weird structure before Ralston Reservoir	TBD	TBD	TBD	TBD	TBD	TBD

Notes:

°C = degrees Celsius µS/cm = microSemiens per centimeter mg/L = milligrams per liter mV =millivolts ORP = Oxidization Reduction Potential

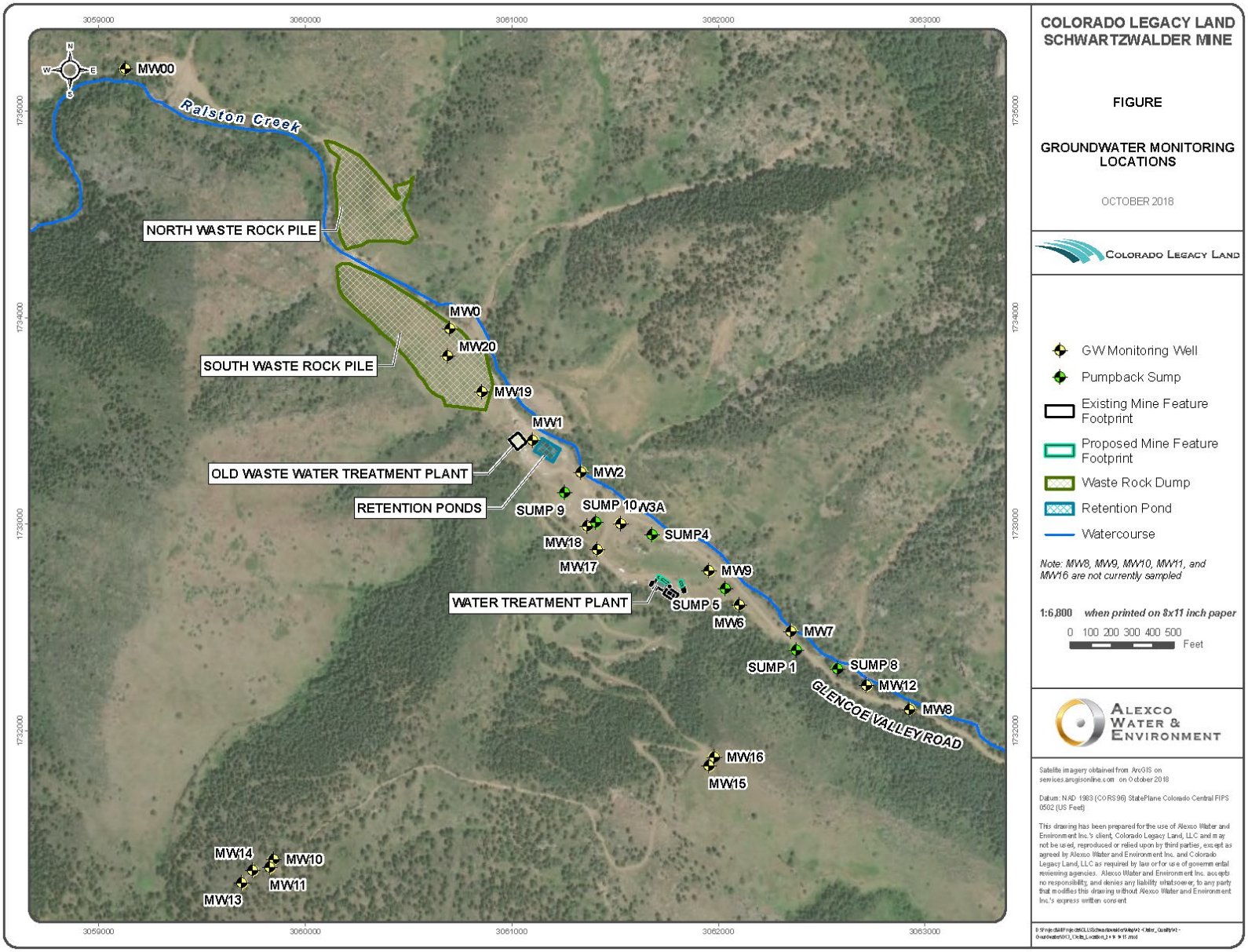

3059000
3060000
3061000
3062000
3063000
1735000
1734000
1733000
1732000
N
W
E
S
MW00
Ralston Creek
NORTH WASTE ROCK PILE
SOUTH WASTE ROCK PILE
OLD WASTE WATER TREATMENT PLANT
RETENTION PONDS
WATER TREATMENT PLANT
GLENCOE VALLEY ROAD
MW0
MW20
MW19
MW1
MW2
SUMP 9
SUMP 10
MW3A
SUMP4
MW18
MW17
MW9
SUMP 5
MW6
MW7
SUMP 1
SUMP 8
MW12
MW8
MW16
MW15
MW14
MW10
MW11
MW13
COLORADO LEGACY LAND
SCHWARTZWALDER MINE
FIGURE
GROUNDWATER MONITORING LOCATIONS
OCTOBER 2018
COLORADO LEGACY LAND
GW Monitoring Well
Pumpback Sump
Existing Mine Feature Footprint
Proposed Mine Feature Footprint
Waste Rock Dump
Retention Pond
Watercourse
Note: MW8, MW9, MW10, MW11, and MW16 are not currently sampled
1:6,800 when printed on 8x11 inch paper
0 100 200 300 400 500
Feet
ALEXCO WATER & ENVIRONMENT
Satellite imagery obtained from ArcGIS on services.arcgisonline.com on October 2018
Datum: NAD 1983 (CORS96) StatePlane Colorado Central FIPS 0502 (US Feet)
This drawing has been prepared for the use of Alexco Water and Environment Inc.'s client, Colorado Legacy Land, LLC and may not be used, reproduced or relied upon by third parties, except as agreed by Alexco Water and Environment Inc. and Colorado Legacy Land, LLC as required by law or for use of governmental reviewing agencies. Alexco Water and Environment Inc. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Alexco Water and Environment Inc.'s express written consent

TABLE 2. GROUNDWATER SAMPLE FIELD PARAMETERS								
Location ID / Sample ID	Sample Date	Field Parameters					Depth to Water (ft btoc)	Notes / Location Description
		pH (unitless)	Temperature (°C)	Conductivity (µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)		
MW-00	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Alluvial well. Above waste dumps, upstream of site.
MW-0	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Alluvial well. Toe of south waste rock pile.
MW-1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Alluvial well. Next to former concrete containment.
MW-2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Alluvial well. Below retention ponds near creek. Usually dry.
MW-3A	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Alluvial well. Near former haul road. Usually dry.
MW-4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Removed in 2008.
MW-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Removed in 2008.
MW-6	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Alluvial well. Near former Sump #2.
MW-7	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Alluvial well. Near Sump #1
MW-8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Not sampled, replaced with well MW-12. Monitor water level only.
MW-9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Not sampled, tied in with sumps. Monitor water level only.
MW-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Not sampled, bentonite in screened interval. Monitor water level only. Replaced with MW-13.
MW-11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Not sampled, bentonite in screened interval. Monitor water level only. Replaced with MW-14.
MW-12	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Below Sump #1.
MW-13	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Nitrogen. Replaced MW-10. Previous Sample ID = L1.
MW-14	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Nitrogen. Replaced MW-11. Previous Sample ID = L2.
MW-15	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Nitrogen. Previous Sample ID = L3.
MW-16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Not sampled, casing too narrow. Monitor water level only. Previous Sample ID = L4.
MW-17	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Nitrogen. Previous Sample ID = L5.
MW-18	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Previous Sample ID = L6.
MW-19	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Toe of south waste rock pile. Previous Sample ID = L7.
MW-20	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Usually dry. Top of south waste rock pile.
Raw Feed	TBD	TBD	TBD	TBD	TBD	TBD	N/A	Sample collected from spigot inside water treatment plant. This is the water treatment plant intake from the mine pool. . Previous Sample ID = Mine Refill.
Sumps	TBD	TBD	TBD	TBD	TBD	TBD	N/A	Sample collected from spigot inside water treatment plant. This is the combined, collected sump water.

Notes:

ft btoc = feet below top of casing
°C = degrees Celsius
µS/cm = microSemiens per centimeter
mg/L = milligrams per liter
mV =millivolts
ORP = Oxidization Reduction Potential

This page intentionally left blank.

TABLE 3: QUARTERLY MINE POOL ELEVATIONS			
DATE	MINE POOL DEPTH (AVERAGE)	DISTANCE BELOW STEVE LEVEL (FEET)	ELEVATION OF WATER LEVEL (FEET)
01/1/2019	TBD	TBD	TBD
01/2/2019	TBD	TBD	TBD
01/3/2019	TBD	TBD	TBD
.			
.			
.			
03/31/2019	TBD	TBD	TBD

This page intentionally left blank.

Attachment B: Standard Operating Procedure for Low-Flow Groundwater Sampling

This page intentionally left blank.

Groundwater Sampling SOP: Low Flow

1. Don the proper PPE: nitrile or latex gloves and eye protection.
2. Open the well. Unlock well, remove metal well lid and j-plug from monitoring well.
3. Measure water level: Use water level meter to record the depth to water from the north side of the PVC casing. Record depth to water (±0.01 ft below top of casing [btoc]) on the groundwater sample field form.
4. Measure total depth of the well: Use the water level meter to measure the total depth of the well (±0.01 ft btoc). Record the total depth on the groundwater sample filed form.
5. As you wind up the static water level, decontaminate the measuring tape with paper towels, alconox spray bottle, and deionized water spray bottle.
6. Connect dedicated tubing (stored inside the well casing) to the peristaltic pump on the ground surface.
7. Connect the peristaltic pumps to the car. It plugs into the car outlet.
8. Set up purge bucket near well. Secure the discharge hose from the well in the bucket using a clamp or zip ties.
9. Begin purging: Turn on peristaltic pump. Record the purge start time on the sample field form.
10. Once the flow through cell is full, record the initial field parameters on the sample field form and use the measuring cup and stop watch to measure the flow rate. The flow rate should be between 100 – 500 mL/minute. If needed adjust the flow rate and remeasure the flow.
11. Record field parameters, measure depth to water, and flow rate every 3-5 minutes on the sample field form.
12. Purge well water until three consecutive measurements of field parameters are within stabilization criteria.

Field Parameter	Stabilization Criteria
Temperature (°C)	± 1 C
pH (unitless)	± 0.1
Conductivity (mS/cm)	± 10%
Dissolved Oxygen (mg/L)	± 10% or > 0.5 mg/L
ORP (mV)	± 10mV

Note, if field parameters do not stabilize within 2 hours of purging the field sampler will collect a sample and note the variance on the field form(e.g. “pH did not stabilize during purge, sample collected after 2 hours”).

13. Record purge stop time on sample field form. Record total purge volume in purge bucket and close lid.
14. To collect a sample, disconnect the discharge tube from the YSI and begin filling bottles provide by the lab. Put samples on ice for preservation.
15. After sampling is complete. Disconnect the pump, tubing, and YSI. Store the dedicated tubing in the monitoring well casing.
16. Decontaminate equipment: Use spray bottles and paper towels to clean the water level meter and YSI between monitoring wells.
17. Record samples on Chain of Custody. Doff PPE and dispose of gloves. Close well lid, secure with lock, and pack up field supplies.

This page intentionally left blank.

ATTACHMENT B SUMMARY TABLE OF GROUNDWATER WELL PURGING FIELD MEASUREMENT STABILITY CRITERIA FROM VARIOUS LITERATURE SOURCES													
pH	**Specific Conductivity**	**Dissolved Oxygen**	**Oxidation-Reduction Potential (ORP or Eh)**	**Temperature**	**Turbidity**	**No. Consecutive Readings**	**Frequency**	**Minimum Purge Volume or time**	**Maximum Purge Volume or time**	**Alternate Criteria**	**Comments**	**Screen Length Applicability**	**Reference**
± 10%	± 10%	----------	± 10%	± 10%	----------	Not Specified	10% of calculated purge requirement	2 well volumes	Not Specified	None	Applicable to low-flow or fixed volume purging Purge volumes and pumping rates should be evaluated on a case-by-case basis. Rule of thumb guidelines for purge volumes should be avoided. No. of well volumes required for purging should be verified using indicator parameters.	Not Specified	USEPA (1985)
± 10%	± 10%	---------	± 10%	± 10%	---------	Not Specified	Not Specified	0.25 well volumes	Not Specified	None	Variations in water chemistry on purging were greater than errors associated with sampling mechanism or well casing effects.	2 ft.	Barcelona and Helfrich (1986)
-------	----------	± 10%	± 10%	----------	± 10%	2	3 minutes	Not Specified	Not Specified	None	Criteria apply to "most wells" Low flow rates are "ideal" Wide range of opinion regarding proper purging procedures.	Not Specified	USEPA (1992)
± 0.1	± 10 µS/cm when <1,000	± 0.2 mg/L	----------	± 0.1 °C	----------	Not Specified	"Over consecutive bore volumes"	< 0.5 well volume	2 well volumes	None	Study applies to VOCs. Stabilization criteria cannot be set *a priori* due to variability in aquifer properties. Dissolved oxygen and specific conductivity are the best indicators.	≤ 5 ft.	Barcelona et al. (1994)
± 0.1	± 5 µS/cm when <1,000 ± 10 µS/cm when >1,000	± 0.2 mg/L	± 30 mV (Optional)	± 0.1 °C	< 5 NTU	3	2 minutes or ½ casing volume	4 well volumes	Not Specified	Purge until readings are ± 10% for each parameter	Specific to low-flow sampling. Turbidity optional if samples are filtered for metals analysis. Stability ranges for indicator parameters may be adjusted based on site-specific conditions.	Not Specified	Karklins (1996)
± 0.1	± 3%	± 10%	± 10 mV	----------	± 10%	3	3 to 5 minutes	Not Specified	Not Specified	Minimum parameters are pH, conductivity, and turbidity or dissolved oxygen	Specific to low-flow sampling.	< 1 m "for high resolution sampling needs".	USEPA (1996)
± 0.1	± 3%	± 0.3 mg/L	± 10 mV	----------	± 10% when >10 NTU	3	Each well volume	Not Specified	Not Specified	None	Specific to "Well-Volume Approach"	Not Specified	USEPA (2002)
± 0.1	± 5% when ≤ 100 µS/cm ± 3% when > 100 µS/cm	± 0.3 mg/L	----------	± 0.2 °C (thermistor) ± 0.5 °C (liquid-in-glass)	± 10% when < 100 NTU	≥ 5	Dependent on purging rate.	1 well volume (mandatory)	Not Specified	None	Specific to standard fixed volume purging. "The number of well volumes to be removed relies on confirming the time over which field measurements stabilize, using knowledge of the well and aquifer hydraulics".	Not Specified	USGS (2005)
Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	"Should be based on purging rate."	A minimum number of well	Not Specified	None	Method D - Purging Based on Fixed Volume Combined with	Not Specified	ASTM (2012)

ATTACHMENT B SUMMARY TABLE OF GROUNDWATER WELL PURGING FIELD MEASUREMENT STABILITY CRITERIA FROM VARIOUS LITERATURE SOURCES													
pH	**Specific Conductivity**	**Dissolved Oxygen**	**Oxidation-Reduction Potential (ORP or Eh)**	**Temperature**	**Turbidity**	**No. Consecutive Readings**	**Frequency**	**Minimum Purge Volume or time**	**Maximum Purge Volume or time**	**Alternate Criteria**	**Comments**	**Screen Length Applicability**	**Reference**
								volumes must be removed regardless of indicator parameter levels." Purge until parameters are stable.			Indicator Parameters Stabilization. "This document cannot replace education or experience and should be used in conjunction with professional judgment". "Parameters should be selected based on knowledge of water chemistry and analytes of interest, or regulatory requirements, or both." "The acceptable variation of values to define stabilization and the minimum number of consecutive stable readings.." "..should be defined in the sampling and analysis plan."		
± 0.1	± 5%	± 0.2 mg/L	Should Not Be Used	Should Not Be Used	Stable (not defined) or < 10 NTU	3	"Frequently enough to provide a sufficient number of measurements to evaluate stability"	3 well volumes	5 well volumes	None	USEPA Science and Ecosystem Support Division uses multiple volume purging for "typical" wells. No set criteria for establishing the number of measurements needed to document parameter stability. If parameters have not stabilized within 5 well volumes, it is at the discretion of the project leader to sample or continue purging.	Not Specified	USEPA (2013)
± 0.1	± 3%	± 10% when > 0.5 mg/L or three values < 0.5 mg/L	± 10 mV	3%	± 10% when >5 NTU or three values <5 NTU	3	≥ 5 minute intervals	Not Specified	2 hours	None	Specific to low-flow sampling.	≤ 10 ft.	USEPA (2017)
± 0.1	± 3%	± 0.3 mg/L	± 10 mV	----------	± 10% when >10 NTU	3	Each ½ well volume after removal of 1 to 1.5 well volumes.	3 well volumes	6 well volumes	None	Actual number of well volumes to be removed is based on stabilization of indicator parameters.	≤ 10 ft.	USEPA (2018)

References:

ASTM. 2012. Standard Guide for Purging Methods for Wells Used for Groundwater Quality Investigations. Designation: D6452-99 (Reapproved 2012). ASTM International, West Conshohocken, PA.

Barcelona, M.J. and J.A. Helfrich. 1986. Well construction and purging effects on ground-water samples. Environmental Science and Technology. 20:1179-1184.

Barcelona, M.J., H.A. Wehrmann, and M.D. Varljen. 1994. Reproducible well purging procedures and VOC stabilization criteria for groundwater sampling. Ground Water, 32:12-22.

Karklins, S. 1996. Groundwater Sampling Desk Reference. Wisconsin Department of Natural Resources. September.

U.S. Environmental Protection Agency (USEPA). 1985. Practical Guide for Ground-Water Sampling. EPA/600/2-85/104. USEPA, Ada, OK.

U.S. Environmental Protection Agency (USEPA). 1992. RCRA Ground-Water Monitoring: Draft Technical Guidance. Office of Solid Waste. USEPA, Washington, DC. November.

U.S. Environmental Protection Agency (USEPA). 1996. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. EPA/540/S-95/504. April.

U.S. Environmental Protection Agency (USEPA). 2002. Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers. EPA 542-S-02-001. May.

United States Geological Survey (USGS). 2005. National Field Manual for the Collection of Water Quality Data. Techniques of Water-Resources Investigations, Book 9 .

United States Environmental Protection Agency (USEPA). 2013. Groundwater Sampling. SESDPROC-301-R3. USEPA, Athens, GA.

United States Environmental Protection Agency (USEPA). 2017. Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples. EQASOP-GW4. USEPA Region 1, North Chelmsford, MA.

United States Environmental Protection Agency (USEPA). 2018. Standard Operating Procedure for the Standard/Well-Volume Method for Collecting a Ground-Water Sample from Monitoring Wells for Site Characterization. https://www.epa.gov/sites/production/files/2015-06/documents/finalgwsamp_sop.pdf. Accessed 4-18-18.