APPENDIX 9-D ML/ARD MANAGEMENT PLAN

Blackwater Gold Project

ML/ARD Management Plan

November 2021

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ACRONYMS AND ABBREVIATIONS

ABA	Acid base accounting
Aboriginal Groups or Indigenous nations	Aboriginal Groups include: Lhoosk'uz Dené Nation, Ulkatcho First Nation, Nadleh Whut'en First Nation, Stellat'en First Nation, Saik'uz First Nation and Nazko First Nation (as defined in Environmental Assessment Certificate M#19-01)
AP	Acid Potential
Artemis	Artemis Gold Inc.
BC	British Columbia
Blackwater	Blackwater Gold Project
BW Gold	BW Gold LTD.
CEMP	Construction Environmental Management Plan
CNP	Carbonate NP
DS	Decision Statement
EAC	Environmental Assessment Certificate
EM	Environmental Monitor
EMLI	Ministry of Energy, Mines and Low Carbon Innovation
EMPR	Ministry of Energy, Mines and Petroleum Resources
ENV	Ministry of Environment and Climate Change Strategy
GM	General Manager
ha	hectares
ICP	Inductively Coupled Plasma
km	kilometer
KP	Knight Piésold Ltd.
ktonnes	kilotonnes
kV	kilovolt
LDN	Lhoosk'uz Dené Nation
LGO	Low grade ore
m	metre
Mt	Million tonnes

MDMER	*Metal and Diamond Mining Effluent Regulations*
ML/ARD	Metal Leaching and Acid Rock Drainage
NAG	Non-acid generating
New Gold	New Gold Inc.
NFN	Nazko First Nation
NP	Neutralization Potential
NPR	neutralization potential ratio
NWFN	Nadleh Whut'en First Nation
PAG	Potentially acid generating
ROM	run-of-mine
SFN	Saik'uz First Nation
SOPs	Standard Operating Procedures
StFN	Stellat'en First Nation
t/d	tonnes per day
The Project	Blackwater Gold Project
TSF	tailings storage facility
UFN	Ulkatcho First Nation
VP	Vice President
WOL	Whole ore leach

1. PROJECT OVERVIEW

The Blackwater Gold Project (the Project) is a gold and silver open pit mine located in central British Columbia (BC), approximately 112 kilometres (km) southwest of Vanderhoof, 160 km southwest of Prince George, and 446 km northeast of Vancouver.

The Project is presently accessed via the Kluskus Forest Service Road (FSR), the Kluskus-Ootsa FSR and an exploration access road, which connects to the Kluskus-Ootsa FSR at km 142. The Kluskus FSR joins Highway 16 approximately 10 km west of Vanderhoof. A new, approximately 13.8 km road (Mine Access Road) will be built to replace the existing exploration access road, which will be decommissioned. The planned new access is at 124.5 km. Driving time from Vanderhoof to the mine site is about 2.5 hours.

Major mine components include a tailings storage facility (TSF), ore processing facilities, waste rock, overburden and soil stockpiles, borrow areas and quarries, water management infrastructure, water treatment plants, accommodation camps and ancillary facilities. The Blackwater deposit is an intermediate sulphidation epithermal-style gold-silver deposit with proven and probable mineral reserves totalling 334.0 Mt at 0.75 g/t Au and 5.78 g/t Ag. Anticipated ore processing rates will range from 15,000 to 55,000 tonnes per day (t/d) throughout operations (MMTS 2020). The gold and silver will be recovered into a gold-silver doré product and shipped by air and/or transported by road. Electrical power will be supplied by a new approximately 135 km, 230 kilovolt (kV) overland transmission line that will connect to the BC Hydro grid at the Glenannan substation located near the Endako mine, 65 km west of Vanderhoof.

The Blackwater mine site is located within the traditional territories of Lhoosk'uz Dené Nation (LDN), Ulkatcho First Nation (UFN), Skin Tyee Nation and Tsilhqot'in Nation. The Kluskus and Kluskus-Ootsa FSRs and Project transmission line cross the traditional territories of Nadleh Whut'en First Nation (NWFN), Saik'uz First Nation (SFN), and Stellat'en First Nation (StFN; collectively, the Carrier Sekani First Nations) as well as the traditional territories of the Nazko First Nation (NFN), Nee Tahi Buhn Band, Cheslatta Carrier Nation and Yekooche First Nation (EAO 2019a, EAO 2019b).

Project construction is anticipated to take two years. Mine development will be phased with an initial milling capacity of 15,000 t/d or 5.5 million tonnes per annum (Mtpa) for the first five years of operation. After the first five years, the milling capacity will increase to 33,000 t/d or 12 Mtpa for the next five-years, and to 55,000 t/d or 20 Mtpa in Year 11 until the end of the 23-year mine life. The Closure phase is 24 to approximately 45 years, ending when the Open Pit has filled and the TSF is allowed to passively discharge to Davidson Creek, and the Post-closure phase is +46 years.

New Gold Inc. (New Gold) received Environmental Assessment Certificate (EAC) #M19-01 on June 21, 2019 under the 2002 *Environmental Assessment Act* (EAO 2019c) and a Decision Statement (DS) on April 15, 2019 under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2019a). In August 2020, Artemis Gold Inc. (Artemis) acquired the mineral tenures, assets and rights in the Blackwater Project that were previously held by New Gold Inc. On August 7, 2020, the Certificate was transferred to BW Gold Ltd. (BW Gold), a wholly-owned subsidiary of Artemis, under the 2018 *Environmental Assessment Act*. The Impact Assessment Agency of Canada notified BW Gold on September 25, 2020 to verify that written notice had been provided within 30 days of the change of proponent as required in Condition 2.16 of the DS, and that a process had been initiated to amend the DS.

1.1 Purpose and Scope

The scope of this document is the management and monitoring of ML/ARD potential associated with geologic materials that will be excavated or exposed as part of the Project. For the purpose of this document, the term 'geologic materials' encompasses waste rock, ore, overburden, and tailings. Overall, the primary objective of the Plan is to minimize ML/ARD and to mitigate potential effects where disturbance of PAG and/or exposed bedrock is unavoidable. The Plan also summarizes the associated record keeping and reporting procedures.

The ML/ARD Management Plan (or Plan) has been developed in accordance with Section 9.5 of the Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits (EMPR & ENV 2019).

1.2 Supporting Documentation

ML/ARD management strategies are based on the Blackwater geochemical characterization study (AMEC, 2014), more recent and ongoing studies, and the mine plan described in the Project's Joint *Mines Act*/*Environmental Management Act* Permit Application. Standard Operating Procedures (SOPs) for all tasks outlined in this ML/ARD Management Plan are provided in Appendices A to E.

This Plan is intended to be used in conjunction with other management and monitoring plans pertinent to the protection of the aquatic receiving environment, including the following:

- Mine Site Water and Discharge Monitoring and Management Plan, which describes the management and monitoring of PAG-influenced waters.

2. ROLES AND RESPONSIBILITIES

ML/ARD management will require coordinated action by members of mine engineering, geology, and environmental teams. Communication and a clear understanding of the roles and responsibilities between the different departments are essential to the successful implementation of this Plan. An overview of the roles and responsibilities relating to tasks outlined herein are provided in Table 2-1.

Table 2-1: Blackwater Roles and Responsibilities

Department	Responsibility
Mine Operations	■ Responsible for the logistical implementation of the ML/ARD Management Plan ■ Development of haul sheets and PAG rock deposition tracking ■ Ensures that adequate resources are available ■ Implements contingency measures as necessary
Environment	■ Ensures all sampling SOPs are up to date ■ Manages, reviews, reports geochemical data from the laboratory ■ Provides relevant geochemical data to geology for implementation in block model ■ Samples surface water (tailings supernatant, TSF ponds, seepage, etc.) and groundwater monitoring wells ■ Coordinates and oversees mine rock management alongside geology department and implementation of contingency measures as necessary
Geology	■ Collection, recording and submitting ML/ARD related samples ■ Responsible for generating predictive ML/ARD modelling as grade control data become available ■ Provides guidance to mine operations with respect to mine rock management and implementation of contingency measures as necessary
Onsite Lab Facilities	■ Responsible for onsite analysis of samples ■ Provide results to Environmental Superintendent
Health & Safety	■ Review and audit sampling procedures as outlined in the SOPs ■ Oversee construction activities as necessary

3. GEOLOGICAL SETTING

The Blackwater project area is part of the Intermontane Belt superterrane and is locally underlain by rocks of the Stikine terrane comprising an assemblage of magmatic arc and related sedimentary rocks that span Jurassic to early Tertiary time (MMTS, 2020). The deposit represents an intermediate sulphidation epithermal-style gold-silver deposit with mineralization being hosted in felsic to intermediate composition volcanic rocks that have undergone extensive silicification and hydrofracturing in association with pervasive stockwork veined and disseminated sulphide mineralization.

Alteration minerals most commonly identified included muscovite, high- and low temperature illite, ammonium-bearing illite, smectite, silica, biotite, and chlorite. Gold–silver mineralization is associated with a variable assemblage of pyrite–sphalerite–marcasite–pyrrhotite ± chalcopyrite ± galena ± arsenopyrite (± stibnite ± tetrahedrite ± bismuthite). Carbonate minerals are relatively rare and are commonly represented by siderite which does not offer significant neutralization capacity.

4. CLASSIFICATION OF ML/ARD POTENTIAL

4.1 ARD Potential (PAG vs. NAG)

The ARD potential of mine waste is determined by acid base accounting (ABA) testwork, which measures the ratio of acid generating to acid neutralizing minerals. The criteria for determining neutralization potential (NP), acid potential (AP), and defining PAG and NAG material, are described in this section.

4.1.1 Neutralization Potential (NP) Determination

The geochemical characterization program (AMEC, 2014) used a variety of methods to measure NP, including Modified (Sobek) NP, siderite-corrected Sobek NP, carbonate NP (CNP) based on total inorganic carbon content. The geochemical characterization program identified a correlation between NP and Ca wt.% measured by aqua regia digestion followed by ICP analysis (ICP-Ca). To integrate the geochemical database with the geologic block model and to make use of a larger dataset across the deposit, a correlation between mod-NP and assay-Ca was developed (AMEC, 2016). This relationship is conservative and was defined as:

$$NP\ (kg\ CaCO_3/t) = 9.89 \times (ICP\text{-}Ca\ wt.\%) + 4.19$$

In the absence of direct NP measurements, this formulation of NP will be used to define the acid generating potential of geologic materials.

4.1.2 Acid Potential (AP) Determination

The acid generating potential of geological material samples is estimated based on its sulphur (S) content. The amount of acidity generated per mass of sulphur depends in large part on the mineralogy and solid phase speciation of sulphur. That is, different sulphide and sulphate minerals produce different amounts of acidity when weathered. The results of the geochemical characterization program show that the sulphur at the Project occurs primarily as sulphide S. For the extrapolation of geochemical results in the geologic block model, exploration assay sulphur data were found to be a reliable surrogate for AP which can be calculated as follows:

$$AP\ (kg\ CaCO_3/t) = ICP\text{-}S\ (\%) \times 31.25$$

4.1.3 PAG Definition

The likelihood of a sample to generate acidity can be quantified by the comparison of NP and AP. The neutralization potential ratio (NPR = NP/AP) represents a measure that is commonly used to identify whether a sample is PAG or NAG. Typically, in agreement with recommendations made in Price (2009), a sample can be considered PAG if the NPR falls below a value of 2, while samples with NPR ≥ 2 can be considered NAG. In other words, according to this classification, NP has to be at least twice as high as the AP in order to render a sample NAG.

The Blackwater waste rock classification scheme developed by AMEC (2014) subdivides two categories of PAG rock, namely a higher-risk PAG1 (NPR ≤ 1.0) and a lower-risk PAG2 (1.0 < NPR ≤ 2.0). NAG material has an NPR > 2 and is further divided based on metal leaching criteria with respect to zinc content (see Section 2.2).

Lithology was shown to have a significant influence in determining lag time to ARD, with andesite showing longer lag times compared to fragmental and laminated volcanics. The ARD classification also influences lag times, with PAG1 rock generally becoming acid generating more quickly than PAG 2 rock. Proportions of acidic PAG1 and PAG2 are estimated as:

- During Operations (assumes 6 months of exposure)
  - PAG1 – 29% of andesite and 77% of laminated and fragmental volcanics are estimated to be acidic
  - PAG2 – 8% of andesite and 31% of laminated and fragmental volcanics are estimated to be acidic
- During Post-Closure
  - PAG1 – 100% assumed to be acidic for all lithologies
  - PAG2 – 26% assumed to be acidic for all lithologies

During post closure, the pit high wall will be the only remaining PAG exposure. All waste rock and tailings will be submerged or covered within the TSF (typically within six months) during operations.

4.2 Metal Leaching Potential (NAG3, NAG4, and NAG5)

Zinc is a parameter of interest for the Project and its mobility was found to be correlated with its solid-phase content under neutral pH conditions (AMEC, 2014). As such, metal leaching risk criteria were developed for NAG waste rock. There are three NAG categories based on zinc content, all of which have an NPR > 2. NAG3 is considered to have the highest zinc leaching potential amongst NAG rock, while NAG4 and NAG5 have lower zinc leaching potential (Table 4.2-1). While the difference in Zn leaching potential between NAG4 and NAG5 is small to negligible (AMEC, 2014), NAG5 is used preferentially for construction and these units should nevertheless be tracked during mining to further reduce risk of neutral Zn leaching and its effect on downstream water quality.

Table 4.2-1: ML/ARD Waste Rock Segregation Criteria

Rock Type	NPR	Zinc (mg/kg)
PAG 1	≤1	n/a
PAG 2	1 - ≤2	n/a
NAG 3	> 2	≥ 1,000
NAG 4	> 2	600-1,000
NAG 5	> 2	< 600

Notes: NPR = Neutralization Potential Ratio, n/a = not applicable.

5. POTENTIAL SOURCES OF ML/ARD

ML/ARD is caused by contact of geologic materials with water and oxygen. While ML/ARD is a natural geochemical process, reaction rates and associated downgradient effects are commonly accelerated by the disturbance and exposure of such materials during mining activities.

Static and kinetic geochemical test programs were conducted to characterize the different materials to be exposed during mining operations (AMEC, 2014). An overview of the sample numbers submitted for each test is given in Table 5-1. The following sections provide a high-level summary of the geochemical results associated with each material type as well as the corresponding production schedules as they pertain to ML/ARD considerations.

Table 5-1: Number of Samples Submitted for Geochemical Testing (AMEC, 2014)

Analysis	Exploration Samples	Waste Rock	Ore	Tailings	Overburden	
					Open Pit/ TSF/ Plant Site	Access Road
Acid Base Accounting	-	890	72	12	76	19
Multi-element Chemistry	285,234	617	72	12	76	19
Mineralogy/Petrography	-	25	48	-	2	-
Shake Flask Extraction	-	58	8	5	14	-
Net Acid Generation Test	-	587	36	8	29	-
Net Acid Generation Leachate	-	78	7	5	5	
Humidity Cells	-	19	2	5	-	-
Modified Humidity Cells	-	3	1	-	-	-
Saturated Columns	-	2	-	-	-	-
Kinetic Field Bins	-	6	2	-	-	-
Oxygen Consumption	-	1	-	-	-	-
Acid Buffering Characteristic Curve	-	12	-	-	-	-
Sequential Net Acid Generation	-	4	-	-	-	-
Kinetic Net Acid Generation	-	6	-	-	-	-
Humidity Cell pH Neutralization	-	5	1	-	-	-
Sequential Extraction	-	10	-	-	-	-
Adsorption Experiments	-	6	-	-	-	-
Scanning Electron and Optical Microscopy	-	5	-	2	-	-
SO2 Air/Cyanide Destruction	-	-	-	23	-	-

Notes: TSF = Tailings Storage Facility.

5.1 Waste Rock

5.1.1 Acid Rock Drainage Potential

The total sulphur contents of waste rock range from 0.01% to 3.2% with sulphide minerals comprising the majority of the sulphur inventory (AMEC, 2014). The dominant sulphide minerals are pyrite and sphalerite. Since sphalerite produces little or no acid upon dissolution, the stoichiometric derivation of AP using sulphide sulphur content was deemed conservative and appropriate, in particular for Zn-rich samples.

Modified NP was found to be relatively low across the deposit, with a median value of 10 kg $CaCO_3$/t. Carbonate minerals represent the largest contributor to NP, with calcite identified to be the dominant carbonate phase in NAG samples. Siderite, which provides reduced or negligible neutralization capacity, was found to be a common carbonate phase in PAG waste materials.

Humidity cell testing conducted on a range of waste rock samples showed that all PAG1 samples became acid generating within 10 weeks and some PAG2 samples (three of six) produce acidic drainages within 30 weeks. Acid generating reactions would proceed at a slower rate under field conditions, however, the rapid onset of ARD in the laboratory tests shows that ARD generation will be a risk even with relatively short exposure duration (weeks to months). As expected, none of the NAG materials studied produced net acid during this test. Results for field-scale kinetic testing were consistent with the humidity cell program; however, lag times to onset of ARD were generally longer in the field.

Supplementary Net Acid Generation testing conducted on a subset of waste rock samples (n = 587 samples) showed that an NPR threshold of 2.0 to discern between PAG and NAG materials is conservative (AMEC, 2014).

5.1.2 Metal Leaching Potential

Metal enrichment is determined via the comparison of the aqua regia digestible solid-phase composition with average crustal concentrations (Price, 1997). Elements with a concentration of greater than ten times the corresponding crustal abundance were flagged. Using this screening approach, the following elements were elevated in more than 60% of the samples: As, Bi, Cd, and P. Silver and Bi were elevated in at least 50% of the samples while zinc was elevated in 49%.

PAG1 and PAG2 waste rock classes have the highest metal leaching potential for two reasons:

1. By definition, these material classes are expected to produce acidic drainage in the long-term if exposed to atmospheric conditions. pH is a dominant variable that governs the solubility of many solutes and metal leaching rates generally increase significantly as pH drops.
2. PAG waste rock units tend to have a higher sulphide content. These minerals are often the main host for metals that are of environmental relevance in mine drainage. As such, the solid-phase abundance of such metals is higher in PAG materials.

Humidity cell testing confirmed that the highest metal release rates are associated with low-pH leachate with an array of species showing relatively high mobility (e.g., Cd, Cu, Fe, Pb, Zn). Under neutral pH conditions, metal loading rates were reduced significantly; however, some neutral metal leaching was observed for As, Sb, Cd and Zn, especially in samples with higher solid-phase contents of these species.

Saturated column testing conducted to investigate the acid generating and metal leaching properties of select samples in an oxygen-deplete environment demonstrated circum-neutral pH and a strong reduction in metal leaching potential (AMEC, 2014).

5.1.3 Material Schedule

Approximately 584 Mt of waste rock will be produced over the life of mine (Table 5.1-1). The majority of the waste rock is classified as PAG1 (58%) and PAG2 (17%). NAG3 and NAG4 are relatively minor rock types, each representing approximately 4% of the total waste rock. NAG5 (16 %) is the dominant rock classification of the three NAG rock units. Undefined waste material represents zones that could not be reliably delineated based on environmental block model output. For the purpose of mine planning, undefined waste rock is conservatively considered to be PAG1.

Table 5.1-1: Waste Rock Production Schedule (MMTS, 2020)

Year	PAG1 Waste	PAG2 Waste	NAG3 Waste	NAG4 Waste	NAG5 Waste	Undefined Waste	Total Waste Rock
	ktonnes	ktonnes	ktonnes	ktonnes	ktonnes	ktonnes	ktonnes
LOM	338,642	97,231	24,300	22,518	94,354	7,113	584,158
Y-2	0	9	0	7	197	111	324
Y-1	282	502	17	433	3,792	322	5,348
Y1	5,179	1,860	761	476	1,011	959	10,246
Y2	6,855	1,537	743	876	2,380	259	12,650
Y3	5,048	1,134	423	425	852	381	8,263
Y4	9,391	4,056	1,620	287	3,316	530	19,200
Y5	8,739	5,224	1,708	2,525	8,295	598	27,089
Y6	20,291	4,648	487	1,348	2,898	31	29,703
Y7	21,062	2,498	222	139	1,073	705	25,699
Y8	26,778	5,754	1,900	1,309	4,092	1,549	41,382
Y9	29,589	10,301	3,586	1,967	3,227	291	48,961
Y10	36,737	9,197	3,074	1,470	2,664	22	53,164
Y11	31,261	5,211	870	1,637	8,732	536	48,247
Y12	18,798	5,364	3,013	1,824	20,099	130	49,228
Y13	18,196	14,836	2,741	4,052	20,012	686	60,523
Y14	26,917	17,998	2,127	2,920	10,417	3	60,382
Y15	32,385	6,071	902	786	1,202	0	41,346
Y16	27,494	791	103	31	60	0	28,479
Y17	13,260	240	4	7	37	0	13,548
Y18	381	0	0	0	0	0	381

Notes: Sub-tonnages may not add up to total tonnages due to rounding.

Waste rock will be stored in multiple locations across the mine site. These include site infrastructure such as the TSF, TSF embankments as well as the Lower and Upper Waste stockpiles, which contain <2% and approximately 70% waste rock, respectively (Table 5.1-2).

Table 5.1-2: Waste Rock Placement by Mine Facility

Mine Facility	PAG1	PAG2	NAG3	NAG4	NAG5	Total
	ktonnes	ktonnes	ktonnes	ktonnes	ktonnes	ktonnes
TSF C impoundment	48,816	16,646	5,515	-	-	70,976
TSF D impoundment	299,808	78,266	18,785	-	-	396,860
Main Dam C - downstream embankment	-	-	2,600	8,924	14,863	26,387
Main Dam D - downstream embankment	-	-	-	11,176	55,837	67,013
Lower waste stockpile	-	-	-	400	57	457
Upper waste stockpile	-	-	-	1,440	19,475	20,916

Notes: Sub-tonnages may not add up to total tonnages due to rounding.

5.2 Ore

5.2.1 Acid Rock Drainage Potential

Ore samples were found to have elevated sulphur contents compared with waste rock, exhibiting a median total S value of 1.3% (AMEC, 2014). Most of the sulphur was found to reside in sulphide minerals, with pyrite, sphalerite and pyrrhotite identified by X-Ray Diffraction. Chalcopyrite and arsenopyrite were additionally identified during petrographic analysis.

With relatively low Modified NP values (median = 4.0 kg $CaCO_3$/t), which are in agreement with sparse carbonate contents, the majority (92%) of ore samples tested returned PAG character based on an NPR threshold of 2. This finding was confirmed by the supplementary Net Acid Generation testing.

Humidity cell testing conducted on two low-grade ore samples (PAG) demonstrated little to no lag time to ARD onset (AMEC, 2014). No high-grade ore samples underwent kinetic testing in the geochemical assessment program; however, it can be assumed that high-grade ore would also be PAG with little to no lag time to ARD onset and potentially even higher metal loading rates. In conclusion, all ore material should be treated as PAG and acidic drainage should be expected from low- and high-grade temporary stockpiles during operations shortly after deposition.

5.2.2 Metal Leaching Potential

More than 50% of the ore samples had elevated concentrations of Ag, As, Bi. Cd, Pb, P, Sb, or Zn. Selenium, which was found to be elevated in 36% of the samples, has a systematically higher content in samples with Zn concentrations >1,000 ppm.

The onset to acidification in the two low-grade ore humidity cells was accompanied by high metal loads for Zn, Cd, Fe, and As. Raising the pH via lime addition was found to be an effective method to attenuate Cd and Zn concentrations in mixed waste rock and low-grade ore humidity cell leachates (AMEC, 2014). Specifically, an increase in pH from 4.0 to around 8.0 resulted in the reduction of Cd and Zn concentrations by approximately two orders of magnitude (attenuation rate of ~99%). Trace metal attenuation is attributed to the co-precipitation of these species with or adsorption to Fe-hydroxides.

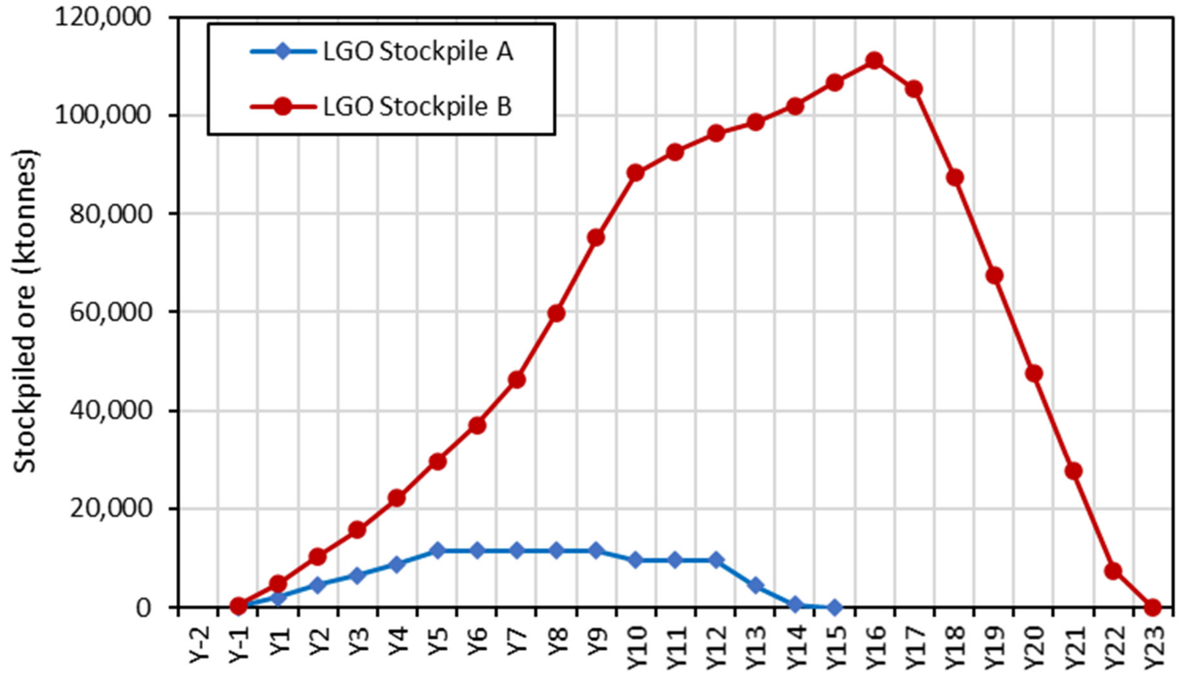
5.2.3 Material Schedule

Ore excavated from the mine pit will either be fed directly to the mill via the run-of-mine (ROM) pad, or temporarily stockpiled in the low grade ore stockpiles (Table 5.2-1 and Figure 5.2-1). In total, approximately 125.5 Mt of low-grade ore will be stockpiled over the life of mine with the maximum material stored at any one time approximately being 111 Mt. It is expected that both stockpiles will be entirely consumed by the end of mining.

Table 5.2-1: Ore Production and Processing Schedule Over the Life of Mine

Mine Year	Resource Mined Directly to Mill	Ore Mined to LGO Stockpile A	LGO Stockpile A to Mill	Cumulative LGO Stockpile A Balance	Ore Mined to LGO Stockpile B	LGO Stockpile B to Mill	Cumulative LGO Stockpile B Balance	Cumulative LGO Stockpile Balance
	ktonnes	ktonnes	ktonnes	ktonnes	ktonnes	ktonnes	ktonnes	ktonnes
LOM	208,706	11,499	11,499	-	113,842	113,842	-	-
Y-2	-	-	-	-	-	-	-	-
Y-1	-	101	-	101	380	-	380	481
Y1	4,500	1,954	-	2,055	4,353	-	4,733	6,788
Y2	5,500	2,494	-	4,549	5,722	-	10,455	15,004
Y3	5,500	1,895	-	6,444	5,170	-	15,625	22,069
Y4	5,500	2,348	-	8,792	6,534	-	22,159	30,951
Y5	5,500	2,708	-	11,499	7,416	-	29,575	41,074
Y6	12,000	-	-	11,499	7,492	-	37,067	48,566
Y7	12,000	-	-	11,499	9,072	-	46,139	57,638
Y8	12,000	-	-	11,499	13,504	-	59,643	71,142
Y9	12,000	-	-	11,499	15,450	-	75,093	86,592
Y10	10,000	-	2,000	9,499	13,155	-	88,248	97,747
Y11	20,000	-	-	9,499	4,419	-	92,667	102,166
Y12	20,000	-	-	9,499	3,659	-	96,326	105,825
Y13	15,000	-	5,000	4,499	2,194	-	98,520	103,019
Y14	16,000	-	4,000	499	3,382	-	101,902	102,401
Y15	19,000	-	499	-	5,314	500	106,716	106,716
Y16	20,000	-	-	-	4,381	-	111,097	111,097
Y17	12,000	-	-	-	2,246	8,000	105,343	105,343
Y18	2,204	-	-	-	-	17,796	87,547	87,547
Y19	-	-	-	-	-	20,000	67,547	67,547
Y20	-	-	-	-	-	20,000	47,547	47,547
Y21	-	-	-	-	-	20,000	27,547	27,547
Y22	-	-	-	-	-	20,000	7,547	7,547
Y23	-	-	-	-	-	7,546	-	-

Notes: Sub-tonnages may not add up to total tonnages due to rounding.
LGO = Low Grade Ore



Note: LGO = Low-Grade Ore

Figure 5.2-1: Ore Stockpile Material Balance–LGO Stockpiles

5.3 Pit Wall Rock

5.3.1 Acid Rock Drainage Potential

Pit wall exposures will be made up of materials representative of waste rock, ore, and overburden. Pit wall exposures as a function of elevation are presented in Table 5.3-1. The proportion of PAG wall rock that is acid generated is determined as a function of lithology and exposure times, as described in Section 2.1.

Table 5.3-1: Percentage of Pit Wall Above Bench Elevation - Operations

Bench	PAG1	PAG2	NAG3	NAG4	NAG5	OVB
1146	41%	16%	5%	4%	22%	12%
1158	40%	16%	5%	4%	22%	12%
1170	40%	16%	5%	4%	22%	12%
1182	40%	17%	5%	4%	22%	12%
1194	39%	17%	5%	4%	22%	13%
1206	39%	17%	5%	4%	23%	13%
1218	37%	17%	5%	4%	23%	13%
1230	36%	17%	5%	4%	24%	13%
1242	33%	18%	5%	5%	25%	14%
1254	32%	18%	5%	5%	26%	14%
1266	30%	18%	5%	5%	26%	15%

Bench	PAG1	PAG2	NAG3	NAG4	NAG5	OVB
1278	30%	19%	5%	5%	26%	15%
1290	29%	19%	5%	5%	27%	15%
1302	27%	19%	6%	5%	27%	16%
1314	25%	19%	6%	5%	28%	17%
1326	25%	19%	6%	5%	28%	17%
1338	23%	19%	6%	5%	29%	17%
1350	22%	19%	6%	5%	29%	18%
1362	20%	20%	6%	5%	30%	19%
1374	18%	19%	6%	5%	32%	20%
1386	16%	19%	6%	5%	32%	20%
1398	15%	19%	6%	5%	33%	21%
1410	14%	19%	6%	5%	34%	22%
1422	14%	17%	6%	4%	35%	24%
1434	13%	13%	5%	4%	38%	26%
1446	13%	12%	4%	4%	39%	27%
1458	12%	11%	4%	3%	40%	30%
1470	12%	11%	4%	3%	40%	31%
1482	10%	10%	2%	3%	41%	34%
1494	8%	10%	2%	4%	43%	34%
1506	8%	8%	2%	4%	44%	34%
1518	5%	7%	2%	4%	48%	34%
1530	4%	6%	1%	4%	50%	34%
1542	4%	5%	1%	3%	54%	33%
1554	1%	3%	1%	2%	57%	34%
1566	1%	3%	0%	2%	59%	35%
1578	0%	3%	0%	0%	60%	36%
1590	0%	3%	0%	0%	59%	37%
1602	0%	4%	0%	0%	55%	41%
1614	0%	5%	0%	0%	52%	43%
1626	0%	5%	0%	0%	49%	45%
1638	0%	4%	0%	0%	36%	59%
1650	0%	3%	0%	0%	32%	65%
1662	0%	0%	0%	0%	28%	72%

5.3.2 Metal Leaching Potential

Pit wall exposures will be made up of materials representative of waste rock, ore, and overburden. Since the ML potential of these materials was already described previously and is further described below (Section 5.5: Overburden), it is not discussed further in this section.

5.3.3 Material Schedule

The open pit will be developed to a maximum planar area of ~227 ha. This corresponds to a total surface area of ~315 ha at the end of mining.

5.4 Tailings

A range of tailings materials, representing rougher, cleaner, and whole ore leach (WOL) tailings, were analyzed and discussed in AMEC (2014). A combined gravity and whole ore leach circuit was selected for processing ore (MMTS, 2020). Crushed ore will be sent to the mill for grinding, followed by gravity concentration, pre-oxidation, cyanide leaching, carbon-in-pulp adsorption, desorption, and refining. Cyanide destruction using SO_2/air will be conducted on the tailings slurry before discharge into the TSF. In order to minimize SO_4 accumulation in the process water and tailings ponds, liquid SO_2 will be used rather than sodium metabisulfite ($Na_2S_2O_5$) as a SO_2 source, thereby minimizing the Na loadings to the system which will promote gypsum formation.

5.4.1 Acid Rock Drainage Potential

The ARD potential of tailings is similar to or lower compared to ore. The AP of the material will remain unchanged through processing; however, some NP will be introduced in the form of lime during the milling process. Tailings samples analyzed for the project (n = 14 samples) were generally found to be PAG with NPRs falling below 1.0 with the exception of one rougher tailings sample (NPR = 1.2). This includes the high-grade ore (HGO) tailings and low-grade ore (LGO) tailings generated during 2019 metallurgical testing. These tailings samples were found to have similar AP and NPR below 1. Consistent with ore and waste rock, sulphur is most commonly associated with sulphide minerals which were identified as pyrite, arsenopyrite, sphalerite, pyrrhotite, galena and chalcopyrite.

Neutralization potential for tailings is generally low, with Modified NP values most commonly falling below 10 kg $CaCO_3$/t. Lag times to depletion of these low levels of NP and the resulting onset to acidic conditions in humidity cells were slightly longer than those observed for waste rock. The lag time to onset of ARD in the whole ore leach tailings was estimated to be on the order of one year. In general, sulphide and transition ore tailings were determined to constitute a higher ARD risk than tailings produced from oxide zone ore.

5.4.2 Metal Leaching Potential

A range of elements were found to be enriched in the solid phase in the majority of the tailings samples, with Ag, As, Cd, P, Pb, Sb, and Zn exceeding ten times the average crustal abundance. This is consistent with findings from ore analyses (see Section 3.2.2).

As for ore and waste rock, increased metal leaching rates of various metals were observed under conditions of low-pH drainage. Cadmium and Zn were also found to be released at elevated concentrations even neutral pH conditions. Two samples that turned acidic during the humidity cell test program additionally released elevated concentrations of Co, Mn, Pb, and Fe.

Saturated tailings column experiments were conducted in 2013 and 2020 to assess tailings behaviour under saturated conditions. Overall, absolute concentrations of most trace elements in column effluents were low, and illustrate a low risk associated with the potential for metal remobilization from saturated tailings over the range of redox conditions likely to be encountered at site (mildly suboxic to strongly reducing). The 2013 columns showed some indication of enhanced mobility for Fe, Mn, and Zn under mildly suboxic redox potentials. However, the recent columns showed lower metal concentrations and lower potential for sulphate release and metal leaching in comparison to the 2013 saturated column tests. In particular, Zn concentrations remained low in the 2020 columns and do not show evidence of Zn release correlated with Mn-oxide dissolution. Cobalt concentrations remained relatively high in the column effluents for both 2013 and 2020 columns, presumably in response to the presence of strong cobalt-CN complexes.

5.4.3 Material Schedule

The TSF was designed to a maximum capacity of 462 Mm^3 of tailings that will be pumped into two cells that are contained by three tailings dams. The TSF C cell will be developed first and will receive tailings over 21 years of operation amounting to a total of approximately 300 Mt (Table 5.4-1). Tailings discharge will be switched to TSF D in year 21 where the remaining ~33 Mt of tailings will be deposited until end of mining.

Table 5.4-1: Annual Tailings Production

Year	Annual Tailings (tonnes)	
	TSF C	TSF D
-2	0	0
-1	0	0
1	4,500,000	0
2	5,500,000	0
3	5,500,000	0
4	5,500,000	0
5	5,500,000	0
6	12,000,000	0
7	12,000,000	0
8	12,000,000	0
9	12,000,000	0
10	12,000,000	0
11	20,000,000	0
12	20,000,000	0
13	20,000,000	0
14	20,000,000	0
15	20,000,000	0
16	20,000,000	0
17	20,000,000	0
18	20,000,000	0
19	20,000,000	0
20	20,000,000	0
21	14,700,000	5,300,000
22	0	20,000,000
23	0	7,546,000

Source: KP, 2021.

5.5 Overburden

Overburden material was assessed as part of the pre-mine geochemical characterization work conducted by AMEC (2014). The dataset (n = 95 samples) included samples from the open pit footprint, proposed tailings storage facility (TSF) site, as well as the access road alignment. Of these, 19 samples from the open pit footprint were recovered from near the overburden-bedrock interface to assess geochemical properties of the overburden/bedrock transition zone.

5.5.1 Acid Rock Drainage Potential

Total sulphur concentrations in overburden samples were very low, ranging from 0.01% to 0.66% (95^{th} percentile of 0.04%). The sample with the highest total S content was sourced from the overburden-bedrock transition and may have included bedrock clasts. Median contents of total S, sulphate, and sulphide S were calculated to be 0.01%, which represent the analytical detection limit. No discrete sulphide minerals were identified through mineralogical testing.

Modified NP was relatively wide range from 0 to 127 kg $CaCO_3$/t. The analysis deemed 94% of all tested overburden materials as NAG. Six samples classified as PAG were all derived from the overburden-bedrock interface within the open pit footprint. With the exception of the one sample that may have been contaminated by bedrock, all other PAG overburden samples showed low total S values and were classified as PAG due to their low NP. Net acid generation testing conducted on a subset of 29 samples confirmed the NAG character of these materials.

5.5.2 Metal Leaching Potential

Elevated Cd concentrations were reported in 35% of all tested overburden samples and 19 samples (20%) had elevated zinc concentrations. Antimony, lead, selenium, and bismuth were also found to be enriched in some samples. In general, metal concentrations were greater in samples near the overburden/bedrock interface (AMEC, 2014).

Shake flask extraction data identified metal leaching potential (*e.g.,* Cd, Fe, Pb, Zn) in some overburden samples. However, these results are viewed as inconclusive owing to the high Al and Fe concentrations. These parameters (Al and Fe) are insoluble in neutral-pH and aerobic conditions and their presence in SFE leachate (median: Al = 17.5 mg/L; Fe = 10.3 mg/L) shows that suspended solids are likely bypassing the filter during leachate collection. This is commonly observed in SFE tests conducted with silt-clay bearing material. Furthermore, elevated ML potential of overburden at this site is not supported by baseline water quality, which generally shows low metal concentrations in site surface and groundwater. Sorption studies using weathered bedrock, basal till and sand and gravel units under the proposed Blackwater TSF found that this material effectively attenuated >90% of Cd and Zn concentrations produced from waste rock humidity cell tests. Humidity cell tests completed on Project waste rock show that ML potential is related to metal content. A similar relationship can be expected in overburden, with metal leaching risks likely limited to samples with elevated trace metal concentrations (e.g., Zn > 1,000 ppm).

5.5.3 Material Schedule

Over the life of mine, an estimated ~120 Mt of overburden will be stripped from the open pit footprint as well as construction sites such as mine access roads plant site, and the TSF embankments. Overburden will be used for construction purposes across the mine site as needed and the majority of the overburden inventory will be utilized in the construction of TSF Embankments (Table 5.5-1). Excess material will be stored in the Lower (early life of mine) and Upper (later mine phases) Waste stockpiles. During mine closure, overburden will also be used for reclamation purposes (e.g., stockpile covers).

Table 5.5-1: Annual Overburden Production Schedule

Year	Construction Sites	TSF Embankments	Lower Waste stockpile	Upper Waste stockpile	Total Excavated
	tonnes	tonnes	tonnes	tonnes	tonnes
-2	250,000	590,909	25,969	-	866,878
-1	250,000	3,131,818	295,502	-	3,677,320
1	-	2,300,000	4,035,378	-	6,335,378
2	-	2,481,818	439,877	-	2,921,695
3	-	609,091	6,469,371	-	7,078,462
4	2,800,000	940,909	13,982,062	-	17,722,971
5	-	2,159,091	2,626,461	-	4,785,552
6	-	3,354,545	106,140	-	3,460,685
7	-	8,918,182	365,803	-	9,283,984
8	-	15,859,091	243,672	-	16,102,763
9	-	7,090,909	54,813	-	7,145,722
10	-	2,504,545	46,896	-	2,551,441
11	-	5,472,727	-	3,834,594	9,307,322
12	-	2,422,727	-	4,478,813	6,901,540
13	-	8,776,000	-	1,442,459	10,218,459
14	-	5,545,455	-	29,372	5,574,827
15	-	4,580,364	-	-	4,580,364
Total	**3,300,000**	**76,738,182**	**28,691,942**	**9,785,239**	**118,515,362**

6. ML/ARD MANAGEMENT

The following section is intended to provide practical guidance with respect ML/ARD management practices. Facilities that will be built with mine materials and are considered part of this ML/ARD Management Plan include:

- Tailings Storage Facility and embankments;
- Upper and Lower Waste stockpiles;
- High- and low-grade ore stockpiles;
- Open Pit; and
- Other infrastructure (e.g., road alignments, construction pads, laydown areas).

The full extent of the mine site layout as it is designed for the later mine phases is illustrated in Figure 6-1.

Most mine waste generated by mining activity will be stored in the TSF. The TSF was designed to contain all tailings and potentially acid generating (PAG) waste rock generated from the pit (MMTS, 2020). The TSF will be bound by a series of embankments, namely the Main Dam D, the Main Dam C, and the West Dam. An environmental control dam (ECD) and interception trenches serve to capture seepage downstream of the facility.

6.1 Tailings Storage Facility

6.1.1 Tailings

Whole ore leach tailings are expected to be PAG with relatively short lag times of up to one year to ARD. Therefore, the operational tailings management plan is to cover any unsaturated tailings beaches with fresh tailings within one year of tailings deposition. This will likely require relatively frequent adjustment of tailings lines and spigots.

At closure, any permanently exposed tailings beaches will be covered with a till/overburden layer to shed meteoric water and limit oxygen ingress into the uppermost tailings layer.

6.1.2 Waste Rock and Overburden

Waste rock management will occur based on environmental class (i.e., PAG1, PAG2, NAG3, NAG4, NAG5) of a mining block defined through pre-mine characterization and validated through operational monitoring. A flow chart showing the decision-making sequence with respect to waste rock is given in Figure 6.1-1.

All PAG1, PAG2, and NAG3 waste rock will be stored under saturated conditions in the TSF in the long-term. Specifically, PAG1 and PAG2 waste rock will be stored in the TSF which will ultimately be submerged by tailings slurry. Waste rock will be submerged as quickly as the mine schedule allows, with a maximum exposure period of one year. The expected exposure periods are shown in Table 6.1-1. Based on the results from the kinetic test program (AMEC, 2014), it is expected that ARD may develop locally in PAG domains within the TSF basin before flooding is achieved. This scenario is accounted for in the source term and water quality model.

NAG3 waste rock will be used in construction of the TSF dams or otherwise stored in the TSF and submerged within five years of mining to reduce metal leaching. NAG4 and NAG5 material will be used in the construction of unsaturated and downstream portions of the TSF embankments.

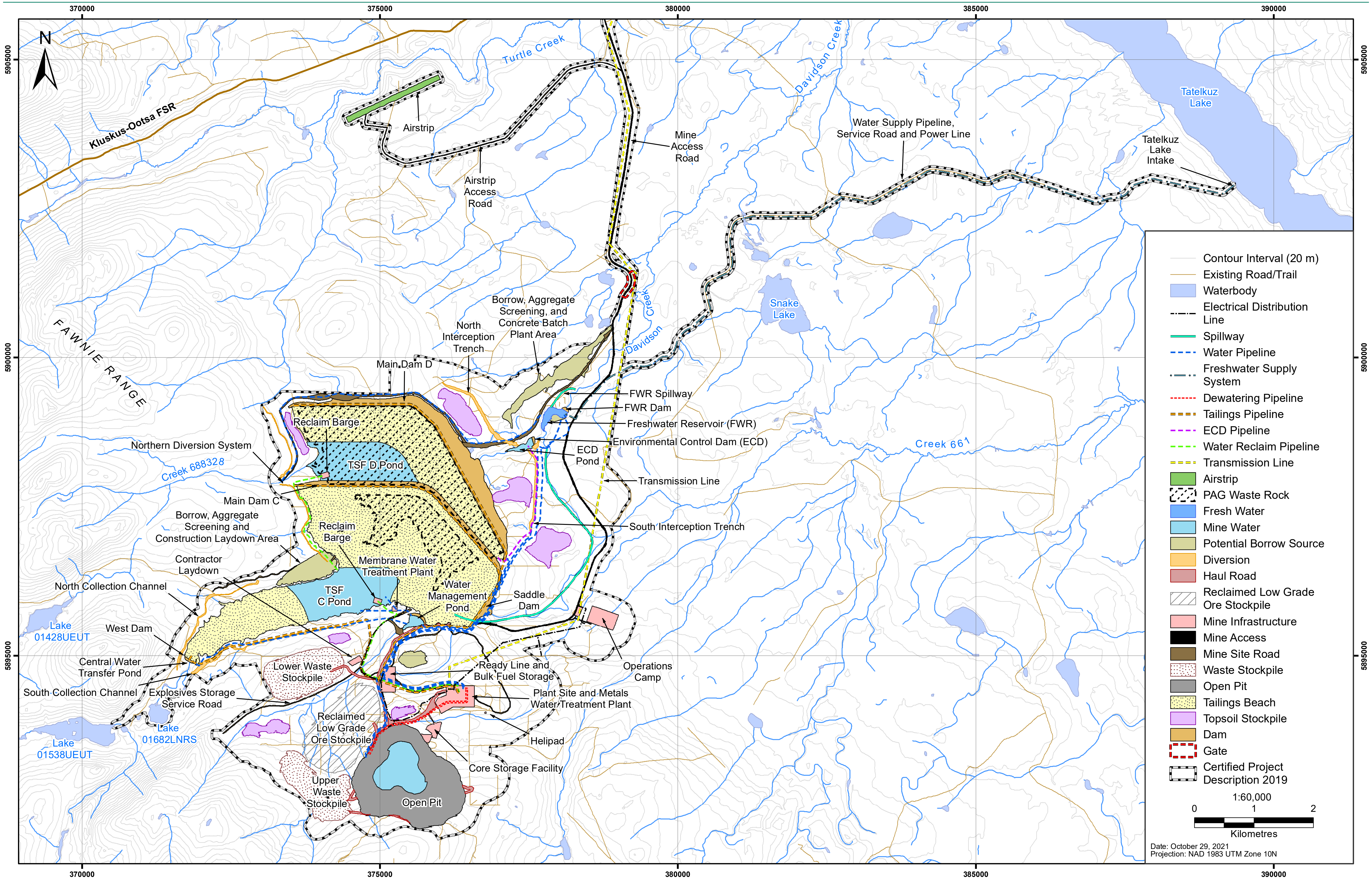
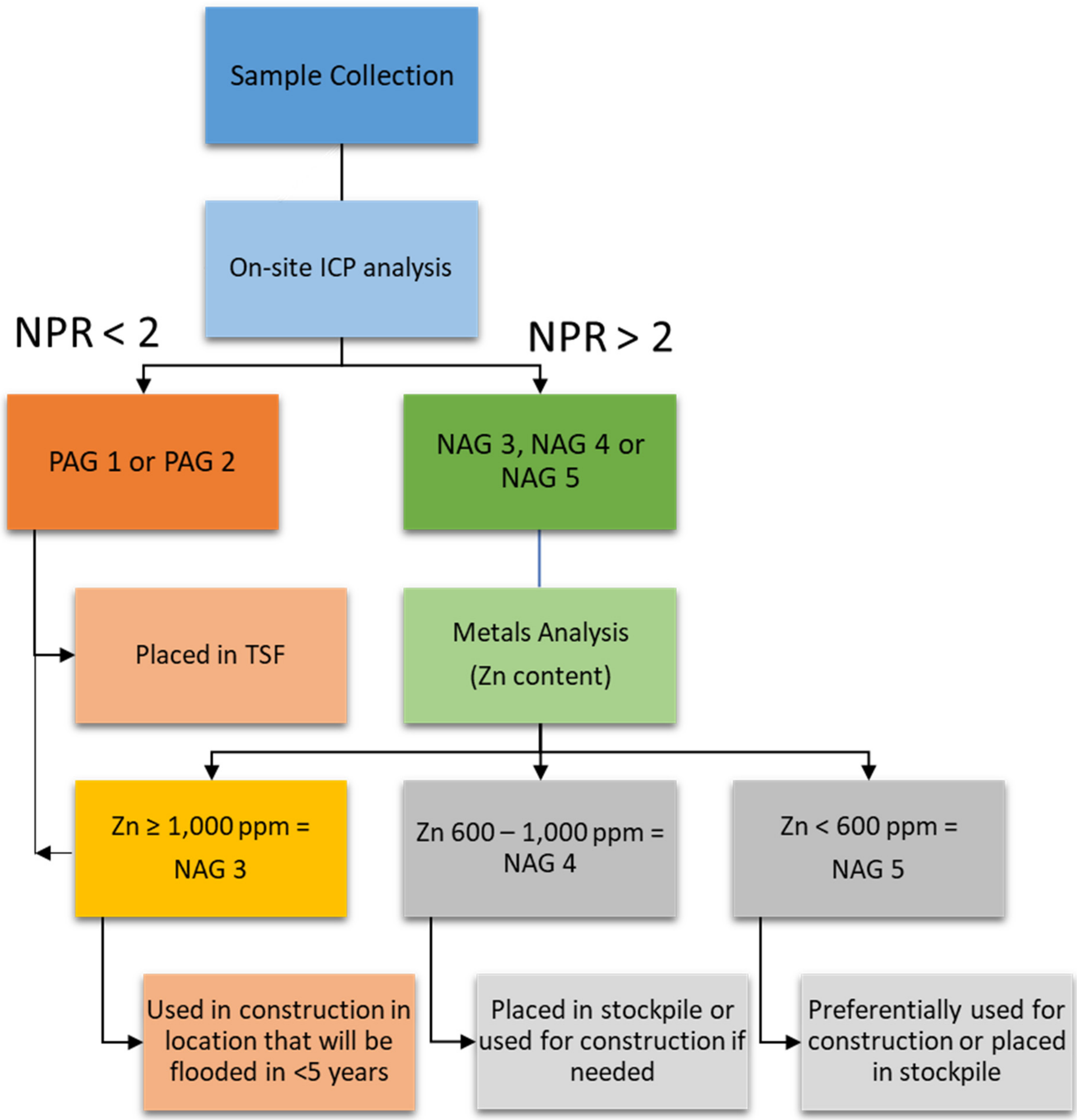


Figure 6-1: General Arrangement of the Blackwater Project at Year +23



PAG = Potentially Acid Generating; NAG = Non-Acid Generating.

Figure 6.1-1: Flow Chart Illustrating the Decision Sequence and ML/ARD Management Strategies that will be Employed for Waste Rock and Overburden

The vast majority of overburden across the project site is expected to be NAG with low ML potential. Overburden will be required for the construction of TSF embankments. Management of overburden material that is either PAG and/or has a solid-phase Zn content ≥1,000 ppm will mirror that of waste rock as illustrated in Figure 6.1-1. The volume of overburden requiring active management is expected to be minor and limited to zones near the bedrock contact.

Table 6.1-1: Months of Exposure Prior to Submergence of PAG Rock Stored in TSFC and TSFD

Year	Estimated Months of Exposure	
	TSF C	TSF D
-2	<1	-
-1	<1	-
1	1	-
2	3	-
3	6	-
4	12	-
5	12	-
6	12	<1
7	-	3
8	-	3
9	-	3
10	-	3
11	-	3
12	-	3
13	-	3
14	-	3
15	-	3
16	-	3
17	-	3
18	-	-

6.2 Upper and Lower Waste Stockpiles

Excess NAG overburden as well as NAG4 and NAG5 waste rock that is not being used for construction purposes will be deposited in surface (i.e., unsaturated) stockpiles located north (Lower Waste stockpile) and west (Upper Waste stockpile) of the open pit.

As an additional layer of conservatism, NAG5 material should be prioritized in the construction of infrastructure where possible, in particular near water courses. At closure, all permanent stockpiles will be covered with a minimum of 30 cm of overburden and revegetated for reclamation purposes to reduce water ingress into these facilities.

6.3 Ore Stockpiles

The ore stockpile (i.e., lower- and higher-grade ore) will be built over a compacted, low-permeability foundation with a geosynthetic liner. Drainage from these stockpiles is expected to be acidic and contain elevated concentrations of sulphate and metals shortly after exposure. When acidification of drainage is observed, water will be neutralized before being discharged into the TSF.

Ore material that is classified as direct mill feed will be stored on a ROM ore pad temporarily. To reduce the risk of acid generation from this pad and minimize geochemical loads reporting to the water management system, any direct mill feed material will be processed within six months of mining.

6.4 Open Pit

At the end of mining operations, surplus TSF water will be pumped to the open pit to accelerate pit filling. This has the effect of flooding exposed PAG rock more rapidly and thereby inhibiting further sulphide oxidation occurring within the pit walls.

6.5 Other Infrastructure

Infrastructure such as road alignments, construction pads, and laydown areas are part of the operational mine site layout and will be constructed with excess waste rock and/or borrow source material. To prevent ML/ARD release from construction sites that contain waste rock fill, only NAG4 and NAG5 material will be used for unsaturated construction locations across the mine site.

7. MINE WASTE MONITORING

The overarching objective of the ML/ARD monitoring program is to generate a high density of representative waste rock, ore, overburden and tailings samples to enhance the current (pre-mining) geochemical databases and confirm environmentally-relevant material classes and tonnages.
Data generated during this program will guide ML/ARD management strategies that are communicated directly to mine operations. The monitoring program described herein will be conducted at the mine site using an onsite laboratory operated by an accredited contractor. QA/QC measures will be implemented on a subset of samples using an external (offsite) laboratory.

7.1 Solid Phase Monitoring

In this section, sample collection methods and sampling frequency of geologic materials are described. Standard operating procedures (SOP) describing in detail the various tasks and responsibilities of the monitoring program are appended to this plan. An overview of the required sample frequency for the different material types is given in Table 7.1-1.

Table 7.1-1: Sampling Frequency for the Different Material Types during Operational Monitoring

Sample Type	Sampling Frequency
Waste rock/ore	1 sample per 50,000 t
Tailings/Supernatant	5 samples per quarter
Overburden	1 sample per 25,000 m^3
Verification (Waste Stockpiles and Tailings Beach)	Waste stockpiles: 1 sample per 200,000 t Tailings: Opportunistically when access allows
QA/QC	1 duplicate per 10 samples

7.1.1 Waste Rock and Ore

Waste rock and ore will be monitored by collecting either blast hole or grade control drill cuttings from within the mine pit with subsequent analysis at the onsite laboratory. Grade control sampling is preferable since geochemical data would be produced well before material movement allowing for more flexibility with respect to integration into the geological block model and mine planning. However, it is understood that grade control sampling will on occasion not adequately cover waste rock blocks and therefore, blast hole sampling will need to be employed as needed. The overall sampling frequency will be a minimum of one (1) sample per 50,000 tonnes of material blasted. This frequency shall be achieved via the combined blast hole and grade control sampling monitoring programs.

Geochemical data obtained from grade control monitoring will be incorporated in the mine plan ahead of mining together with other assay data. The Mine Geologist will use geostatistical models to predict metal distribution and determine appropriate dig lines for NAG / PAG blocks at the same time as doing grade outlines for the production crew. Outlines will be uploaded to a high precision GPS unit on the excavator and/or clearly marked with wooden stakes on the ground. After blasting, every truck load will be tracked with tracking sheets or electronic material tracking software recording both origin and destination of each load of material. Analytical results will be recorded within a database such that the sample can be correlated with the geologic model for the Project.

Boundaries of environmental waste rock classes predicted by the block model will be avoided during a given blast where possible. If avoidance is not feasible, a higher resolution of blast hole samples representing unique ARD units will be collected and submitted for analysis separately. SOPs for waste rock and ore blast hole and grade control sampling for the purpose of ML/ARD characterization are provided in Appendices A and B, respectively.

7.1.2 Tailings

The tailings slurry will be sampled at a frequency of five (5) samples per quarter. The slurry will be filtered and the tailings solids will be submitted for analysis at the onsite laboratory. Supernatant (process water) associated with the tailings slurry should undergo water analysis at the same frequency. The parameter list for supernatant samples is consistent with the standard parameters required as part of the Mine Water and Discharge Management and Monitoring Plan (Application Section 9.6). Given the mine life of 23 years over which tailings production will occur, this sample frequency will result in approximately 460 tailings solid and supernatant samples collected in total. An SOP for tailings sampling is provided in Appendix C.

7.1.3 Overburden

Inorganic overburden will be monitored by collecting composite samples from test pits or active excavation areas as it is being excavated. One (1) composite overburden sample is to be collected for every 25,000 m^3 of material disturbed and analyzed at the onsite laboratory. A minimum of two well-spaced samples collected from each distinct Project component (e.g., plant site) where excavation of overburden amounts to <50,000 m^3. An SOP for overburden sampling is provided in Appendix D.

7.1.4 Verification Monitoring

A verification monitoring program will be initiated for selected mine components to confirm NAG identification and segregation practices as well as to validate assumptions made in support of geochemical source term development. This supplementary monitoring program will apply to:

1. Waste rock deposited in the Upper and Lower Waste Stockpiles; and
2. Tailings exposed under unsaturated conditions on TSF beaches for ≥ 1 year.

The waste rock verification monitoring program will be implemented at a sampling frequency of one (1) sample per 200,000 t of waste rock stored in either of the two waste facilities. The samples will be collected *in situ* from the Upper and Lower Waste Stockpiles.

Verification monitoring of the TSF beaches will be carried out opportunistically when safe access to beached tailings allows. An SOP describing the verification monitoring program in detail is provided in Appendix E.

7.1.5 QA/QC Sampling

In order to maintain quality assurance and quality control (QA/QC) of monitoring data, duplicate samples will be collected and submitted to an offsite analytical laboratory. One (1) QA/QC sample will be taken for every 10 samples. QA/QC sampling will be conducted across all material types and the sample collection procedure of all duplicates should be identical to that of the primary samples as outlined in the respective SOPs.

7.1.6 Analytical Techniques

A variety of static testwork will be conducted as part of the ML/ARD monitoring program. A basic suite of geochemical parameters comprising ICP ML/ARD proxies will be determined as part of the routine monitoring program at the onsite laboratory. In accordance with the assessment conducted by AMEC

(2014), proxy analyses required for the reliable determination of the different environmental material classes (e.g., PAG 1, NAG4, etc. op) are as follows:

- Aqua regia digestible elemental scan

Using aqua regia digestible S (proxy for AP), Ca (proxy for NP), and Zn (metal leaching criteria), the environmental designation can be derived in the same manner as was done for the block model development. Aqua regia digestible elemental analysis with ICP-finish will be conducted at the onsite laboratory.

Since the above parameters are merely ABA surrogates to quantify NP and AP for the calculation of NPR, the QA/QC samples described in Section 7.1.5 should additionally undergo a more comprehensive analytical suite at an external laboratory comprising:

- Total S;
- Sulphate S by HCl digestion;
- Modified NP;
- Net Acid Generation Test; and
- Aqua regia digestible elemental scan.

Further, laboratory QA/QC procedures (e.g., analysis of standard reference materials and internal duplicates) will apply to ensure analytical precision and replicability.

7.2 Contingency Measures

Several contingency measures were established to manage and mitigate potential ML/ARD risk associated with Project's geological materials. These are summarized in Table 7.2-1.

Table 7.2-1: Overview of Potential ML/ARD Contingency Measures

Condition	Contingency Measure
Higher than expected PAG or NAG3 proportion	▪ Adjustment of assay proxies
	▪ Redefinition of block model using ML/ARD monitoring results
	▪ Re-design of PAG storage facilities in TSF/ Adjustment of mine plan
	▪ Revisit source term assumptions and water quality models
Misplaced PAG or NAG3 material	▪ Delineation of misplaced PAG zones
	▪ Rehandling of PAG and NAG3 material as necessary
	▪ Quantify effect on source term and water quality models
	▪ Adjust water management and/or treatment capacities
Failure to submerge PAG or NAG3 rock within prescribed time frame in TSF	▪ Increase water quality monitoring frequency at location of interest to assess pH stability
	▪ Optimize tailings spigot placement to ensure unsaturated beaches are not exposed >1 year
	▪ Adjust water management/sourcing to accelerate flooding of PAG and NAG3 materials
	▪ Add lime to tailings ponds or tailings discharge line to stabilize decreasing pH as necessary

Adaptive management and trigger response measures related to geochemical results in contact water, such as higher than predicted metal concentrations or development of acidic pH conditions in the TSF or other site water management ponds, are further addressed in the Mine Water and Discharge Management and Monitoring Plan (Application Section 9.6). Water management and monitoring components described in that plan are intended to form the foundation of a detailed Trigger Response Plan that will be developed prior to the Operations phase.

8. IMPLEMENTATION AND REPORTING

8.1 Communication and Operational Protocols

The Environmental Manager (EM) is responsible for the implementation of the ML/ARD Monitoring program. The EM or designate is responsible for coordinating sampling and will arrange for sampling support by qualified Environmental Monitors. SOPs for each part of the ML/ARD Monitoring program are included as Appendices A through E. Currently, the staffing and associated organizational structure for aspects relating to operational management have not been formalized. Once these components are finalized, more detail with respect to communication protocols can be provided as necessary.

8.2 Record Keeping and Tracking

Field results will be recorded when taken, and onsite and external lab test results will be transferred electronically into a database. The Environmental Superintendent or designate will be responsible to ensure the maintenance of the original records and database. Parameters of concern will also be tracked graphically and reviewed periodically to identify trends.

Investigations and corrective action will be undertaken if monitoring data indicate that observed geochemical characteristics are significantly different than expected based on geochemical characterization testwork conducted to date.

8.3 Reporting

Results of the ML/ARD monitoring program will be reviewed and summarized in external reports as needed. This is anticipated to include an annual report at a minimum. Should adaptive management or trigger response be required throughout the life of mine, adaptive management strategies, rationales and associated monitoring results will be described in standalone memoranda.

9. PLAN REVISION

This Plan is a 'living document' and components of the plan may be reviewed over the life of the Project. This Plan will be reviewed annually as part of reporting. Any revisions will be implemented following review by stakeholders and an opportunity for response by BW Gold.

BW Gold will conduct an annual (or as necessary) evaluation of the efficacy of mitigation and monitoring activities. This Plan may be updated as frequently as every year, or not at all, if the mitigation and monitoring measures are found to be robust.

10. QUALIFIED PROFESSIONALS

Note: This QP signoff form may be replaced by the Professional Reliance forms and moved to the front of the Management Plan

Under the direction of Lorax, this management plan has been prepared and reviewed by, or under the direct supervision of, the following qualified professionals:

Prepared by:

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11. REFERENCES

AMEC (2014). *Blackwater Gold Project - 2013 Geochemical Characterization Report*. Technical Report prepared for New Gold Inc. in September 2014.

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APPENDIX A STANDARD OPERATING PROCEDURE – WASTE ROCK AND ORE BLAST HOLE MONITORING

Appendix A: Standard Operating Procedure – Waste Rock and Ore Blast Hole Monitoring

OBJECTIVE

The geochemical properties of waste rock and ore will be monitored by the collection of blast hole and/or grade control drill cuttings within the mine pit. The objective of this Standard Operating Procedure (SOP) is to provide BW Gold Ltd. personnel for the collection and preparation of mine rock (blast hole) samples for the Blackwater Gold Project (the Project). The sampling protocol described in this SOP is intended to ensure that blast hole sample collection and preparation methodology supports accurate and representative geochemical characterization of waste rock and ore material encountered during mining. This SOP follows the general requirements outlined in the Metal Leaching and Acid Rock Drainage (ML/ARD) Management Plan. Operational monitoring results will be used to validate pre-mine ML/ARD characterization data and associated geochemical source term model assumptions.

SCOPE

This SOP describes activities related to the operational ML/ARD monitoring of mine rock through the mine life of the Project and covers the following tasks:

- Sample selection and collection protocols.
- Sample shipping and handling details.
- Select laboratory analyses and procedures.
- Quality assurance and quality control (QA/QC) requirements.
- Communications with analytical laboratories.
- Documentation of results.

DEFINITIONS

ABA: Acid-Base Accounting

ML/ARD: Metal Leaching and Acid Rock Drainage

NAG: Non-Acid Generating

PAG: Potentially Acid Generating

PPE: Personal Protective Equipment, including hardhat, steel toed boots and safety glasses

QA/QC: Quality Assurance and Quality Control

COC: Chain of Custody

PREPARATION*

The work covered by this SOP will be performed by responsible mine personnel following BW Gold's Health and Safety policies and procedures including the use of personal protective equipment (PPE), following safe work practices/procedures, and completing assessment of hazards and controls. Mine personnel implementing this SOP must be aware of potential hazards that include but are not limited to the following:

- **Hazards**:
  - Slips, trips and falls.
  - Working near heavy mobile and stationary equipment.
  - Working in areas where explosives are being utilized.
  - Potential for unstable and unsafe pit walls.

The following training is required for personnel implementing this SOP:

- **Training**:
  - Knowledge of sampling protocols.
  - SOP review and signed acknowledgement.
  - Trained and qualified to work around heavy mobile and stationary equipment. Working in areas where explosives are being utilized.
  - Knowledge of mine rock geology.

This SOP requires the following equipment and supplies:

- **Equipment**:
  - Standard Personal Protective Equipment (PPE).
  - Soil sampling probe or small metal hand scoop.
  - Flagging tape and/or marking paint.
  - Field book.
  - Plastic heavy-duty sample bags with zip ties.
  - Camera.
  - GPS.
  - Map of blast hole pattern for making notes and comments.

**Note that the components listed do not reflect the laboratory equipment and training requirements for the execution of the on-site geochemical analyses.*

IMPLEMENTATION

The Mine Geology Department will collect blast hole samples based on a predefined sample plan which ensures a proper sample distribution over the whole deposit with a minimum of one (1) sample per 50,000 tonnes of waste rock material mined. This frequency shall be achieved via the combined blast hole and GC sampling monitoring programs.

Prior to each blast, blast holes are drilled on a grid to distribute explosives throughout the rock volume. During blast hole drilling, air is used to clear cuttings away from the drill bit which are returned to surface and deposited in a conical pile next to the blast hole. Drill cuttings are ideal for blast material sampling since they provide representative fine-grained material from the entire volume to be blasted.

TASKS

Preparation

Person Responsible

- Sample tags are generated before sampling for every sample to be collected in the field. Samples are assigned unique sample IDs assigned to the blast ID number and adherence to mine geology GIS requirements. Records of which blast holes are represented by each sample are retained by the Mine Geologist.

- Mine Geologist / Technician

Sample Selection

- The selection of blast holes for composite sampling will be based on the mine geologist's interpretation of geology and the requirement to collect samples that are representative of mine rock lithology, identifiable rock units, mineralogy, ore grade, and other relevant rock/structural characteristics.

Sample Collection

- Once drilling of the blast pattern is completed, a member of the Mine Geology Department (qualified technician and/or geologist) will collect the samples from the selected blast holes.
- The drill cuttings from each drill hole will be deposited around the circular open hole. To collect a representative sample from the blast hole cuttings pile:
  - Divide the conically shaped cuttings pile into four quadrants and drive the sampling probe or scoop at a downward angle at approximately ½ the height of the pile.
  - If using a soil probe: Once the probe is removed from the pile, lay the probe horizontally to prevent the sample from sliding out of the sampling chamber, then place the sample in a sample bag.
  - Repeat steps for the remaining three quadrants, ensuring that the locations in each quadrant are replicated and equal amounts are extracted.

  Repeat this at least once for each blast hole cuttings pile to be sampled and combine for the blast hole cuttings samples from a given blast and / or waste rock unit into one ML/ARD monitoring composite sample. This process should yield a minimum of 2 kg of composite sample to be submitted for geochemical testing.
- Place a sample tag into the sample bag. Record the sample tag number along with sample characteristics any observations associated with the sample taken. At a minimum, record the following information with each sample:
  - Blast ID, Material Classification and approximate quantity.
  - Location of selected blast holes (for sampling).
  - Sample ID and date.
  - Grade (i.e., ore versus waste).
  - Approximate tonnage of the blast represented by the composite sample.

  - Location within pit on map or as coordinates.
  - Any observations (e.g., Fe-staining, geological and structural features, etc.).
- Seal the sample bag with a zip tie and prepare for delivery to the on-site laboratory for the analysis of: 1) aqua regia digestible metals; and 2) total sulphur via LECO furnace methods. It is the technician's responsibility to give clear delivery instructions if the sample is not delivered personally.

QA/QC Sample Collection

- Collect a minimum of one (1) field duplicate sample for every 10 samples and send to an accredited external laboratory (i.e., 10% duplication). This number may be reduced once sufficient confidence is achieved for the on-site laboratory analysis.
- Collect the field duplicate sample in the same manner as the primary sample. Ideally, the duplicate is a split of the test sample; whereby a larger sample amounting of at least 4 kg is collected from the blast hole cuttings composite, from which the duplicate is sub-sampled. Cone and quartering should be employed such that a homogenous split is achieved.
- Place the duplicate in a separate sample bag with a unique sample ID tag. The duplicate sample ID tag and location must be recorded in the notes.

Analytical Parameters

- Send all regular monitoring samples to the on-site laboratory for the analysis of aqua regia digestible metals and total sulphur via LECO furnace methods.
- Submit QA/QC (duplicate) samples to an accredited laboratory for the full suite of ABA analyses and solid phase element determination by aqua regia digestion. The full list of parameters to be measured shall be included on the laboratory COC and includes the following parameters:
  - Total S (LECO) and sulphate S (by HCl digestion).
  - Total inorganic carbon.
  - Modified neutralization potential (NP).
  - Net Acid Generation test.
  - Aqua regia digestible metals.
- Ship a completed COC form with the QA/QC samples to the external laboratory and an electronic version sent via e-mail to a Qualified Person (QP) for geochemistry and to the accredited laboratory.

DATA ANALYSIS AND RECORD KEEPING

All background information collected during sample collection as outlined above shall be digitized in an appropriate database. ML/ARD monitoring data will be compiled, linked with the background information, and evaluated by the Chief Geologist, or their designate and reviewed by the Environmental Manager or designate with the help of a QP for geochemistry as needed. The definition of the environmental class (e.g., PAG1, NAG4, etc.) to inform ML/ARD management strategies will be based on analytical surrogates derived for aqua regia digestible metals results as described in the ML/ARD Management Plan.
External analytical results of the QA/QC (duplicate) samples will serve the confirmation of the on-site laboratory performance as well as the ongoing validation of the surrogate accuracy. These datasets are to be merged with the master ML/ARD monitoring database as they become available.

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July 30, 2021	Initial Version		Lorax Environmental Services Ltd.
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September 20, 2021	Revision of sampling frequency	Page 2	Lorax Environmental Services Ltd.

APPENDIX B STANDARD OPERATING PROCEDURE – WASTE ROCK AND ORE GRADE CONTROL MONITORING

Appendix B: Standard Operating Procedure – Waste Rock and Ore Grade Control Monitoring

OBJECTIVE

The geochemical properties of waste rock and ore will be monitored by the collection of blast hole and/or grade control (GC) drill cuttings within the mine pit. The objective of this Standard Operating Procedure (SOP) is to provide BW Gold Ltd. personnel for the collection and preparation of mine rock (grade control) samples for the Blackwater Gold Project (the Project). The sampling protocol described in this SOP is intended to ensure that Grade Control sample collection and preparation methodology supports accurate and representative geochemical characterization of waste and ore encountered during mining. This SOP follows the general requirements outlined in the Metal Leaching and Acid Rock Drainage (ML/ARD) Management Plan. Operational monitoring results will be used to validate pre-mine ML/ARD characterization data and associated geochemical source term model assumptions.

SCOPE

This SOP describes activities related to the operational ML/ARD monitoring of mine rock through the mine life of the Project and covers the following tasks:

- Sample selection and collection protocols.
- Sample shipping and handling details.
- Select laboratory analyses and procedures.
- Quality assurance and quality control (QA/QC) requirements.
- Communications with analytical laboratories.
- Documentation of results.

DEFINITIONS

ABA: Acid-Base Accounting

ML/ARD: Metal Leaching and Acid Rock Drainage

NAG: Non-Acid Generating

PAG: Potentially Acid Generating

PPE: Personal Protective Equipment, including hardhat, steel toed boots and safety glasses

QA/QC: Quality Assurance and Quality Control

GC: Grade Control

RC: Reverse Circulation

COC: Chain of Custody

PREPARATION*

The work covered by this SOP will be performed by responsible mine personnel following BW Gold's Health and Safety policies and procedures including the use of personal protective equipment (PPE), following safe work practices/procedures, and completing assessment of hazards and controls. Mine personnel implementing this SOP must be aware of potential hazards that include but are not limited to the following:

- **Hazards**:
  - Slips, trips and falls.
  - Working near heavy mobile and stationary equipment.
  - Working in areas where explosives are being utilized.
  - Potential for unstable and unsafe pit walls.

The following training is required for personnel implementing this SOP:

- **Training**:
  - Knowledge of sampling protocols.
  - SOP review and signed acknowledgement.
  - Trained and qualified to work around heavy mobile and stationary equipment. Working in areas where explosives are being utilized.
  - Knowledge of mine rock geology.

This SOP requires the following equipment and supplies:

- **Equipment**:
  - Standard Personal Protective Equipment (PPE).
  - Respiratory protection.
  - Flagging tape and/or marking paint.
  - Field book.
  - Plastic heavy-duty sample bags with zip ties.
  - Camera.
  - GPS.
  - Map of GC pattern for making notes and comments.

**Note that the components listed do not reflect the laboratory equipment and training requirements for the execution of the on-site geochemical analyses.*

IMPLEMENTATION

The Mine Geology Department will collect GC samples based on a predefined sample plan which ensures a proper sample distribution over the whole deposit with a minimum of one (1) sample per 50,000 tonnes of waste rock material mined. The sample distribution will allow the Mine Geologists to create an accurate geostatistical model for metals distribution and NAG/PAG waste rock classification. This frequency shall be achieved via the combined blast hole and GC sampling monitoring programs.

All samples should be mapped and recorded within a database for their location such that the sample can be correlated with the geologic model for the Project.

Prior to mining the orebody, a significant portion of waste rock is being drilled and sampled using a Reverse Circulation (RC) Grade Control rig. During RC drilling, which covers several mining benches prior to mining, air is injected in the outer double walled drill string to clear away cuttings from the drill head and sucked through the inner tube of the drill string into a cyclone and splitting apparatus. These drill cuttings are ideal for sampling as no contamination can occur and the splitting apparatus allows for precise sample splits. Duplicate or triplicate samples can be collected as required for any interval through the splitting apparatus, ensuring best possible sample QA/QC.

TASKS

Preparation	**Person Responsible**
■ Sample tags are generated before sampling for every sample to be collected in the field. Samples are assigned unique sample IDs assigned to the borehole ID number and adherence to mine geology GIS requirements. Records of GC holes that are represented by each sample are retained by the Mine Geologists.	■ Mine Geologist / Technician

Sample Selection

- The selection of GC sampling will be based on the mine geologist’s interpretation of geology and the requirement to collect samples that are representative of mine rock lithology, identifiable rock units, ore grade, and other relevant rock/structural characteristics.

Sample Collection

- The samples will be collected by a member of the Mine Geology Department (qualified technician and/or geologist) during the GC program from the splitting apparatus.
- A sample bag will be placed beneath the sampling chute and a predetermined percentage split of the whole sample will be collected ensuring a minimum sample size of 2kg over the required sample interval.
- Place a sample tag into the sample bag. Record the sample tag number along with any observations associated with the sample taken. At a minimum, record the following information with each sample:
  - Hole ID, depth from and depth to, material classification and approximate quantity.
  - Sample ID and date.
  - Location within pit on map or as coordinates.
  - Any observations (e.g., Fe-staining, geological and structural features).
- Seal the sample bag with a zip tie and prepare for delivery to the on-site laboratory for the analysis of: 1) aqua regia digestible metals; and 2) total sulphur via LECO furnace methods. It is the technician’s responsibility to give clear delivery instructions if the sample is not delivered personally.

QA/QC Sample Collection

- Collect a minimum of one (1) field duplicate samples for every 10 samples and send to an accredited external laboratory (i.e., 10% duplication). This number may be reduced once sufficient confidence is achieved for the on-site laboratory analysis.
- Collect the field duplicate sample in the same manner as the primary sample. Ideally, the duplicate is a split of the test sample; whereby a larger sample amounting of at least 4 kg is collected from the GC cuttings, from which the duplicate is sub-sampled with a Jones riffle splitter.
- Place the duplicate in a separate sample bag with a unique sample ID tag. The duplicate sample ID tag and location must be recorded in the notes.

Analytical Parameters

- Send all regular monitoring samples to the on-site laboratory for the analysis of aqua regia digestible metals and total sulphur via LECO furnace methods.
- Submit QA/QC (duplicate) samples to an accredited laboratory for the full suite of ABA analyses and solid phase element determination by aqua regia digestion. The full list of parameters to be measured shall be included on the COC and includes the following parameters:
  - Total S (LECO) and sulphate S (by HCl digestion).
  - Total inorganic carbon.
  - Modified neutralization potential (NP).
  - Net Acid Generation test.
  - Aqua regia digestible metals.
- Ship a completed COC form with the QA/QC samples to the external laboratory and an electronic version sent via e-mail to a Qualified Person (QP) for geochemistry and to the accredited laboratory.

DATA ANALYSIS AND RECORD KEEPING

All background information collected during sample collection as outlined above shall be digitized in an appropriate database. ML/ARD monitoring data will be compiled, linked with the background information, and evaluated by the Chief Geologist, or their designate and reviewed by the Environmental Manager or designate with the help of a QP for geochemistry as needed. The definition of the environmental class (e.g., PAG1, NAG4, etc.) to inform ML/ARD management strategies will be based on analytical surrogates derived for aqua regia digestible metals results as described in the ML/ARD Management Plan. External analytical results of the QA/QC (duplicate) samples will serve the confirmation of the on-site laboratory performance as well as the ongoing validation of the surrogate accuracy. These datasets are to be merged with the master ML/ARD monitoring database as they become available.

REVISION CONTROL SHEET

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September 13, 2021	Initial Version		Klaus Popelka, Artemis Gold Inc.
September 20, 2021	Revision of sampling frequency	Page 2	Lorax Environmental Services Ltd.

APPENDIX C STANDARD OPERATING PROCEDURE – TAILINGS MONITORING

Appendix C: Standard Operating Procedure – Tailings Monitoring

OBJECTIVE

Tailings monitoring is conducted to track the geochemical properties over time, and validate pre-mine ML/ARD characterization data and associated geochemical source term model assumptions The objective of this Standard Operating Procedure (SOP) is to provide guidance for BW Gold Ltd. mine personnel for the collection and preparation of tailings solids and supernatant samples from slurry for the Blackwater Gold Project (the Project). The sampling protocols described in this SOP are intended to ensure that the tailings solids and associated process water collection and preparation methodologies support the accurate and representative geochemical characterization of these materials and follows general requirements outlined in the Metal Leaching and Acid Rock Drainage (ML/ARD) Management Plan.

SCOPE

This SOP describes activities related to the operational ML/ARD monitoring of tailings produced through the mine life of the Project and covers the following tasks:

- Sample selection and collection protocols.
- Sample shipping and handling details.
- Select laboratory analyses and procedures.
- Quality assurance and quality control (QA/QC) requirements.
- Communications with the analytical laboratories.
- Documentation of results.

DEFINITIONS

ABA: Acid-Base Accounting

ML/ARD: Metal Leaching and Acid Rock Drainage

NAG: Non-Acid Generating

PAG: Potentially Acid Generating

PPE: Personal Protective Equipment, including hardhat, steel toed boots and safety glasses

QA/QC: Quality Assurance and Quality Control

PREPARATION*

The work covered by this SOP will be performed by responsible mine personnel following BW Gold's Health and Safety policies and procedures including the use of personal protective equipment (PPE), following safe work practices/procedures, and completing assessment of hazards and controls. Mine personnel implementing this SOP must be aware of potential hazards that include but are not limited to the following:

- **Hazards**:
  - Slips, trips and falls.
  - Working near heavy mobile and stationary equipment.
  - Working near hazardous chemicals.
  - Working near energized and pressurized equipment, pipelines and vessels.

The following training is required to carry out this SOP:

- **Training**:
  - Trained and qualified to conduct tailings solids sampling.
  - Trained and qualified to conduct water (supernatant) sampling.
  - Knowledge of tailings sampling protocols, including SOP review and signoff.
  - Mill orientation or escort by mill personnel.
  - Workplace Hazardous Materials Information System (WHMIS) training.

This SOP requires the following equipment and supplies:

- **Equipment**:
  - Field book.
  - Standard PPE plus any additional PPE required based on hazard assessment.
  - Sample bag(s).
  - Zip ties.
  - 5-gallon pail.
  - Mixing drill.
  - Filter paper.
  - Buchner funnel and vacuum pump.
  - Water sampling supplies.*

** Upon decanting, supernatant (process water) sampling shall be similar to sampling procedures for operational water quality monitoring. Therefore, the equipment list and detailed procedural steps are not presented as part of this SOP.*

IMPLEMENTATION

The ML/ARD Management Plan requires tailings sampling to be conducted at a minimum frequency of five (5) samples per quarter whenever a tailings slurry is being produced. All samples are to be linked, to the extent possible, with the corresponding ore grade, major lithological make-up of the ore, as well as mill reagents and CN-detoxification additives utilized during the time period when the tailings slurry sample is collected.

TASKS

Note: The following describes the procedure to separate the liquid and solid phases of the tailings slurry as well as the sampling protocol for the tailings solids. Please refer to the Mine Water and Discharge Management and Monitoring Plan for a description of the water sampling procedure.

Preparation	**Person Responsible**
■ Sample tags for tailings solids are generated before sampling for every sample to be collected in the field. Samples are assigned unique sample IDs. The development of the sample ID methodology is still in progress but will likely include identifiers such as a specific prefix (e.g., “TS-“), a two-digit identifier for the calendar year, and a four-digit sequential numerical value unique to each tailings sample. ■ The nomenclature for supernatant samples should correspond to that of the tailings solids with the exception that the prefix should be different (e.g., “TL-“).	■ Environmental/ Mill Ops ■ Mill technician

Sample Collection

- Each tailings sample needs to be collected by a qualified technician.
- At a suitable location within the mill building, position a clean 5-gallon pail underneath tailings sampling port to be selected based on safety and quality assurance of the process sample. Ensure that the tailings sampling port is representative of material that has undergone CN-detoxification and is representative of the material to be discharged into the Tailings Storage Facility (TSF).
- Discharge approximately 4 L of tailings slurry into the pail. Seal the bucket with a cover and transport to suitable sample preparation location.
- Assemble the Buchner funnel of an appropriate size and connect the vacuum pump line to the funnel.
- Wet the filter paper using de-ionized (DI) water and place into the top of the funnel. Turn on the vacuum pump.
- Uncover the pail and homogenize the sample using the mixing drill. Lift the pail with the homogenized sample and pour the slurry into the funnel, ensuring that the sample does not overflow the funnel. To the extent possible, ensure that the entire homogenized slurry sample is poured into the funnel to prevent particle size or mineralogical segregation of the sample.
- Once all the solution has been filtered through the solids, turn the pump off and disconnect the vacuum hose from the funnel.

- **Note:** The filtrate can be used as the supernatant (process water) sample associated with the tailings slurry. Follow the prescribed water sampling procedure associated with water quality monitoring described under separate cover.
- Using the edges of the exposed filter paper, carefully lift the sample out of the funnel and place both the tailings solids sample and filter paper in a sample bag for submission.
- Place a sample tag into the sample bag. Seal the sample bag with a zip tie and prepare for delivery to the on-site laboratory for the analysis of aqua regia digestible metals. It is the technician's responsibility to give clear delivery instructions if the sample is not delivered personally.
- Record the sample tag number along with sample characteristics any observations associated with the sample taken. At a minimum, the information recorded with each sample should include:
    - Ore grade (i.e., low, medium, high).
    - Major lithologies represented by the tailings sample.
    - Reagent and CN-detox additive use associated with the sample.

QA/QC Sample Collection

- Collect a minimum of one (1) duplicate tailings sample for every ten (10) regular samples and send to an accredited external laboratory. At the minimum sampling frequency, this equates to two duplicate samples per year.
- Collect the duplicate (QA/QC) sample in the same manner as the primary sample. Ideally, the duplicate is a split of the test sample; whereby a larger sample amounting to approximately 8 L of tailings slurry is collected from which the duplicate is sub-sampled onto a separate filter paper. The Buchner funnel and filtrate collection container will need to be thoroughly cleaned between the collection of the primary and the duplicate sample.
- Place the duplicate sample in a separate sample bag with a unique sample ID tag.

Analytical Parameters

- Tailings Solids:
    - Send all regular tailings solids monitoring samples to the on-site laboratory for the analysis of aqua regia digestible metals and total sulphur via LECO furnace methods.
    - Submit all QA/QC (duplicate) samples to an accredited laboratory for the full suite of ABA analyses and solid phase element determination by aqua regia digestion. The full list of parameters to be measured shall be included on the COC and includes the following parameters:
    - Total S (LECO) and sulphate S (by HCl digestion).
    - Total inorganic carbon.
    - Modified neutralization potential (NP).

  - Net Acid Generation test.
  - Aqua regia digestible metals.
  - Ship a completed COC form with the QA/QC samples to the external laboratory and an electronic version sent via e-mail to a Qualified Person (QP) for geochemistry and to the accredited laboratory.
- Tailings Supernatant
  - Send all tailings supernatant monitoring samples to the external laboratory designated for all water quality monitoring analyses.
  - The water analytical suite will be similar to that of other water quality monitoring samples and should include, at a minimum:
    - Field pH and conductivity;
    - Anions (sulphate, Cl, F, Br);
    - Dissolved organic carbon;
    - Total dissolved phosphorous;
    - Nitrate, nitrite, ammonia;
    - Total CN, WAD CN, cyanate; and
    - Dissolved metals and metalloids.
    - Ship a completed COC form with the QA/QC samples to the external laboratory and an electronic version sent via e-mail to a Qualified Person (QP) for geochemistry and to the accredited laboratory.

DATA ANALYSIS AND RECORD KEEPING

All background information collected during sample collection as outlined above shall be digitized in an appropriate database. Tailings monitoring data will be compiled, linked with the background information, and evaluated by both the Environmental Manager and Metallurgy Superintendent or their designates with the help of a QP for geochemistry as needed. The definition of the environmental class (e.g., PAG1, NAG4, etc.) to inform ML/ARD management strategies will be based on analytical surrogates derived for aqua regia digestible metals results as described in the ML/ARD Management Plan. External analytical results of the QA/QC (duplicate) samples will serve the confirmation of the on-site laboratory performance as well as the ongoing validation of the surrogate accuracy. These data are to be merged with the master ML/ARD monitoring database as they become available. Supernatant water geochemical results will be compiled as part of the master water quality monitoring database.

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July 30, 2021	Initial Version		Lorax Environmental Services Ltd.
September 3, 2021	Revised based on Artemis review		Lorax Environmental Services Ltd.
September 10, 2021	Revised based on additional Artemis review		Lorax Environmental Services Ltd.

APPENDIX D STANDARD OPERATING PROCEDURE – OVERBURDEN MONITORING

Appendix D: Standard Operating Procedure – Overburden Monitoring

OBJECTIVE

Overburden materials monitoring is conducted to validate pre-mine ML/ARD characterization data and associated geochemical source term model assumptions. In addition, the understanding of overburden geochemistry is crucial for reclamation planning. The objective of this Standard Operating Procedure (SOP) is to provide guidance for BW Gold Ltd. personnel for the collection and preparation of overburden samples for the Blackwater Gold Project (the Project). The sampling protocols described in this SOP are intended to ensure that overburden sample collection and preparation methodology support accurate and representative geochemical characterization of overburden material encountered during site excavation activities. This SOP follows general requirements outlined in the Metal Leaching and Acid Rock Drainage (ML/ARD) Management Plan.

SCOPE

This SOP describes activities related to the operational ML/ARD monitoring of mine rock through the mine life of the Project and covers the following tasks:

- Sampling selection and collection protocols.
- Sample shipping and handling details.
- Select laboratory analyses and procedures.
- Quality assurance and quality control (QA/QC) requirements.
- Communications with the analytical laboratories.
- Documentation of results.

DEFINITIONS

ABA: Acid-Base Accounting

ML/ARD: Metal Leaching and Acid Rock Drainage

NAG: Non-Acid Generating

PAG: Potentially Acid Generating

PPE: Personal Protective Equipment, including hardhat, steel toed boots and safety glasses

QA/QC: Quality Assurance and Quality Control

PREPARATION*

The work covered by the SOP will be performed by responsible mine personnel following BW Gold's Health and Safety policies and procedures including the use of personal protective equipment (PPE), following safe work practices/procedures, and completing assessment of hazards and controls. Mine personnel implementing this SOP must be aware of potential hazards that include but are not limited to the following:

- **Hazards**:
  - Slips, trips and falls.
  - Working near heavy mobile and stationary equipment.

The following training is required for personnel implementing the activities outlined in this SOP:

- **Training**:
  - Knowledge of overburden sampling protocols.
  - Trained and qualified to conduct overburden sampling including SOP review and sign off.
  - Trained and qualified to work around heavy mobile and stationary equipment and in areas where explosives are used.
  - Knowledge of overburden geology.

This SOP requires the following equipment and supplies:

- **Equipment**:
  - Standard PPE.
  - Hand auger or trowel/shovel.
  - Flagging tape and/or marking paint.
  - Notebook.
  - Sample bag(s).
  - Zip ties.
  - Camera.
  - GPS.

** Note that the components listed do not reflect the laboratory equipment and training requirements for the execution of the on-site geochemical analyses.*

IMPLEMENTATION

The ML/ARD Management Plan requires overburden sampling to be conducted prior to and during excavation at a minimum sample frequency of one (1) sample per 25,000 m^3 of material disturbed. Where excavation of overburden amounts to less than 50,000 m^3 within a distinct Project area to be disturbed, a minimum of two well-spaced samples are to be collected. All samples should be mapped and recorded within a database such that the samples the spatial distribution of low- and high-risk overburden materials can be tracked. Overburden monitoring will ensure that appropriate material is being stockpiled in designated laydown areas and can be used for reclamation activities.

TASKS

Preparation

Person Responsible

- Sample tags are generated before sampling for every sample to be collected in the field. The tag identifies each sample with a unique identifier. Sample identifiers will be generated using the prefix "OB-", a two-digit identifier for the calendar year, and a four-digit numerical value starting with 0001 for the overburden sample.

- Mine Geologist/ Environmental Technician

Sample Collection

- Each overburden sample needs to be collected by a qualified technician and/or geologist. The sample taken should represent material that will be disturbed during construction and mining activities.
- Overburden samples will be collected prior to and during excavation of material as follows:
  - Prior: Test pits or transect samples from overburden area surface, after removal of surficial organic soil.
  - During: Composite samples from the deeper portions of the overburden cut that that are not reachable prior to excavation (e.g., near overburden bedrock interface).
- Pre-excavation: Collect monitoring samples from test pits or hand auger holes that are at least 0.5 m in depth unless bedrock is encountered at a shallower depth. Collect a minimum of four (4) sub-samples from an equivalent number of auger holes along a transect or along a test pit. The transect or test pit should have a minimum length of 10 m. Each sub-sample should comprise at least 1 kg of material.
- Excavation: Collect monitoring samples from active construction areas where overburden is being disturbed and exposed. Samples from this portion of the monitoring program will target deeper horizons (i.e., > 0.5 m depth) including material directly overlying the bedrock-overburden interface.
  - Where safe access allows, collect a minimum of four (4) samples from an equivalent number of auger holes along a transect (minimum length of 10 m). Sample collection should focus on the deeper zones of the overburden cut. If the bedrock-overburden contact is <0.5 m below the cut surface, recover samples from the excavation surface using a hand trowel or similar device.
  - Where access into the overburden cut is unsafe, collect the sub-samples from overburden stockpiles next to the excavation site. In this case, instruct the excavator operator to carefully place overburden material from the targeted area (≥ 10 m radius) into small stockpiles near the edge of the cut while roughly maintaining the spatial integrity. Then, conduct the sampling from these stockpiles in the same manner as described above.
- Composite all sub-samples at equal proportion to create a sample representative of the transect or test pit. Each composite sample should comprise a minimum of 3 kg of overburden material.

- Place a sample tag into the composite sample bag. Record the sample tag number along with sample characteristics any observations associated with the sample taken. At a minimum, include the following information recorded with each sample:
  - General soil characteristics.
  - Observations regarding grain size (e.g., presence and abundance of pebbles).
  - Location within pit on map or as coordinates.
  - Any observations (e.g., Fe-staining, geological features, etc.).
- Seal the sample bag with a zip tie and prepare for delivery to the on-site laboratory for the analysis of aqua regia digestible metals. It is the technician's responsibility to give clear delivery instructions if the sample is not delivered personally.

  Note: All overburden geochemical analyses are to be conducted on the <2 mm fraction and therefore, the on-site lab will be required to screen the submitted sample before analysis the remove larger particle sizes.

QA/QC Sample Collection

- Collect a minimum of one (1) field duplicate sample for every 10 regular samples and send to an accredited external laboratory.
- Collect the field duplicate sample in the same manner as the primary sample. Ideally, the duplicate is a split of the test sample; whereby a larger composite sample amounting to at least 6 kg is collected from which the duplicate overburden material is sub-sampled.
- Place the duplicate in a separate sample bag with a unique sample ID tag. The duplicate sample ID tag and location must be recorded in the notes.

Analytical Parameters

- Send regular monitoring samples to the on-site laboratory for the analysis of aqua regia digestible metals and total sulphur by LECO furnace.
- Submit QA/QC (duplicate) samples to an accredited laboratory for the full suite of ABA analyses and solid phase element determination by aqua regia digestion. The full list of parameters to be measured shall be included on the COC and includes the following parameters:
  - Total S (LECO) and sulphate S (by HCl digestion).
  - Total inorganic carbon.
  - Modified neutralization potential (NP).
  - Aqua regia digestible metals.
- Ship the completed COC form with the QA/QC samples to the external laboratory and an electronic version sent via e-mail to a Qualified Person (QP) for geochemistry and the accredited laboratory.

DATA ANALYSIS AND RECORD KEEPING

All background information collected during sample collection as outlined above shall be digitized in an appropriate database. Overburden monitoring data will be compiled, linked with the background information, and evaluated by the Chief Geologist and reviewed by the Environmental Manager or designate with the help of a QP for geochemistry as needed. The definition of the environmental class (e.g., PAG1, NAG4, etc.) to inform ML/ARD management strategies will be based on analytical surrogates derived for aqua regia digestible metals results as described in the ML/ARD Management Plan. External analytical results of the QA/QC (duplicate) samples will serve the confirmation of the on-site laboratory performance as well as the ongoing validation of the surrogate accuracy. These data are to be merged with the master ML/ARD monitoring database as they become available.

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July 30, 2021	Initial Version		Lorax Environmental Services Ltd.
September 3, 2021	Revised based on review by Artemis		Lorax Environmental Services Ltd.
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APPENDIX E STANDARD OPERATING PROCEDURE – VERIFICATION MONITORING

Appendix E: Standard Operating Procedure – Verification Monitoring (Waste Stockpiles and Tailings Beach)

OBJECTIVE

Verification monitoring will be carried out in the Upper and Lower Waste Stockpiles as well as tailings beaches that are exposed for extended periods of time (>1 year) in order to confirm the geochemical character of in-situ materials as well as to validate the effectiveness of the imposed mitigation strategies. The objective of this Standard Operating Procedure (SOP) is to provide guidance to BW Gold Ltd. personnel for the collection of verification monitoring samples for the Blackwater Gold Project (the Project). The sampling protocol described in this SOP is intended to ensure that sample collection and preparation methodology supports accurate and representative geochemical characterization of the targeted materials. This SOP follows the general requirements outlined in the Metal Leaching and Acid Rock Drainage (ML/ARD) Management Plan. Verification monitoring results will be used to validate operational ML/ARD characterization data, confirm that PAG and NAG waste materials are stored in the intended locations, and assess whether assumptions made in support of source term development are accurate.

SCOPE

This SOP describes activities related to ML/ARD verification monitoring of mine rock and tailings through the mine life and covers the following tasks:

- Sample collection protocols.
- Sample shipping and handling details.
- Laboratory analyses and procedures.
- Quality assurance and quality control (QA/QC) requirements.
- Communications with analytical laboratories.
- Documentation of results.

DEFINITIONS

ABA: Acid-Base Accounting

ML/ARD: Metal Leaching and Acid Rock Drainage

NAG: Non-Acid Generating

PAG: Potentially Acid Generating

PPE: Personal Protective Equipment

QA/QC: Quality Assurance and Quality Control

COC: Chain of Custody

TMF: Tailings Management Facility

PREPARATION*

The work covered by this SOP will be performed by responsible mine personnel following BW Gold's Health and Safety policies and procedures including the use of personal protective equipment (PPE), following safe work practices/procedures, and completing an assessment of hazards and controls. Mine personnel implementing this SOP must be aware of potential hazards that include but are not limited to the following:

- **Hazards**:
  - Slips, trips and falls, and
  - Working near heavy mobile and stationary equipment/machinery.

The following training is required for personnel implementing this SOP:

- **Training**:
  - Knowledge of sampling protocols.
  - SOP review and signed acknowledgement.
  - Trained and qualified to work around heavy mobile and stationary equipment.
  - Working in areas where explosives are being utilized.
  - Knowledge of mine rock geology.

This SOP requires the following equipment and supplies:

- **Equipment**:
  - Standard PPE.
  - Shovel.
  - Hand trowel or soil probe.
  - 5-gallon pail.
  - Field sieve (1/2-inch mesh).
  - Flagging tape and/or marking paint.
  - Field book.
  - Plastic heavy-duty sample bags with zip ties.
  - Camera.
  - GPS.

**Note that the components listed do not encompass the laboratory equipment and training requirements for the execution of the on-site geochemical analyses.*

IMPLEMENTATION

The Mine Geology Department will collect verification samples of NAG mine rock and deposited tailings (from beach) based on a predefined sample plan which will ensure a proper sample distribution over the Upper and Lower NAG Stockpiles and TMF is achieved. At a minimum, one (1) large composite sample will be collected per 200,000 tonnes of waste rock material deposited in the Upper and Lower Waste Stockpiles. Tailings sampling from the beach will be conducted opportunistically when safe access onto an inactive beach surface allows.

For verification sampling of waste rock from the Upper and Lower Waste Stockpiles, sample locations will be informed by pre-blast (grade control and blasthole) ML/ARD monitoring programs. The sample should constitute a composite of material deposited along a bench face and covering a transect length that represents the equivalent volume of one blast at a minimum. Note that this SOP refers to waste rock (bedrock) material only and does not apply to overburden materials which will be co-deposited in the waste stockpiles.

TASKS

Preparation	Person Responsible
▪ Sample tags are prepared before sampling for every sample to be collected in the field. Waste rock samples are assigned unique sample IDs identifying the stockpile, lift/bench elevation, and date of sampling. ▪ Tailings samples collected from an inactive beach should identify the facility (i.e., TMF), location (near discharge point *vs.* downgradient), as well as the date of sample collection.	▪ Mine Geologist / Technician

Sample Selection

- The selection of waste rock verification monitoring samples will be based on the ML/ARD monitoring results while maintaining the minimum sampling frequency of one sample per 200,000 t of material deposited. To demonstrate the effectiveness of NAG and PAG segregation, the verification monitoring program should target benches/lifts containing waste rock from blasts known to contain PAG rock.
- Tailings beach sampling will be conducted opportunistically where safe access on to an inactive and stable beach area allows.

Sample Collection

Waste Rock

- Once waste rock material has been deposited in one of the waste stockpiles, an area/lift of interest has been identified, and the area is safe to access, the responsible geologist/technician shall mobilize to the designated sampling location.
- At a safe location with freshly-dumped waste rock, mark a 10-m long, horizontal transect along the lift/bench face with flagging tape and record the coordinates.
- At the starting point of the transect, manually dig a 30 cm deep hole into the waste rock deposit with the shovel and place the material in a cone-shaped pile next to the hole.
- Prepare the sampling container by placing the field sieve on the 5-gallon bucket.
  - Divide the conically shaped cuttings pile into four quadrants and insert the sampling trowel or soil probe into the bottom half of the height of the pile. Slowly lift the sampling device through the height of the pile ensuring that as little material as possible falls of the sides. If using a soil probe: Once the probe is removed from the pile, lay the probe horizontally to prevent the sample from sliding out of the sampling chamber.

  - Place the collected material from all four quarters of the hole onto the field sieve and screen out the <1/2" material fraction by gently shaking and rotating the bucket and sieve until only the coarse fraction remains on the sieve. Discard the coarse fraction accumulating on the sieve after every scoop/probe addition. Clean the field sieve from any particulate matter as much as possible between sub-sample additions.
  - Repeat steps for the remaining three quadrants, ensuring that the locations in each quadrant are replicated and equal amounts of rock are extracted.
- To complete the sample collection, repeat the above process for four (4) additional holes at a spacing of 2.5 m until the end point of the transect is reached. The five (5) subsamples then represent one composite waste rock verification monitoring sample. Place the sample into a labelled sample bag and close with a zip tie. This composite sample should have a minimum mass of 5 kg, made up of equal proportions from each of the subsampled holes.
- During sample collection, record any notes and take photos of features (e.g., rock type, weathering, moisture content) that are relevant for geochemical interpretation of the data. Note whether the expected lithological make-up from the block model is represented by the sample.
- Once the sampling process is complete, safely backfill all holes.

Tailings

- In-situ samples from beached tailings are to be collected from inactive beach areas that have been exposed to the atmosphere for >1 year where safe access allows.

  Note: Since the primary ML/ARD management strategy for tailings is to cover exposed TSF beaches within 1 year of discharge, tailings verification sampling would only occur if the implementation of this strategy fails.
- To evaluate the effect of particle sorting along the tailings settling path, two (2) tailings samples are to be collected during every sampling event:
  - Access the TMF beach near the discharge point of the tailings in the area of interest. Choose a sampling location within 20 m downgradient of the discharge point. If the discharge point for the tailings deposited > 1 year ago cannot be located conclusively, collect the sample within 20 m downgradient of the TSF dam from where the beach area was accessed.
  - Using a hand trowel, collect a tailings sample (≥1.5 kg) by inserting the hand trowel into the beach surface at shallow (≤30º) angle and not exceeding a penetration depth of 5 cm. Place the subsample into the sample bag.
  - Repeat the above step in the same location to generate a contiguous, small-scale trench until the minimum sample mass of 1.5 kg is obtained. Then, close the sample bag with a zip tie.
  - Collect a second sample using the same method directly downgradient of the first sample location to capture grain size sorting mechanisms. Ideally, the second sample location is at least 20 m removed from the first sample location parallel to the perceived tailings slurry flow path.

- Record the GPS location of the sampling locations, take photos of the cross section of the small sampling trenches, and make note of any observation relevant to the geochemical interpretation of the collected materials. At a minimum, such notes should include the depth of the oxidation front (if discernably visible) and differences in particle size between the two locations assessed.

QA/QC Sample Collection

- Collect a minimum of one (1) field duplicate sample for every 10 samples and send to an accredited external laboratory (i.e., 10% duplication). This number may be reduced once sufficient confidence is achieved for the on-site laboratory analysis.
- For waste rock, collect the field duplicate sample in the same manner as the primary sample. The sample should be field-sieved into a separate 5-gallon pail. Place the duplicate in a sample bag with a unique sample ID tag.
The duplicate sample ID tag and location must be recorded in the notes.
- For tailings duplicate samples, collect the field duplicate sample in the same manner as the primary sample. The duplicate sampling location to be trenched must be immediately (within 30 cm) next to the primary sampling location, perpendicular to the perceived tailings slurry flow direction. Place the duplicate in a sample bag with a unique sample ID tag. The duplicate sample ID tag and location must be recorded in the notes.

Analytical Parameters

- Send all regular monitoring samples to the on-site laboratory for the analysis of aqua regia digestible metals and total sulphur via LECO furnace methods.
- Submit QA/QC (duplicate) samples to an accredited laboratory for the full suite of ABA analyses and solid phase element determination by aqua regia digestion. The full list of parameters to be measured shall be included on the laboratory COC and includes the following parameters:
  - Total S (LECO) and sulphate S (by HCl digestion).
  - Total inorganic carbon.
  - Modified neutralization potential (NP).
  - Net Acid Generation test.
  - Aqua regia digestible metals.
- Ship a completed COC form with the QA/QC samples to the external laboratory and an electronic version sent via e-mail to a Qualified Person (QP) for geochemistry and to the accredited laboratory.

DATA ANALYSIS AND RECORD KEEPING

All background information collected during sample collection as outlined above shall be digitized in an appropriate database. ML/ARD monitoring data will be compiled, linked with the background information, and evaluated by the Chief Geologist, or their designate and reviewed by the Environmental Manager or designate with the help of a QP for geochemistry as needed. The definition of the environmental class (e.g., PAG1, NAG4, etc.) to inform ML/ARD management strategies will be based on analytical surrogates derived for aqua regia digestible metals results as described in the ML/ARD Management Plan.
External analytical results of the QA/QC (duplicate) samples will serve the confirmation of the on-site laboratory performance as well as the ongoing validation of the surrogate accuracy. These datasets are to be merged with the master ML/ARD monitoring database as they become available.

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