Appendix A
Monitoring Plan

Plan of Operations
Palmer Advanced Exploration Project
Haines, Alaska

Phase II – Underground Exploration
Upland Mining Lease No. 9100759

CONSTANTINE
MINING

Prepared for:
Alaska Mental Health Trust Land Office
Alaska Department of Natural Resources
Alaska Department of Environmental Conservation

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April 2019

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SUMMARY

This Monitoring Plan describes environmental monitoring that Constantine will continue to perform under this Phase II Plan of Operations.

Constantine has completed a variety of environmental and characterization studies which include Acid Base Accounting, Aquatic Resources, Cultural Resources, Geology, Geotechnical, Water Quality, Groundwater Hydrology, Meteorology, Snow and Avalanche, Wetlands, Wildlife and Wildlife Habitat as a major step in characterizing the natural environment in the project area. Information derived from these studies was integrated into the project designs and plans with the intent of preventing unnecessary or undue degradation to the environment.

The monitoring done to-date has been largely motivated by Constantine's own initiative to understand the natural environment in which they operate and develop plans that are as least intrusive as possible. Except for the storm water inspections, and potentially the groundwater monitoring of the LAD monitoring wells, none of the monitoring described in this plan is required by regulation but some of it may become a requirement of one or more forthcoming permits.

The data from these efforts contribute to a fundamental understanding of the natural environment in the project area, including a baseline of environmental conditions. They define an environmental backdrop against which Constantine can detect changes, over time, including those that might be detected concurrent with project activities.

Constantine will continue to perform the following monitoring as part of its ongoing exploration efforts at Palmer:

- Surface water quality sampling and flow measurements at sites P01, P27 in Glacier Creek, P25 in Waterfall Creek and P26 in Hangover Creek
- Meteorological monitoring at two existing stations in Glacier Creek and the ridge above the South Wall north of Glacier Creek
- Leachate sampling from the 4 ABA sample barrels located in Glacier Creek Valley
- Visual monitoring and periodic geochemical sampling of development rock from the underground exploration ramp
- Underground seepage flow monitoring and water quality sampling in the proposed exploration ramp
- Flow monitoring of discharge from the portal to the settling ponds
- Flow monitoring of discharge from the portal to the upper diffuser
- Groundwater level monitoring in 8 drillholes, and two monitoring wells near the lower diffuser
- Shallow groundwater quality sampling in monitoring wells above and below the lower diffuser and initiate new monitoring of a shallow groundwater well below the upper diffuser

- Stormwater inspections as required by the Construction General Permit and Multi-Sector General Permit
- Incidental wildlife sightings by project personnel

Each is discussed in this monitoring plan. This plan is considered a living document subject to change in response to new information or changes in monitoring or new permitting requirements. Constantine reserves the right to modify this plan for any reason except for any monitoring that is, or becomes, a requirement under a permit or authorization.

1.0 ENVIRONMENTAL MONITORING

Constantine has been performing several environmental monitoring and characterization programs for the project starting as early as 2008. Most of these efforts started in 2014.

Past environmental monitoring and characterization studies have included Acid Base Accounting, Aquatic Biology, Cultural Resources, Geology, Geotechnical, Water Quality, Groundwater Hydrology, Meteorology, Snow and Avalanche, Wetlands, Wildlife and Wildlife Habitat as an important step in characterizing the natural environment in the project area. Information derived from these studies was integrated into the project designs and plans, with the intent of preventing unnecessary or undue degradation to the environment.

The monitoring and characterization work done to-date has been largely motivated by Constantine's initiative to understand the natural environment in which they operate and to develop project plans that are compatible with the local environment.

The data from these efforts contribute to a fundamental understanding of the natural environment in the project area, including a baseline of environmental conditions. They define an environmental backdrop against which Constantine can detect changes, over time, including those that might be concurrent with project activities.

This monitoring plan describes all the monitoring that Constantine will perform as part of their continuing exploration activities for the Palmer Project. Except for the storm water inspections, none of the monitoring described in this plan is currently required by regulation. However, Constantine has applied for several permits and approvals, and some of the monitoring proposed here, and potentially additional monitoring, may be required as stipulations in those forthcoming permits and approvals.

This monitoring plan will be updated as required to accurately reflect the monitoring that Constantine is performing. Constantine reserves the right to change this plan, except for monitoring that is, or becomes, a requirement under any of the project permits or authorizations.

1.1 Surface Water Monitoring

Constantine has been performing surface water quality sampling since 2008 from as many as 27 stations, and surface water quantity measurements from 13 stations since 2014. Details regarding this baseline sampling is available (Integral 2018; and Appendix B of Waste Management Permit Application). The sampling completed to date serves to establish a robust baseline of water quality and flows in, and surrounding, the Palmer project area. Now that Constantine has characterized the surface water quality and flows in the broader Palmer project area, the company plans to reduce the total number of surface water quality and flow sample sites. Reductions in the scope of environmental baseline monitoring are common for advanced exploration projects following collection of sufficient data to characterize an area somewhat larger than the anticipated footprint of the project.

1.1.1 Surface Water Quality Monitoring

Constantine will continue water quality sampling at sites P01 and P27 in upper and mid-Glacier Creek, respectively, P26 in Hangover Creek and P25 in Waterfall Creek as shown in Figure 1 **Error! Reference source not found.**. during the underground exploration program. These sites are the most relevant sites for detecting any significant change in water quality, over time, that may be coincide with Constantine's underground exploration activities which are restricted to the upper Glacier Creek area. Sampling frequency will generally be 4 x/year in the ice-free months. Water quality sampling and analytical procedures will remain unchanged and be performed in accordance with Constantine's QAPP, prepared by Integral Consulting in 2018 and included as an appendix to this monitoring plan.

Samples are analyzed by ALS for conventional parameters, settleable solids, cations/anions, total/dissolved metals and field parameters are also collected at each site during the sampling event. Table 1 provides the list of parameters and measurement quality objectives for the surface water quality samples.

The following parameters will be measured for surface water samples:

- Field parameters – Field measurements of general water quality characteristics, including conductivity, dissolved oxygen, oxygen-reduction potential (ORP), pH, temperature, and turbidity, will be taken at all sampling stations, in accordance with the QAPP (Integral 2018). A YSI multiprobe will be used for dissolved oxygen, pH, temperature, and conductivity measurements. A LaMotte turbidity meter will be used for turbidity measurements. If these instruments will be not available, equivalent instruments that meet method requirements will be used and calibrated per the manufacturer instructions.

- Conventional parameters – Conventional analyses will be performed by the ALS laboratory included acidity, hardness as CaCO3, total dissolved solids (TDS), and total suspended solids (TSS).

- Cations/anions – Major cations and anions that are typically analyzed including alkalinity as CaCO3, bromide, chloride, fluoride, nitrate, combined nitrate/nitrite, sulfate, and ammonia.

- Total/Dissolved Metals – Thirty-three metals will be analyzed for both the total and dissolved fraction.

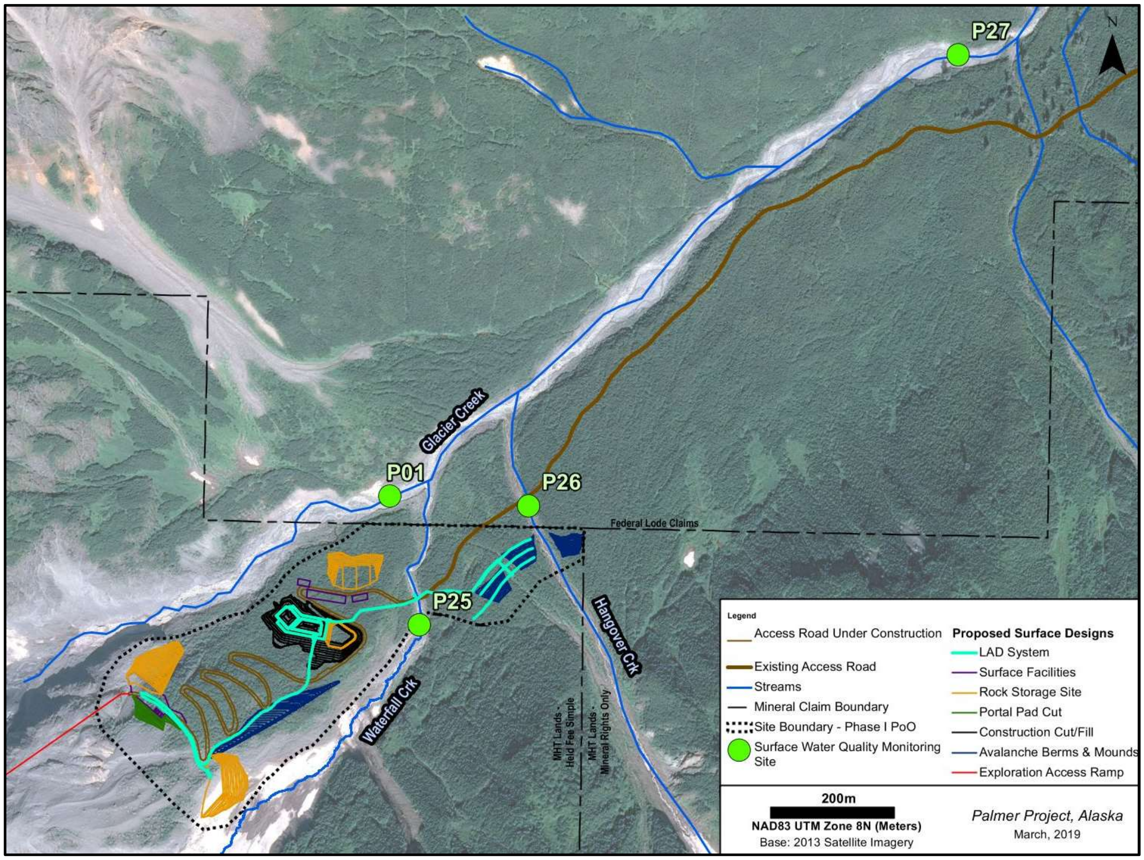

Figure 1. Surface Water Quality Monitoring Stations for Underground Exploration Program

Group	Analyte	Sample Preparation Method	Analytical Method [a]	Units	MDL	PQL	Alaska Water Quality Standards [b] Aquatic Life (Fresh Water) Acute	Alaska Water Quality Standards [b] Aquatic Life (Fresh Water) Chronic	Alaska Water Quality Standards [b] Drinking Water MCL	Resolution	Laboratory Precision (RPD)	Laboratory Accuracy (% recovery)
Field Parameters [c]	Dissolved oxygen	NA	SM 4500-O G	mg/L	NA	0.01	4 – 17	4 – 17	--	0.01 mg/L	--	0 to 20 mg/L, ±0.2 mg/L or ±2% of reading, whichever is greater; 20 to 50 mg/L, ±6% of the reading.
	pH	NA	SM 4500-H B	pH units	NA	0.01	6.5 – 8.5 [d]	6.5 – 8.5 [d]	6.5 – 8.5 [e]	0.01 pH units	--	±0.2 pH units
	Temperature	NA	SM 2550B	°C	NA	0.1	13 – 20 [f]	13 – 20 [f]	--	0.1°C	--	±0.15 °C
	Turbidity [u]	NA	EPA 180.1	NTU	NA	0.1	NC [g]	NC [g]	NC [g]	0.01 NTU (0.00-10.99 NTU), 0.1 NTU (11.00-109.9 NTU), and 1 NTU (110-4000 NTU)	--	±2% (0-100 NTU), ±3% (above 100 NTU)
	Conductivity	NA	SM 2510	mS/cm	NA	0.001-0.1	--	--	--	0.001 mS/cm to 0.1 mS/cm (range dependent)	--	±0.5% of reading or 0.001 mS/cm, whichever is greater (4-m cable) ±1% of reading or 0.001 mS/cm, whichever is greater (20-m cable)
Conventional Parameters	Hardness as $CaCO_3$	SM 2340B, 20th ed.	SM 2340B, 20th ed.	mg/L	0.05	0.05	--	--	--	--	20	80–120 %
	Total dissolved solids	SM 2540C, 20th ed.	SM 2540C, 20th ed.	mg/L	10	10	1,000	1,000	500 [e]	--	20	85–115 %
	Acidity	SM 2310B, 20th ed.	SM 2310B, 20th ed.	mg/L	1	1	--	--	--	--	20	85–115%
	Turbidity [u]	NA	APHA 2130	NTU	NA	0.10	NC	NC	--	--	15	85–115%
	Total cyanide [v]	ISO 14403:2002	ISO 14403:2002	mg/L	0.005	0.005	0.022	0.0052	0.2 [u]	--	20	80-120
	Settleable solids	SM 2540F, 20th ed.	SM 2540F, 20th ed.	mL/L	0.1	1	NC	NC	--	--	--	--
	Total suspended solids	SM 2540D, 20th ed.	SM 2540D, 20th ed.	mg/L	3	3	--	--	--	--	20	85–115 %
Cations/Anions	Alkalinity as $CaCO_3$	EPA 310.2	EPA 310.2	mg/L	1	2	--	20 [h]	--	--	20	85–115 %
	Ammonia as N	Waston et al. [i]	Waston et al. [i]	mg/L	0.005	0.005	PD [j]	PD [k]	--	--	20	85–115 %
	Bromide	EPA 300.1	EPA 300.1	mg/L	0.05	0.05	--	--	--	--	20	85–115%
	Chloride	EPA 300.1	EPA 300.1	mg/L	0.5	0.5	860 [l]	230 [l]	250 [e]	--	20	90–110 %
	Fluoride	EPA 300.1	EPA 300.1	mg/L	0.02	0.02	--	--	4.0	--	20	90–110%
	Nitrate as N	EPA 300.1	EPA 300.1	mg/L	0.005	0.005	--	--	10	--	20	90–110%
	Nitrite as N	EPA 300.1	EPA 300.1	mg/L	0.001	0.001	--	--	1	--	20	90–110%
	Nitrate + Nitrite (complex)as N	EPA 300.1	EPA 300.1	mg/L	0.1	0.1	--	--	10	--	20	90–110 %
	Sulfate	EPA 300.1	EPA 300.1	mg/L	0.3	0.3	--	--	250 [e]	--	20	90–110 %
	Aluminum	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.003	0.003	0.75 [m]	0.087 [m, n]	0.05 - 0.2 [e]	--	20	80–120 %
	Antimony	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0001	0.0001	--	--	0.006	--	20	80–120 %
	Arsenic	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0001	0.0001	0.34 [o]	0.15 [o]	0.01	--	20	80–120 %
	Barium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.00005	0.00005	--	--	2	--	20	80–120 %
	Beryllium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.00002	0.00002	--	--	0.004	--	20	80–120 %
	Bismuth	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.00005	0.00005	--	--	--	--	20	80–120 %
	Boron	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.01	0.01	--	--	--	--	20	80–120 %
	Cadmium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.000005	0.000005	HD [o]	HD [o]	0.005	--	20	80–120 %
	Calcium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.05	0.05	--	--	--	--	20	80–120 %
	Chromium (total)	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0001	0.0001	-- [p]	-- [p]	0.1 [m]	--	20	80–120 %
	Cobalt	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0001	0.0001	--	--	--	--	20	80–120 %

Table 1. Water Quality Parameter List and Measurement Quality Objectives

Group	Analyte	Sample Preparation Method	Analytical Method [a]	Units	MDL	PQL	Alaska Water Quality Standards [b] Aquatic Life (Fresh Water) Acute	Alaska Water Quality Standards [b] Aquatic Life (Fresh Water) Chronic	Alaska Water Quality Standards [b] Drinking Water MCL	Resolution	Laboratory Precision (RPD)	Laboratory Accuracy (% recovery)
Metals	Copper	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0005	0.0005	HD [o]	HD [o]	1 [e]	--	20	80–120 %
	Iron	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.01	0.01	--	1.0 [j]	0.3 [e]	--	20	80–120 %
	Lead	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.00005	0.00005	HD [o]	HD [o]	--	--	20	80–120 %
	Lithium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.001	0.001	--	--	--	--	20	80–120 %
	Magnesium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.05	0.05	--	--	--	--	20	80–120 %
	Manganese	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0001	0.0001	--	--	0.05 [e]	--	20	80–120 %
	Mercury	EPA 1631E	EPA 1631E	mg/L	0.00001	0.00001	1.4E-03 [o]	7.7E-02 [o]	2.0E-03	--	20	80–120 %
	Molybdenum	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.00005	0.00005	--	--	--	--	20	80–120 %
	Nickel	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0005	0.0005	HD [o]	HD [o]	--	--	20	80–120 %
	Phosphorus	SM 4500-P, 20th ed.	SM 4500-P, 20th ed.	mg/L	0.002	0.002	--	--	--	--	20	80–120 %
	Potassium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.1	0.1	--	--	--	--	20	80–120 %
	Selenium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0001	0.0001	-- [q]	0.005 [m,q]	0.05	--	20	80–120 %
	Silicon	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.05	0.05	--	--	--	--	20	80–120 %
	Silver	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.00001	0.00001	HD [o]	--	0.1 [e]	--	20	80–120 %
	Sodium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.05	0.05	--	--	--	--	20	80–120 %
	Strontium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0002	0.0002	--	--	--	--	20	80–120 %
	Thallium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.00001	0.00001	--	--	0.002	--	20	80–120 %
	Tin	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0001	0.0001	--	--	--	--	20	80–120 %
	Titanium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0003	0.0003	--	--	--	--	20	80–120 %
	Uranium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.00001	0.00001	--	--	0.03	--	20	80–120 %
	Vanadium	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0005	0.0005	--	--	--	--	20	80–120 %
	Zinc	EPA SW-846 3005A, Rev. 1	EPA SW-846 6010B, Rev. 2 EPA SW-846 6020A, Rev. 1	mg/L	0.0005 [t]	0.0005 [t]	HD [o]	HD [o]	5 [e]	--	20	80–120 %

Table 1. Water Quality Parameter List and Measurement Quality Objectives

Group	Analyte	Sample Preparation Method	Analytical Method [a]	Units	MDL	PQL	Alaska Water Quality Standards [b] Aquatic Life (Fresh Water) Acute	Chronic	Drinking Water MCL	Resolution	Laboratory Precision (RPD)	Laboratory Accuracy (% recovery)

Notes:

-- = criteria not available
ALS = ALS Laboratory Group
CALA = Canadian Association for Laboratory Accreditation
EPA = U.S. Environmental Protection Agency
HD = hardness-dependent criteria

MCL = maximum containment level
MDL = method detection limit
NA = not applicable
NC = natural conditions-based criteria
NTU = nephelometric turbidity units

PQL = practical quantitation limit
PD = pH-dependent criteria
RPD = relative percent difference
SOP = standard operation procedure

[a] Analytical methods for ALS Environmental are adapted from the referenced methods listed in this table.

[b] Water quality criteria source documents:

Alaska Department of Environmental Conservation. Water Quality Standards. 18 AAC 70. Amended April 8, 2012.

Alaska Department of Environmental Conservation. Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances. Draft. Amended December 12, 2008.

United States Environmental Protection Agency. National Primary Drinking Water Regulations. EPA 816-F-09-004. May 2009

[c] For field parameters, a YSI 556 muliprobe will be used for DO, pH, temperature, and conductivity measurements. A LaMotte 2020e turbidity meter will be used for turbidity measurements. If these instruments are not available, equivalent instruments that meet method requirements will be used.

[d] May not vary more than 0.5 pH units from natural conditions.

[e] Secondary MCL.

[f] The following maximum temperatures may not be exceeded, where applicable:

<15°C (migration routes and rearing areas)

<13°C (spawning and egg/fry incubation areas)

[g] For aquatic life, may not exceed 25 NTU above natural conditions. For drinking water, may not exceed 5 NTU above natural conditions (for natural turbidity < 50 NTU), or may not exceed 10% increase above natural conditions (for natural turbidity > 50 NTU).

[h] Minimum concentration as $CaCO_3$, except where natural alkalinity is lower

[i] Waston, R.J., C. Edward, V. Butler, L.A. Clementson, and K.M. Berry. 2005. Flow-injection Analysis with Fluorescence Detection for the Determination of Trace Levels of Ammonium in Seawater. *J. Environ. Monit*. 7:37-42.

[j] Acute (when fish are present) = $0.275/(1+10^{7.204-pH}) + 39.0/(1+10^{pH-7.204})$

Acute (when fish are not present) = $0.411/(1+10^{7.204-pH}) + 58.4/(1+10^{pH-7.204})$

[k] Chronic (when fish are present) = $(0.0577/(1+10^{7.688-pH}) + 2.487/(1+10^{pH-7.688})) \times MIN(2.85, 1.45\times10^{0.028(25-Temperature)})$

Chronic (when fish are not present) = $(0.0577/(1+10^{7.688-pH}) + 2.487/(1+10^{pH-7.688})) \times (1.45 \times 10^{0.028\cdot(25-MAX(Temperature,7))})$

[l] Applies to dissolved chloride when associated with sodium

[m] Total recoverable

[n] For pH > 7.0 and hardness > 50 mg/L $CaCO_3$, the chronic aluminum standard is equal to the acute aluminum standard (0.75 mg/L).

[o] Dissolved

[p] Criterion for dissolved Cr (VI) is 16 µg/L (acute) and 11 µg/L (chronic). Criterion for dissolved Cr (III) is hardness dependent.

[q] EPA needs to conduct additional work to complete its review of the mercury and selenium aquatic life criteria. The current criteria may change substantially in the future.

[r] Radiochemistry precision is not evaluated with an RPD calculation. A Duplicate Error Ratio is used to include sample specific total propagated uncertainty.

[s] The criterion of 5 pCi/L applies to the combined Radium-226 and Radium-228 value.

[t] Can only be achieved for low turbidity waters; other PQL is 3.0E-03 mg/L

[v] Field-measured turbidity will be used for comparison to screening levels. Turbidity analysis will also be conducted in the laboratory to support sample preparation and analytical method decisions.

[u] Measured as free cyanide (CN/l); the aquatic life criteria for free cyanide shall be measured as weak acid dissociable cyanide or equivalent EPA-approved methods.

Table 1. Water Quality Parameter List and Measurement Quality Objectives

1.1.2 Surface Water Flow Monitoring

Constantine has been monitoring surface water flows (aka hydrology) at 13 sites in Glacier Creek since 2014. Outside the project area water levels are measured at two USGS stations and Constantine's station P14B (a.k.a. station KR). Details are on baseline hydrological conditions are available elsewhere (Integral 2018).

Glacier Creek and its tributaries provide the primary drainage within the Palmer project boundary, ultimately flowing into the Klehini River.

When it is safe to do so (dangerous during high flows) Constantine will continue to measure stream flows at the same four sites that it will continue to monitor surface water quality: P01, P27, P25 and P26 as illustrated in Figure 1.

1.2 Groundwater Monitoring

Constantine has been performing groundwater quality sampling and monitoring water levels in drillholes which it plans to continue. It also intends to start monitoring underground seepage inflows as the proposed underground ramp advances. Each are described in more detail below.

1.2.1 Groundwater Quality Monitoring

Constantine has been performing groundwater quality sampling since 2014. A primary objective of the sampling was to characterize groundwater as a step in predicting the quality of seepage water inflows into any future underground ramp. Sampling was performed in accordance with Constantine's QAPP.

Two drillholes with artesian flow (site P17 at drillhole GT-14, and site P29 at drill hole GT17-05) are routinely sampled, during the snow-free season. Site P17 is a horizontal hole at the South Wall prospect, which can be used to characterize subsurface drainage associated with the hanging wall basaltic rocks of the mineralized South Wall zone and site P29 is also a horizontal hole characterizing subsurface drainage associated with the Jasper Mountain basalts. In addition to the drillholes, Constantine also samples a spring at the base of Paddy's Pocket referred to as site P19.

In 2018 Constantine developed two groundwater monitoring wells above and below the proposed LAD lower diffuser site (MW01 and MW02, respectively). Groundwater monitoring sites are depicted on Figure 2 and Figure 3. The results of the sampling are being used to characterize the natural groundwater conditions for the area and in part to predict the water quality of the anticipated underground seepage water. The monitoring wells above and below the lower LAD diffuser have only been sampled three times so far but they are being used to characterize the shallow groundwater in the vicinity of the lower LAD diffuser and to provide a basis for comparison after Constantine starts discharging water through the lower LAD diffuser.

Constantine also intends to develop a shallow groundwater well down-gradient of the proposed upper LAD diffuser in 2019 and will begin monitoring then. Monitoring these sites is being done currently as part of Constantine's voluntary baseline monitoring program and may modify the monitoring of some of these sites. However, Constantine is committed to monitoring groundwater quality in MW-01, 02 and 03 and in the new monitoring well proposed for 2019 below the upper diffuser as shown in Figure 2 and Figure 3.

Constantine intends to continue groundwater sampling, including sampling select underground seepage water inflows. Constantine will continue to sample groundwater at the two LAD wells and underground seepage water as it leaves the portal. These samples will be collected quarterly and in accordance with the QAPP.

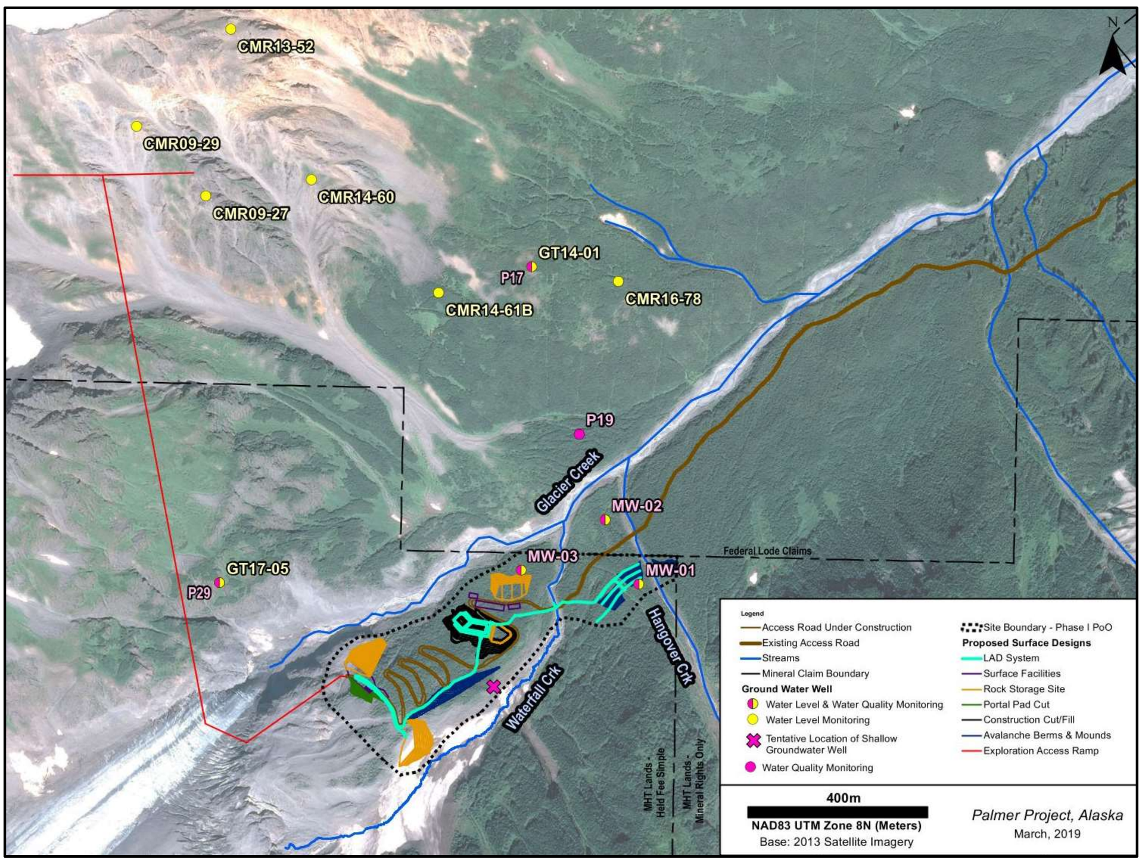

Figure 2. Groundwater Monitoring Location Map

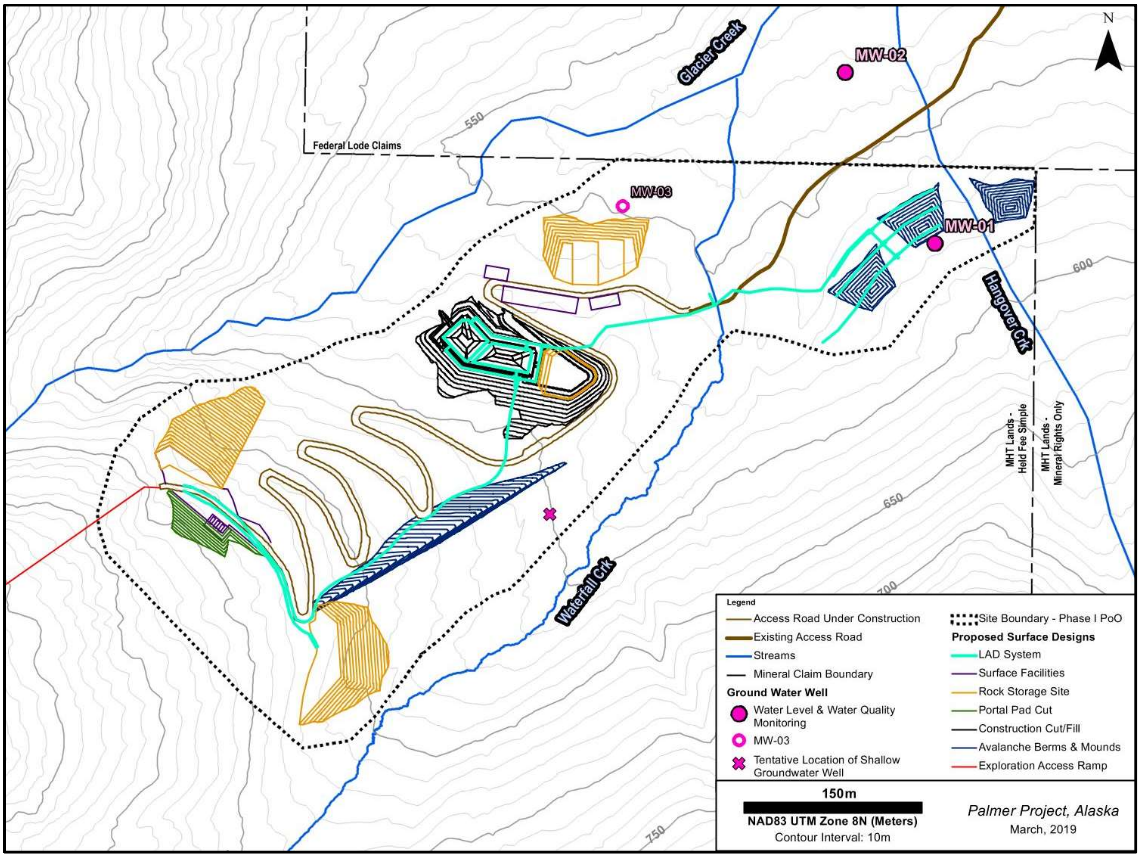

Figure 3. Groundwater Monitoring Location Map for Underground Exploration Program

1.2.2 Groundwater Level Monitoring

Constantine has measured groundwater levels in 10 drillholes using pressure transducers and continues to do so in eight of these as listed in Table 2 and illustrated in Figure 2. Monitoring in two of these holes was terminated. The original wells have more than a three-year water level record.

The groundwater level monitoring well data are evaluated on a two-year cycle. The last full evaluation was in 2016. Constantine will continue to monitor the water level in these 8 drillholes.

Constantine also has transducers in MW-01 and MW-02 above and below the lower LAD diffuser site and will monitor groundwater levels in these wells.

Table 2. List of Groundwater Level Monitoring Wells

Hole ID	Pad	Elevation (mamsl)	Azimuth	Dip	Monitoring Start	Monitoring End	Period (yr)	Status
CMR09-27	Long	1194	337	-48	7-Oct-14	na	3.3	Active
CMR09-29	JP	1358	340	-53	7-Oct-14	na	3.3	Active
CMR13-52	Stryker	1323	153	-72	13-Jul-15	na	2.6	Active
CMR14-58	Green	1258	342	-60	6-Oct-14	1-Jun-15	0.7	Dropped
CMR14-60	Marmot	1096	317	-68	7-Oct-14	na	3.3	Active
CMR14-61B	Brazil	820	0	-50	6-Oct-14	na	3.3	Active
CMR15-76	Pocket	585	0	-46	30-Jun-16	12-Sep-16	0.2	Dropped
CMR16-78	Taz	701	359	-51	23-Aug-16	na	1.4	Active
GT14-01	U6	793	280	-5	na	na	0.0	Active
GT17-05	Hari	898	334	-15	7-Sep-17	na	0.4	Active

1.2.3 Underground Seepage Monitoring

After Constantine begins excavating the exploration ramp it will collect seepage water quality samples on an opportunistic basis. For example, when there is enough seepage inflow to provide a sample, samples will be collected on a quarterly basis.

Constantine may have opportunities to sample pristine seepage water (i.e. from pilot or exploration drillholes). If artesian drillholes are encountered Constantine will install a valve in at least one of these holes to provide opportunities for quarterly sampling.

Modeling of predicted seepage inflow volumes performed by Tundra (2018) suggests that inflows may increase toward the far end of the proposed underground ramp. Under this circumstance there may be increased opportunities to collect seepage samples as the ramp advances.

Constantine will also monitor the quantity of underground seepage water inflows underground by measuring the flow in the water discharge pipe at the portal, as the water is conveyed to the settling ponds and or upper diffuser.

Finally, Constantine will monitor the area below the upper and lower LAD diffusers for signs of new seeps that might result from the discharges.

1.3 Storm Water Monitoring

Constantine is doing requisite storm water monitoring (inspections) currently under its Construction General Permit (CGP AKR100000) to manage storm water runoff from its road construction and other surface disturbance activities. Constantine has developed a SWPPP that describes the storm water inspections it will perform during the activities described in this Plan of Operations. The inspection location and scope are defined by the CGP in section 6.4. Inspections are performed on a weekly schedule (excluding winter shut-down periods) as required by section 6.1 of the CGP that applies to sites where the mean annual precipitation exceeds 40 inches. An inspection report will be completed for each inspection in accordance with CGP section 6.7. Upon completion of all surface construction activities (settling ponds, LAD, diffuser, portal pad) Constantine will be transitioning over to the Multi-Sector General Permit (AKR060000) for stormwater at the start of underground ramp development activities and will follow monitoring/inspection schedule in the MSGP SWPPP.

1.4 Development Rock Monitoring

Constantine initiated a rock characterization program in 2014. The purpose of the program was to characterize the various rock types at Palmer in terms of their capacity to generate acid and/or leach metals (ARD/ML) into the environment if they were subjected to the surface weathering environment. The study was expanded in 2017 to include additional core samples and surface outcrop samples that are representative of the rock types that will be intersected by the underground ramp proposed in this Plan of Operations. Presently 101 rock samples from drill core and surface outcrops have been analyzed to generate a baseline ARD/ML characterization of the rocks that Constantine will encounter in the proposed underground ramp.

The results of that work are illustrated in Table 5 and indicate that the rocks that the ramp will intersect will be non-PAG and that Constantine is unlikely to intersect any PAG rock during the excavation of the underground exploration ramp or any rock that is likely to leach significant metal into the environment, after being exposed to the environment on the surface.

Nonetheless, Constantine will implement the following monitoring and segregation activities for development rock generated while excavating the underground exploration ramp:

- Constantine will utilize a geologist to perform the following inspection of each round of development rock before it is disposed of on the surface
    - Visually examine the rock and determine its predominant lithology (volcanic basalt, intrusive rock, sedimentary rock, other).
    - Visually estimate the types of sulfide minerals in the rock and the percentage of each type.
    - Apply weak hydrochloric acid to the rock to determine the presence or absence of effervescent carbonate minerals.
    - Deem the round as non-PAG if it contains 2% or less sulfide. If the round contains more than 2% sulfide it will be characterized as PAG and it will be temporarily segregated and stored on the temporary rock stockpile (near the settling ponds) pending the laboratory ABA analytical results of a sample collected by the geologist.
    - Record the observations of the geologist and keep them in a digital file. Constantine will have a system of uniquely identifying each round and keep

records of the visual examination of each round and a map that shows where the round originated in the underground ramp.

If the round is determined to be non-PAG it will be repurposed for construction purposes, snow deflection structures, or permanently disposed of in one of the development rock storage locations on the surface.

If ABA geochemical analyses confirm that that rock is PAG then it will remain on a lined storage pad and eventually be placed back underground as described under the Reclamation Plan for Permanent Closure contained in the Phase II Plan of Operations.

Constantine will also perform quarterly random grab sampling of development rock that has been placed in any of the snow deflection structures or other non-PAG rock disposal areas during that quarter. Two quarterly samples will be collected from each active disposal area. The purpose of this sampling is to confirm the non-PAG character of this material through ABA geochemical analyses. A reasonable effort will be made to sample material that has been placed in that quarter. Descriptions and locations of the samples will be recorded and mated with the analytical results as it becomes available.

Table 3. Summary of Acid Base Accounting Results by Rock Type for Samples Representative of the Proposed Exploration Ramp.

Rock Type	Statistic	Paste pH	Total S	Sulfate S	Sulfide S	MPA	Modified NP	CO_3 NP	NNP	NPR
			wt. %			kg$CaCO_3$/t				
All Rock (n = 101)	Min	7.5	0.01	0.01	0.01	0.3	6	4	5	2.5
	Median	8.8	0.13	0.01	0.12	4	100	89	96	33
	Max	9.8	1.09	0.19	1.05	34	651	647	634	381
Jasper Mtn Basalt (n=38)	Min	8.1	0.01	0.01	0.01	0.3	17	4	10	2.5
	Median	8.8	0.12	0.01	0.11	4	93	78	88	31
	Max	9.2	0.32	0.19	0.26	10	617	622	607	219
Limey Argillite (n = 14)	Min	7.5	0.04	0.01	0.03	1	114	110	96	6.3
	Median	8.6	0.57	0.02	0.55	18	435	457	414	27
	Max	8.9	1.09	0.04	1.05	34	651	647	634	235
HW Basalt (n=37)	Min	8.0	0.01	0.01	0.01	0.3	28	13	28	7.9
	Median	8.8	0.05	0.01	0.04	2	91	82	89	80
	Max	9.7	0.44	0.03	0.41	14	381	381	379	381
Mafic Dyke (n = 8)	Min	8.2	0.13	0.01	0.12	4	46	37	40	4.9
	Median	9.0	0.28	0.01	0.28	9	74	62	61	7.0
	Max	9.8	1.06	0.01	1.05	33	201	211	196	43
Gabbro (n = 2)	Min	8.8	0.03	0.01	0.03	1	40	26	39	13
	Max	9.0	0.22	0.01	0.21	7	88	74	81	43
Fault (n = 1)		8.4	0.23	0.01	0.23	7	245	237	238	34
Cap Intrusive (n=1)		8.9	0.03	0.02	0.01	1	6	4	5	6

1.5 Wildlife Monitoring

Wildlife and Terrestrial studies were initiated by consultant Hemmera in 2014 and performed seasonally through 2017. Wildlife habitat mapping and assessment for suitability for wildlife species of interest was done and resident species of interest were identified. Bird surveys (song birds and birds of prey) were also completed. Mountain Goat populations in the project area are seasonally surveyed via fixed-wing aircraft (since 2014). Incidental wildlife observations are reported by Palmer Project employees using digital geo-referenced reporting forms. Constantine personnel have identified the following wildlife in the area: black and brown bear, mountain goat, coyote, wolf, red fox, moose, Steller's Jay, Rock Ptarmigan, Belted Kingfisher, Golden Eagle, Red-tailed Hawk, Hoary Marmot and ground squirrels.

Going forward Constantine will continue the incidental wildlife observation program that is implemented by project personnel.

1.6 Meteorological Monitoring

Precipitation, temperature, solar radiation, wind speed and direction, relative humidity and snow depth data are collected at one station along the existing Glacier Creek access road, and temperature, wind speed and direction data (primarily to assist with avalanche forecasting) are collected from a second station, located on the ridge north of Glacier Creek (South Wall). The station on the access road has been operational since 2014 and the other since 2016. The data are collected in accordance with a QAPP for each station. Monitoring will continue at both stations.

Appendix A Water Quality Sampling QAPP