PLAN OF OPERATIONS
Integrated Waste Management Plan

WASTE ROCK MANAGEMENT PLAN

Donlin Gold Project

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ACRONYMS

ABA	Acid Based Accounting
AMEC	AMEC Americas Limited
AP	acid generating potential
ARD	acid rock drainage
CIL	carbon-in-leach
CWD	Contact Water Dam
GPS	global positioning system
GWK	greywacke
HCT	humidity cell test
ICP	inductively-coupled plasma
LLDPE	linear low-density polyethylene
MD	mafic dykes
MDAG	Mine Drainage Assessment Group
ML	metal leaching
MWMP	Meteoric Water Mobility Procedure
NAG	non-acid generating
NP	neutralizing potential
OVB	overburden
PAG	Potentially Acid Generating
Plan	Waste Rock Management Plan
RD	Rhyodacite
SAG	semi-autogenous grinding
SHL	shale
TSF	tailings storage facility
WRF	waste rock facility
WRMC	waste rock management categories

UNITS OF MEASURE

%	percent
$<$	less than
$=$	equal to
$>$	greater than
°C	degree Celsius
°F	degree Fahrenheit
amsl	above mean sea level
bmsl	below mean sea level
cfs	cubic feet per second
cm	centimeters
cm/s	centimeters per second
ft	foot/feet
ha	hectares
kg	kilogram
km	kilometer
Ktonnes	thousand metric tonnes
Ktons	thousand short tons
lb	pound/pounds
m	meter
m^3/s	cubic meters per second
Mm^3	million cubic meters
msl	mean sea level
Mst	million short tons
Mt	million tonnes
MW	megawatt
oz/st	Troy ounces per short ton
st	short ton
stpd	short tons per day
t	tonne (1,000 kg)
tpd	tonnes per day

ELEMENTS AND COMPOUNDS

H_2SO_4	sulfuric acid
NP_{CO3}	neutralizing potential from carbonate minerals
S_T	total sulfur concentration
$CaCO_3/t$	Amount of Calcium Carbonate (or equivalent) per ton (tonne) required to neutralize acid generating material
As/S	arsenic/sulfur ratio

1.0 INTRODUCTION

This Waste Rock Management Plan (Plan) has been developed by Donlin Gold LLC[1] (Donlin Gold) for the proposed Donlin Gold project to define the procedures and practices associated with the characterization, management, placement of waste (development) rock, and final closure at the proposed Donlin Gold mine. This Plan is a volume in the *Integrated Waste Management Plan*, *Volume III,* 2016a.

1.1 Project Location and Summary

Donlin Gold is proposing the development of an open pit, hardrock gold mine in southwestern Alaska, about 277 miles (446 km) west of Anchorage, 145 miles (233 km) northeast of Bethel, and approximately 10 miles (16 km) north of the village of Crooked Creek (Figure 1-1). This document provides an overview of the proposed plans waste rock management.

The proposed Donlin Gold project would require three to four years to construct, with the active mine life currently projected to be approximately 27 years. The mine is proposed to be a year-round, conventional “truck and shovel” operation, using both bulk and selective mining methods. The operation would have a projected average mining rate of 422,000 stpd (383,000 tpd), or 154 Mst (140 Mt) per year, and an average mill production rate of 59,000 stpd (53,500 tpd). Milling components include a gyratory crusher, semi-autogenous grinding (SAG) and ball mills, followed by flotation, concentration, pressure oxidation, and carbon-in-leach (CIL) process circuits. Onsite retort and gold furnaces would produce an end-product of gold doré bars, which would be shipped to a custom refinery for further processing.

A tailings storage facility (TSF) would encompass an area of 2,351 acres (951 ha), with a total capacity of approximately 356,714 acre-ft (440 Mm^3) of mill tailings, decant water, and storm water. Total waste rock material is estimated at 3,048 Mst (2,765 Mt), with approximately 2,460 Mst (2,232 Mt) placed in a waste rock facility (WRF) located outside the mine pit, 114 Mst (103 Mt) used for construction, and the remaining 467 Mst (424 Mt) of waste rock backfilled in the pit.

A description of the Project can be found in the *Plan of Operations, Project Description, Volume I,* SRK 2016b*.*

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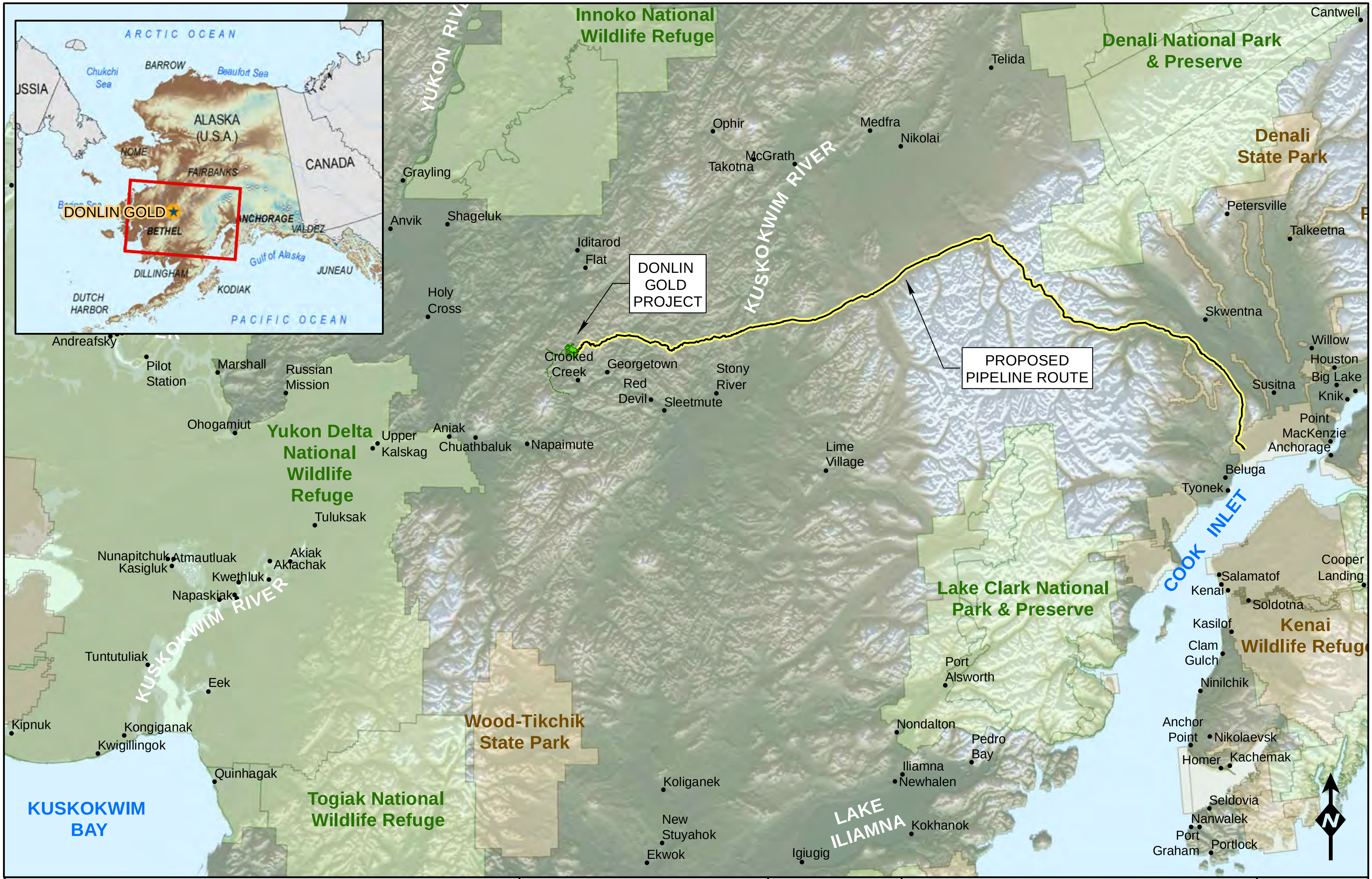
[1] Donlin Gold LLC is a limited liability company equally owned by Barrick Gold U.S. Inc. and NovaGold Resources Alaska, Inc.



- ● Populated Place
- — Proposed Natural Gas Pipeline Alignment
- 🟩 Proposed Infrastructure Layout
- 🟩 Federal Administrative Boundaries
- 🟨 State Administrative Boundaries

Seward Meridian, UTM Zone 5, NAD83

SCALE:

0 12.5 25 50 mi

0 20 40 80 km

DONLIN GOLD

PROJECT LOCATION MAP

DONLIN GOLD PROJECT

FIGURE:

1-1

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1.2 Objective and Scope

This Plan documents the procedures for characterizing, classifying, and managing waste rock associated with the proposed Donlin Gold project for surface disposal. The first step in developing a Plan is to characterize the geochemical behavior of the various waste rock material types associated with the project. This characterization defines the potential for the waste rock material to generate acid or leach deleterious constituents. The characterization is used to develop a classification system that can be used during implementation of a waste rock handling plan that manages waste rock materials for different facilities. Specifically, this Plan includes:

- a summary of the geochemical characterization programs that define the geochemical behavior of the waste rock
- the volume of waste rock to be produced according to the current long-range mine plan
- waste rock classification according to operational criteria for waste rock management
- waste rock placement design and procedures to minimize potential oxidation and solute generation
- reclamation and closure activities planned for the waste rock disposal facilities.

This Plan incorporates acid-base accounting (ABA) and solute generation information, and general waste rock volumes and types, in order to optimize the development of waste rock disposal facilities and minimize the potential for constituent releases, while supporting final closure actions.

1.3 Plan Revisions

This Plan will periodically be modified to integrate data from ongoing geochemical studies, mine modeling changes, mine planning, WRF performance monitoring, and changes to the Integrated Waste Management Permit and/or other information. Table 1-1 provides a record of these changes.

Table 1-1 Record of Changes and Amendments

Date	Section (s) Revised or Amended

2.0 SITE CONDITIONS

2.1 Physical Setting

The proposed Donlin Gold project is located in an area of low-lying, well-rounded ridges on the western portion of the Kuskokwim Mountains, with elevations ranging from 500 to 2,100 ft (152 to 640 m). Area vegetation is typically hard shrubs and small trees. Hillsides are forested with black spruce, alder, birch, and larch. Soft muskeg and discontinuous permafrost can be found in poorly drained areas at lower elevations.

2.2 Climate

Based on a detailed analysis of regional precipitation data from McGrath and Crooked Creek, and limited site data, a synthetic dataset was generated by BGC (2011) for the proposed Donlin Gold project site. The area has a relatively dry interior continental climate, with an average annual precipitation of 19.6 inches (50 cm).

Summer temperatures are relatively warm and may exceed 83°F (28°C). Minimum temperatures may fall to -45°F (-43°C) during the winter months. Additional information on climate and meteorological characteristics of the mine site can be found in the *Water Resources Management Plan, Volume II,* SRK 2016c.

2.3 Geology

The site geology is summarized in the SRK 2016b. The mineralogy of the major rock types at the site with respect to acid forming or neutralizing potential and the geology of the WRF area are described as follows.

2.3.1 Major Rock Types

The proposed Donlin Gold project deposit is hosted by rhyodacitic sills and dikes intruded into a sedimentary package consisting of calcareous and non-calcareous shale and greywacke. The sedimentary host rocks contain diagenetic iron sulfide mineralization, as well as iron, arsenic, antimony, and mercury sulfide minerals introduced with the gold mineralization. The intrusive rocks contain the same sulfide minerals introduced by mineralizing processes. Mineralogical analyses have shown that carbonate minerals occur variably in both rock type groups. Carbonate minerals are dominated by magnesium- and iron-enriched varieties such as dolomite, ankerite and siderite, rather than pure calcium carbonates such as calcite.

The following sections provide a description of the major rock types associated with the proposed Donlin Gold project based on observations made by SRK geologists (SRK 2007).

Shale

The majority of shale examined in core contained no visible sulfide minerals. In the intervals where pyrite was observed, it occurred mainly as very fine disseminated grains but also as larger blebs and veinlets. Generally, carbonates did not occur in the matrix of the shale in the intervals examined, but rather as veinlets, which appeared to be zones of weakness that would break preferentially. Sparry dolomite was rarely observed, and no arsenopyrite was observed.

Greywacke

Similar to the shale, the majority of greywacke examined contained no visible sulfide minerals. Pyrite, where observed, was not commonly disseminated, but instead occurred as blebs and veinlets associated with carbonate.

The iron content of carbonates was commonly apparent by iron staining on veinlets in core. Similarly, brown weathering indicative of iron carbonates was also observed in road cuts throughout the project area. In intervals where the carbonate veinlets were not stained by iron, the white carbonate minerals were identified as dolomite, based on its slow reaction with dilute hydrochloric acid. Like the shale, arsenopyrite was not observed in the greywacke. Coarse vuggy stibnite and coarse disseminated realgar were observed.

Rhyodacite

The term “Rhyodacite” is broadly used for the various porphyries that are observed within the project area. Both pyrite and arsenopyrite were observed in the rhyodacite in a variety of forms. Pyrite occurs in finely to coarsely disseminated sulfide veinlets and in mixed carbonate and sulfide veinlets. Carbonates occur mainly as veinlets and rarely as part of the matrix. Natural weathering of rhyodacite in outcrop has resulted in orange brown mottles, suggesting oxidation and leaching of sulfides, but no sulfide minerals were observed in the fractures. In one outcrop of rhyodacite (possibly crowded porphyry), green staining was observed, which appeared to be malachite.

2.3.2 Geology Underlying the Waste Rock Facility

Several field investigations have been carried out within the proposed footprint of the WRF. The investigations started in 2004 and included test pit excavations, auger hole drilling, core drilling, ground reconnaissance, seismic refraction surveys, and resistivity surveys. The overburden consisted of peat, loess, colluviums, alluvium, and terrace gravel deposits to shallow levels. The bedrock in the area consists of greywackes, siltstones, and shales of the Cretaceous Kuskokwim Group.

3.0 WASTE ROCK CHARACTERIZATION

Several extensive geochemical characterization studies have been completed that define the geochemistry of waste rock materials associated with the proposed Donlin Gold project. Geochemical data collected during these waste rock characterization programs were evaluated to characterize and predict the potential reactivity and stability of waste rock that would be extracted from the pit. The two main considerations of the waste rock characterization programs include:

- acid generation due to oxidation of sulfide minerals, which, when mixed with water, can form sulfuric acid (H_2SO_4), leading to acid rock drainage (ARD)
- potential for leaching of metals and metalloids (e.g., arsenic) and salts (e.g., sulfate).

The processes of acid generation and leaching can operate independently, although the development of acidic conditions enhances the leachability of many constituents.

The characterization programs completed for the proposed Donlin Gold project utilized the following testing methodologies:

- mineralogy, including optical and quantitative (Rietveld method) x-ray diffraction mineralogy on 40 samples and microprobe analysis of 617 carbonate mineral grains
- bulk geochemical analysis using four-acid digest and Inductively-Coupled Plasma (ICP) mass spectrometry analysis to determine total metal and metalloid chemistry
- ABA including paste pH, total sulfur analysis using a LECO® sulfur analyzer and neutralization potential (NP) testing by titration using the standard Sobek method (Sobek et al., 1978) of 2,312 samples
- sequential Meteoric Water Mobility Procedure (MWMP) with geochemical analysis of the leachate for specific constituents on 20 composite samples
- kinetic testing using standard humidity cell test (HCT) procedures designed to simulate water-rock interactions and predict the rate of reaction for acid generation and metals mobility.

The ARD and metal leaching (ML) potential of the proposed Donlin Gold project waste rock has been characterized in several phases, as summarized in SRK (2011).

The following conclusions were made based on a review and evaluation of the geochemical database for the proposed Donlin Gold project and from data obtained from ongoing static testing of waste rock, continuing waste rock field and laboratory kinetic tests, new field and laboratory kinetic tests, and additional mineralogical characterizations (x-ray diffraction and microprobe of carbonates and sulfides) (SRK 2011):

- The majority of the waste rock at the project has a low potential for ARD with neutralization potential/acid generating potential (NP/AP) well above two. However, some samples fall in the uncertain range (i.e., $1<NP/AP<2$) or are PAG based on a site-specific criterion of $NP/AP\leq 1.3$.
- Concentrations of arsenic, antimony, and mercury are above global crustal averages due to the introduction of these elements during mineralization. Arsenic concentrations are weakly correlated with sulfur concentrations for all major rock units, and both arsenic and sulfur show a bimodal distribution that corresponds to weakly and strongly

mineralized populations. The sedimentary rocks had large weakly mineralized populations, whereas the rhyodacite was mostly strong mineralized. The overall distribution of arsenic is similar to sulfur.

- Water quality predictions for waste rock indicate arsenic has the potential to be leached from waste rock under both acidic and non-acidic conditions.
- Acid generation potential and ML is controlled to some degree by rock type, but the over-printing effect of sulfide mineralization results in variable sulfur content, variable potential for ARD, and ML in all rock types. Therefore, rock type alone is not a reliable indicator of ML or ARD potential.
- Results from continuous sample intervals showed that geochemical characteristics tend to show uniform NP/AP and arsenic concentrations over intervals spanning tens of meters, indicating that waste segregation based on ARD and ML characteristics is feasible. No large-scale spatial trends in these parameters have been observed.
- Characterization of carbonate mineralogy resulted in development of a site-specific correction factor for NP that accounts for the presence of carbonates that would not contribute to the actual neutralizing potential of the material. This correction factor is to prevent overestimation of the waste rock NP.

3.1 Waste Rock Geochemical Modeling

A waste rock block model has been developed to provide a basis for the initial planning and the long-range mine plan for the proposed Donlin Gold project. The waste rock block model uses the waste rock management categories defined by SRK (2011), as summarized in Table 3-1, to define the ARD characteristics of the deposit.

Variables that were incorporated in the block model to aid with the geochemical classification of waste rock at the proposed Donlin Gold project include NP from carbonate minerals (NP_{CO_3}) and AP.

AP is calculated from the total sulfur concentration (S_T) where:

$$AP = 31.25 \times \text{estimated } S_T\ (\%)$$

NP from carbonate minerals (NP_{CO3}) was estimated from:

$$NP_{CO_3} = 0.76 \cdot NP + 4.8$$

To avoid a bias at low NP values, the calculated neutralization potential from carbonate minerals (NP_{CO3}) should not exceed analytical NP when NP is below 50 lb (22.7 kg) calcium carbonate or equivalent per tonne ($CaCO_3$/t). Therefore, the following rules were applied to the calculation of NP:

If $NP \leq 22.7$ kg $CaCO_3$/t: $NP_{CO3} = NP$

If $NP > 22.7$ kg $CaCO_3$/t: $NP_{CO3} = 0.85 \cdot NP + 3.4$

Table 3-1: Waste Rock Management Categories (SRK 2011)

Waste Rock Management Category	Category Description	NP*/AP Range and AP	As/S (As in mg/kg and S in %)
NAG 1	Very unlikely to generate ARD and "low" arsenic leaching	AP < 3 kg $CaCO_3$/t or NP*/AP > 2	As/S < 196 and As < 250
NAG 2	Very unlikely to generate ARD and arsenic leaching potentially significant	AP < 3 kg $CaCO_3$/t or NP*/AP > 2	As/S > 196 or As > 250
NAG 3	Unlikely to generate ARD and "low" arsenic leaching	1.4 < NP*/AP ≤2	As/S < 196 and As < 250
NAG 4	Unlikely to generate ARD and arsenic leaching potentially significant	1.3 < NP*/AP ≤ 2	As/S > 196 or As > 250
PAG 5	PAG but with very long delays (several decades) to onset of ARD	1.0 < NP*/AP ≤ 1.3	All
PAG 6	PAG in the life of the mine (possibly less than a decade)	0.2 < NP*/AP ≤ 1.0	All
PAG 7	PAG but with shorter delays to onset (less than a few years)	NP*/AP ≤ 0.2	All

*Site-specific $NPCO_3 = 0.76 \cdot NP + 4.8$ (SRK 2011)

Table 3-2 summarizes the site-specific calculation of ABA parameters developed for characterization and block modeling. These variables were estimated for each block to calculate NP_{CO3}/AP. In addition, the block model estimates for arsenic and sulfur values were used to calculate the ratio of arsenic to sulfur (As/S) for each block. The ARD potential as defined by the ratios NP_{CO3}/AP and As/S was then used to preliminarily classify blocks into the waste rock management categories that are subdivided into PAG and NAG groups. The two NAG categories are each split into two sub-categories to allow for identification of arsenic leaching.

Table 3-2 Site-specific Calculation of ABA Parameters

Source	Acid Potential (AP) kg $CaCO_3$/t	Neutralization Potential (NP) kg $CaCO_3$/t
SRK (2011)	31.25 x S_T (%)	If NP ≤ 22.7 NP = NP If NP > 22.7 NP = 0.85.NP + 3.4

3.2 Development of Waste Rock Classification System

With respect to waste management and classification of material, SRK (2011) concluded the following:

- Kinetic tests have shown that rates of sulfide mineral oxidation are strongly and positively correlated with sulfur content, and arsenic release is strongly associated with arsenic content of the rock. This suggests that bulk rock characteristics can be related to leaching behavior.
- Kinetic test results have demonstrated that NP/AP values below 1.3 define PAG rock, and that NP/AP values above 1.3 define NAG rock. Therefore, segregation of PAG waste rock can be based on a NP/AP value less than 1.3.[1]
- A relationship between NP/AP and the delay to onset of ARD has been developed using humidity cell results. For rock with elevated NP/AP near 1.3, the delay to onset is estimated to be on the order of ten years or more. For rock with NP/AP less than 1, ARD may be produced in less than a decade or several years.
- Arsenic leaching is a potentially significant concern for almost all waste rock, due to widespread elevated concentrations in the rock and leachability indicated by testwork.
- Waste rock mixing or blending has merit, though mainly to combine rock with a very long delay to onset of ARD (i.e., 1<NP/AP<1.3) with NAG rock (NP>1.3).
- Water chemistry modeling indicates that blending would need to be managed to ensure that sufficient alkalinity is available to neutralize acid. The calculated tonnage of Category 5 rock that can be blended with Categories 1–4 is 81%, provided that active management measures result in adequate mixing of Categories 1-4 and 5. The remaining 19% of PAG 5 waste rock mined will be placed as backfill into the ACMA pit.

In the characterization of waste rock geochemistry, the material is segregated according to a series of detailed chemical characteristics that are diagnostic of ML and acid generation potential. The classification of the waste rock according to operational criteria for waste rock management requires a site-specific criterion or criteria that are sufficiently sensitive to the indicators of ML and acid generation but simple enough for operational waste rock management. The geochemical characterization programs (SRK 2011) completed for the proposed Donlin Gold project have confirmed that NP_{CO3}/AP can be used as the main diagnostic indicator of ML and acid generation potential. Consequently, this parameter has been selected as the site-specific criterion to segregate PAG waste rock. Therefore, the four revised waste rock management categories defined by the Donlin Gold geochemical evaluation can be grouped into the following four material types for the purposes of waste rock management during operations (Table 3-3):

1. Non-acid generating (NAG 1-4 and overburden [OVB])

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[1] The theoretical NP/AP that defines the potential for acid generation is between 1 and 2. The range depends on the completeness of the acid neutralization reactions by carbonates. Regulators in various jurisdictions have proposed higher screening threshold values in the absence of site-specific information. These thresholds have, for example, ranged at times up to 3 in California and 4 in British Columbia. The higher values reflect uncertainty in the chemical measurements particularly of NP, which can include acid neutralizing components of the rock that are not sufficiently reactive under field conditions. The approach used to address this uncertainty at Donlin Gold has been to (a) calculate a site-specific NP based on mineralogical studies, which is lower than or equal to the laboratory-determined NP values; and (b) use kinetic weathering studies to determine the site-specific NP/AP threshold of 1.3 consistent with the site-specific NP approach (SRK 2007).

2. Potentially acid generating with a very long onset to ARD (PAG 5)
3. Potentially acid generating with a moderate onset to ARD (PAG 6)
4. Potentially acid generating with a short onset to ARD (PAG 7)

The classification of waste rock in relation to these characterizations is as follows:

1. Materials with a NP_{CO3}/AP value greater than 1.3 are considered non-acid generating, and include NAG 1-4 waste rock and OVB. NAG 2 and NAG 4 waste rock have the potential to leach significant arsenic even though the acid generating potential is low (Table 3-1).

2. For material with a NP_{CO3}/AP value less than 1.3, but greater than 1, the delay to onset is estimated to be on the order of ten or more years is classified as PAG 5.

3. For material with a NP_{CO3}/AP value less than 1, but greater than the lowest value (0.2), the delay to onset is estimated to be less than a decade and may occur within the life of mine. This material is classified as PAG 6.

4. Material with the lowest NP_{CO3}/AP values (i.e., <0.2) is classified as PAG 7 and is considered the most reactive material with ARD predicted to take place within a few years.

Table 3-3: Waste Rock Classification System

NP_{CO3}/AP	Waste Rock Classification	Description	Delay to Onset of ARD
>1.3	NAG 1-4 and OVB	Non-acid generating	--
$1.0 < NP_{CO3}/AP \leq 1.3$	PAG 5	Potentially acid generating	Several decades
$0.2 < NP_{CO3}/AP \leq 1.0$	PAG 6	Potentially acid generating	Less than a decade
≤ 0.2	PAG 7	Potentially acid generating	Less than a few years

$NPCO_3 = NP\ CO_3 = 0.76 \cdot NP + 4.8$, where NP is determined using the Sobek method (Sobek et al., 1978)
AP =Total Sulfur (wt%) x 31.25

3.3 Mine Plan and Waste Rock Distribution

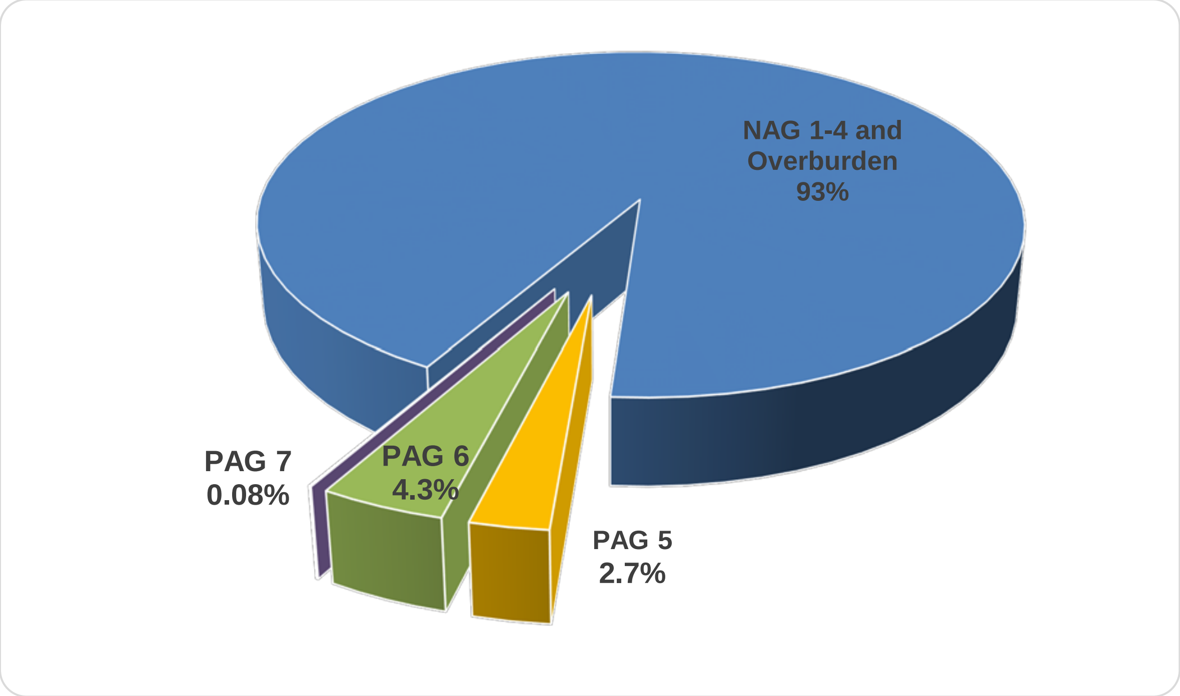
The proposed Donlin Gold mine plan would produce a total of about 3 billion tons (2.7 billion tonnes) of waste rock. The amount of each type of waste rock to be mined is summarized in Table 3-4 and illustrated in Figure 3-1. A summary of the mine production schedule for the life of the mine is provided in Appendix A.

As shown in Figure 3-1, NAG 1-4 and OVB make up almost 93% of the total waste rock tonnage. PAG 5 waste rock is estimated to be less than 3% of the total waste rock tonnage that would be generated during the project. Furthermore, the rate at which PAG 5 would be extracted from the pit is fairly consistent throughout the life of mine and never exceeds 5% of the total waste rock mined during any one year. Therefore, the quantity of PAG 5 waste rock is considered to be within the range that could be accommodated by blending with NAG 1-4 rock to create an overall mixture that does not produce ARD. However, for the blended approach described in Section 4.3 below to be successful in mitigating ARD, waste rock must be managed to ensure that PAG 5 and NAG 1-4 waste rock is adequately mixed at a small enough scale. This has been confirmed by water quality predictions based on HCT results that indicate acidity is mitigated by reaction with acid-consuming minerals for well-mixed conditions (SRK 2007).

Table 3-4: Waste Rock Tonnage Estimates

Waste Rock Classification	Tonnage		Percent of Total
	tons (thousands)	tonnes (thousands)	
NAG 1-4 and Overburden	2,920,000	2,649,000	93
PAG 5	87,200	79,100	2.7
PAG 6	135,300	122,700	4.3
PAG 7	2,600	2,360	0.08
Total Waste Rock	**3,145,000**	**2,853,100**	**100.00**

Figure 3-1: Total Waste Rock Material Distribution



In order to gain a better understanding of the modeled distribution of the various waste rock types, a series of snapshots throughout the life of mine schedule was produced from the block model shown in Appendix B. End-of-period status maps (section view, along with a selected bench plan view) are provided in the Appendix B block model views; the pit design for the current year is shown as a black line; NAG 1-4 waste rock in grey; PAG 5 waste rock in orange; PAG 6 and PAG 7 waste rock in blue. The grid lines are 250 m in plan, with elevation lines every 24 m in the section view.

The series of status maps provided in Appendix B illustrate that the PAG 5 waste rock is disseminated throughout the deposit with very few large contiguous zones indicated. For the most part, PAG 5 is mined and placed in the WRF, would be adequately mixed with the surrounding NAG waste rock and would in effect, produce a desirable blend to negate the reactivity of the PAG 5 rock. For those periods where PAG 5 is predominant material would be dispersed on the WRF to produce a well-mixed blend. This would require operational controls as described in Section 4.2 below, in order to ensure the PAG 5 is not repeatedly placed on the same dump location. Where PAG 5 in the pit is surrounded by more reactive PAG 6 or PAG 7 waste rock, and is too small a zone to be selectively mined, it would be incorporated in the management of the PAG 6 or PAG 7 waste rock.

4.0 WASTE ROCK MANAGEMENT

4.1 Waste Rock Classification

The proposed Donlin Gold project waste rock classification system would consist of four waste rock material types that are defined by the ratio of NP_{CO3} to AP according to Table 3-3.

Total sulfur would be measured in the onsite laboratory using a LECO analyzer. AP is then calculated from the total sulfur concentration where:

$$AP = 31.25 \times \text{total sulfur (wt\%)}$$

NP would be measured in the onsite laboratory according to the standard Sobek method (Sobek et al., 1978). The rock is digested with boiling hydrochloric acid, and then the base equivalent amount of acid consumed is determined by titrating the acid solution to a pH of 7 and converting the measured quantities to NP expressed as kg $CaCO_3$/t. Once NP is calculated, a correction factor would be applied to account for the presence of carbonates that do not contribute to the actual neutralizing potential of the material as described in Section 3.1. NP_{CO3} would be estimated from the following equations:

$$NP_{CO3} = NP \text{ (for } NP \leq 22.7 \text{ kg } CaCO_3/t)$$

$$NP_{CO3} = 0.85 \cdot NP + 3.4 \text{ (for } NP > 22.7 \text{ kg } CaCO_3/t)$$

The ratio NP_{CO3}/AP would then be calculated and used to classify waste rock according to Table 3-3.

4.2 Waste Rock Mining and Segregation

The current mine schedule targets an average mining rate of approximately 422,000 stpd (383,000 tpd) of total material that would be mined by bulk open pit mining methods. Waste rock alone would be extracted from the open pit at an average mining rate of 345,000 stpd (313,000 tpd). This mining rate is subject to change based on operational considerations during the life of the project.

The key to the success of this Plan would be the identification of the various material types in the field and, in particular, at the active mining face. This approach would require a material identification system that is built into the ore control system. Sources of information include:

- daily survey control
- maintaining an up-to-date 3-D block model
- blasthole sampling and logging to assist in this waste characterization
- possibly bench face sampling including mapping and visual inspections.

Blasthole cuttings would be collected during drilling operations for analysis at the onsite laboratory. The number of blasthole samples collected would depend on the geologic conditions within the blast area and the blasthole pattern. However, it is anticipated that a sample density of 1 in 12 would be adequate to perform the required waste rock segregation.

These samples would be submitted to the onsite laboratory for ABA testing and calculation of NP_{CO3}/AP. Based on the results, the material would be classified as one of the four waste rock material types as described above. The sampling and testing would be completed on the same schedule as ore determination in order to be effectively included in the short-term mine planning process.

The resulting information would be used to assign material types to the areas of the active bench. Each area would be assigned a destination code based on classification of the material. An automated routing and tracking system would be used that integrates the ore control data with a global positioning system (GPS)-enabled loading and hauling fleet to route and track material. Each of the shovels working in ore and waste at the proposed Donlin Gold project would be equipped with GPS positioning to allow real-time updates of the digging face in relation to ore grades and waste rock types.

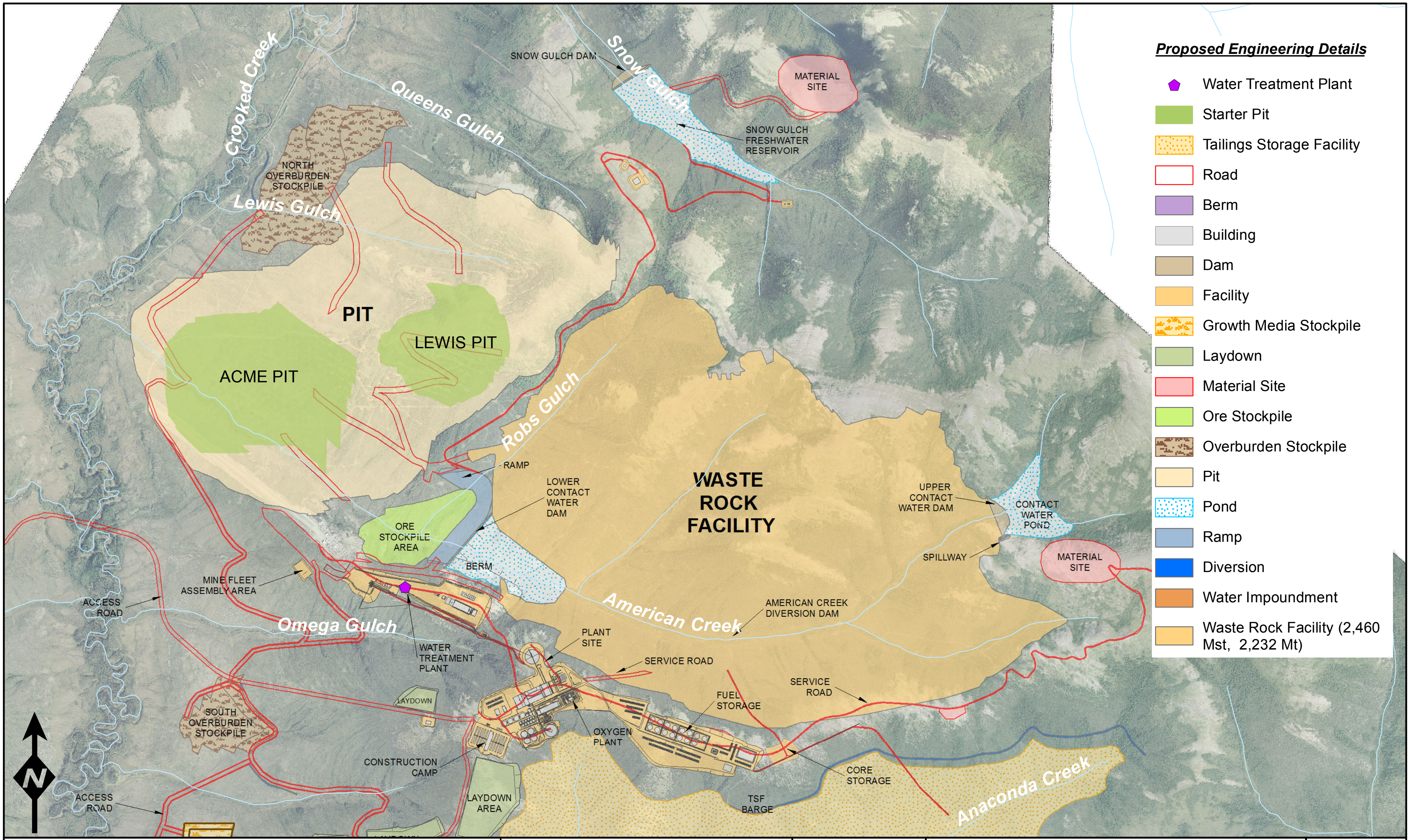
An electronic map would be developed by the short range planner to differentiate between the ore and waste types. This electronic map would be available to the shovel operator in real time via an on-board computer screen so the type of material loaded into the truck would be known at all times. Furthermore, all the trucks would be equipped with a GPS dispatch system. When equipment is loading from a particular area, a code would be assigned to the truck being loaded and the designation would appear on the operator’s screen. The system would record the volume of each waste rock type mined during each shift and its ultimate destination. This mining methodology would ensure that ore and waste rock types are mined and delivered to the correct location.

4.3 Waste Rock Designation and Placement

The waste rock for this proposed project would be routed to one of three destinations including (Figure 4-1):

1. American Creek drainage WRF (east of the pit)
2. isolated cells within the WRF (Rob’s Gulch)
3. ACMA pit backfill

The estimated tonnage of each waste rock type is summarized in Table 4-1. The methods of waste rock placement are described in the following sections for each facility.



SCALE:

0 0.25 0.5 1 mi

0 0.375 0.75 1.5 km

DONLIN GOLD

WASTE ROCK FACILITY AND OVERBURDEN STOCKPILES

DONLIN GOLD PROJECT

FIGURE:

4-1

DG: PER0033.mxd, 04/21/16, R01

Table 4-1: Waste Rock Tonnage by Facility (thousands)

Material Type	ACMA Backfill		Waste Rock Facility		Isolated Cells in WRF		Tailings Dam	
	tons	**tonnes**	**tons**	**tonnes**	**tons**	**tonnes**	**tons**	**tonnes**
NAG 1-4	442,900	401,800	2,335,900	2,119,100	--	--	95,100	86,300
OVB	45	41	46,400	42,100	--	--	--	--
PAG 5	12,000	10,900	75,200	68,200	--	--	--	--
PAG 6	12,000	10,900	--	--	123,320	112,000	--	--
PAG 7	47	43	2,500[a]	2,300	--	--	--	--
Total	**467,000**	**423,700**	**2,460,000**	**2,231,700**	**123,320**	**112,000**	**95,100**	**86,300**

[a] This tonnage reflects the total PAG 7 waste rock that would be temporarily placed in the low-grade stockpile at the toe of the WRF and relocated to the ACMA pit backfill once space is available.

4.3.1 American Creek Valley WRF

The waste rock types that would be placed on the WRF would consist of NAG 1-4 waste rock and PAG 5 and isolated cells of PAG 6, as described in Section 4.3.2. Waste rock classified as NAG 1-4 has no potential to generate acid and would be placed in WRF without any constraints on placement. NAG 1-4 would be available for blending with the PAG 5 material.

Waste rock classified as PAG 5 has the potential to become acid generating over a long period of time (several decades). To mitigate this potential, PAG 5 waste rock would be blended with the NAG 1-4 waste rock in the WRF. However, PAG 5 rock would need to be adequately blended with the NAG rock for its reactivity to be negated. This requires operational controls to ensure the PAG 5 material is not repeatedly placed at the same dump location, but is staggered or spread across the operational dump face.

The advancing dump crest of any lift would be several hundred feet across to facilitate safe haul truck turnaround. The dump crest would be maintained by a dozer in a typical “dump-and-doze” waste rock handling operation. The dozer operator would be instructed to shift position with each incoming load of waste to allow spreading of successive loads across the entire dump face. The effective blending of PAG 5 material with NAG 1-4 material is possible due to the disseminated occurrence of PAG 5 in the deposit, the small overall percentage of PAG 5, and the staggered placement approach.

To further mitigate the potential for PAG 5 to generate acid, the last 80 ft (24 m) of the dump crest advancement of any lift would be limited to only NAG 1-4 waste rock. This would ensure the final regraded slopes of the WRF would consist of NAG 1-4 waste rock with an average thickness of about 30 ft (9 m). Mine engineers would develop a PAG/NAG boundary beyond which only NAG waste rock can be placed.

This type of waste rock placement methodology has been successfully applied at other mines that operate at a similar scale with similar equipment. Extra management is required at the end of the mine life to ensure no PAG 5 material is dumped on a final face, and there is sufficient NAG material in the mine plan or in prepared stockpiles to cap the top surfaces of the WRF.

4.3.2 Isolated Cells on WRF

Waste rock classified as PAG 6 has the potential to become acid-generating within a decade. To mitigate this potential, PAG 6 would be segregated from the other waste rock types.

Isolating the PAG 6 in this area will result in reduced amounts of water coming into contact with these materials, and will minimize their potential to become acidic. A foundation of NAG rock would be placed beneath the PAG 6 materials in the Rob's Gulch portions of the WRF in order to limit the potential for water running along the drainage to rise and fluctuate within the PAG 6 waste cell. The NAG material will also act as a rock drain to convey the runoff and perennial flows out of this drainage.

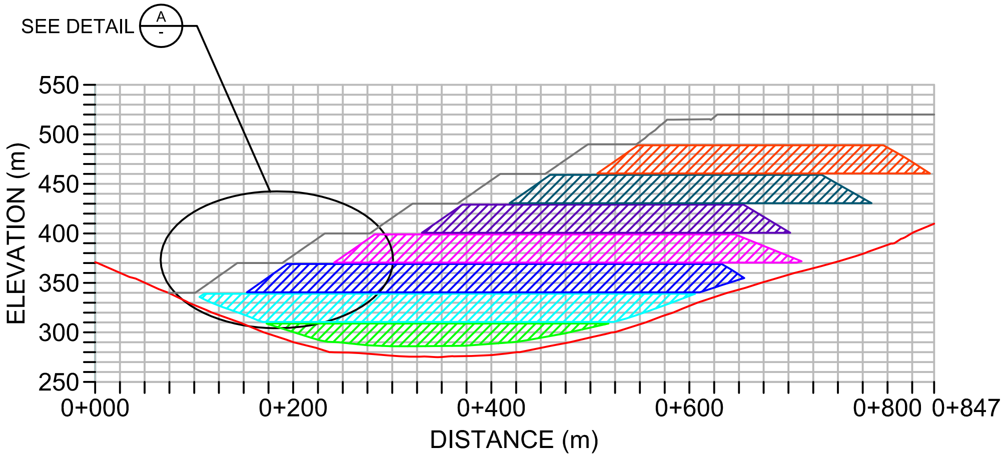
The materials in each PAG 6 cell will be placed in lifts with a maximum height of 100 ft (30 m). Each 100 ft (30 m) cell will then be covered with a low permeability "cap" consisting of terrace gravel, or similar material, to minimize infiltration of surface water once the cell is completed (Figure 4-2). This would limit the amount of runoff and precipitation entering the PAG cells. NAG 1-4 waste rock would be dumped around the sides of the PAG waste rock cells and on top of the final PAG 6 cell to further isolate the material from the final surface of the WRF and from the surrounding natural ground.

During the early years of operation, PAG 6 would be placed in these permanent, isolated cells in the Rob's Gulch and Unnamed Gulch sections of the WRF. Once the ACMA pit becomes available for backfilling, any new PAG 6 waste rock that is mined could also be placed directly into the ACMA pit as backfill.

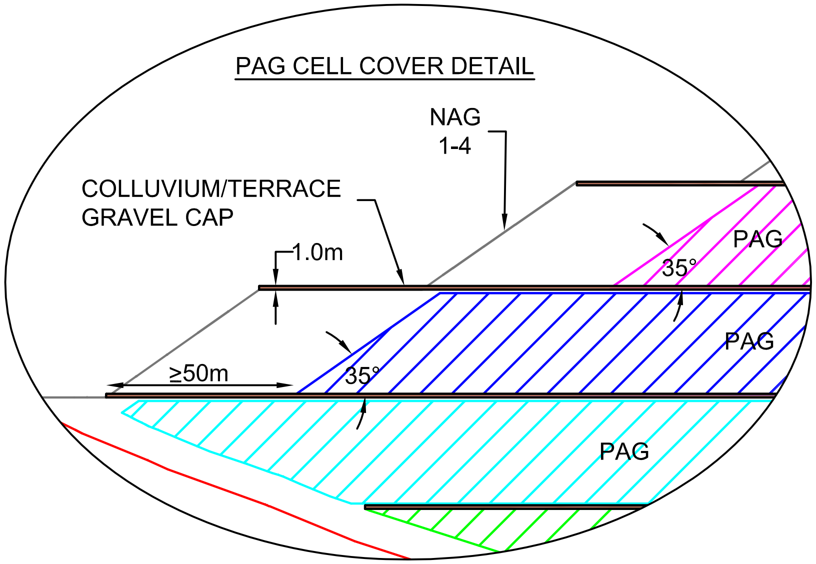
4.3.3 PAG 7 Temporary Storage and Low-Grade Stockpile

Waste rock classified as PAG 7 is highly mineralized material (below the economic cut-off grade) that has the potential to become acid-generating in the shortest timeframe. As a result, PAG 7 would be segregated from the other waste rock material types and placed on the low-grade stockpile area for temporary storage. Once the final limits of the ACMA pit are reached, PAG 7 stored in the low-grade stockpile would be relocated to the bottom of the ACMA pit.

The low-grade stockpile area is located at the toe of the WRF near center of American Creek Valley. During operations, surface water from this area, including stormwater from the PAG 7 waste rock, would report to the Lower Contact Water Dam (CWD) and any seepage that enters groundwater would be intercepted below the Lower CWD for mill make-up water or pumped to the Upper CWD for future mill use.



CROSS SECTION E 07



DETAIL A -

SCALE: NA

LEGEND

— WASTE ROCK FACILITY
— GROUND SURFACE
▨ PAG 310
▨ PAG 340
▨ PAG 370
▨ PAG 400
▨ PAG 430
▨ PAG 460
▨ PAG 490

PAG 6 CELL EVOLUTION

DONLIN GOLD PROJECT

FIGURE:

4-2

DG: 181200.010, 07/11/12, R04

4.3.4 ACMA Pit Backfill

Once the final limits of the pit are reached in Year 22 of the mine life, waste rock would be placed as backfill in the ACMA pit. At this point, all PAG 6 and PAG 7 mined in the Lewis pit would be placed in the ACMA pit backfill and no additional waste rock would be placed in the low-grade stockpile or isolated cells. Material classified as PAG 5 and NAG 1-4 would also be placed in the ACMA pit backfill as the material is mined from the Lewis pit, with the majority of the waste rock consisting of NAG 1-4. The deepest portion of the ACMA pit would be backfilled to approximately 695 ft bmsl (212 m bmsl) elevation. At this pit depth, a pit lake can be maintained with an approximate maximum depth of 1,023 ft (312 m). Other portions of the Lewis and ACMA pits would be backfilled to approximately 111 ft amsl (34 m amsl) to maintain a depth of approximately 216 ft (66 m). This maximum recommended backfill for the ACMA pit is based on the pit lake study completed by Lorax Environmental (2015) and is necessary to keep the pit lake stratified and PAG backfill anoxic.

4.3.5 Tailings Storage Facility

The TSF would be a fully lined impoundment located in the Anaconda Creek Valley, 2.2 miles (3.5 km) south of the open pit. Waste rock from the pit would be used in the construction of the TSF as rockfill, filter zone material, riprap, and underdrain rockfill. NAG 1-4 waste rock would be used for TSF construction.

5.0 WASTE ROCK FACILITY DESIGN

5.1 Waste Rock Facility Construction

The WRF construction would be typical to the mining industry with a safety berm at the edge of the dump face that the trucks would back up to prior to dumping. A dozer would advance the safety berm toward the face as additional material is dumped and cascades down the dump face extending the dump. The combination of dumping from the haul trucks and dozing material over the crest of the dump provides a mechanism to adequately blend and mix waste rock types Figure 5-1.

Figure 5-1: Typical Waste Rock Dump Construction

The WRF has been designed to maximize reclamation efficiency, utilize the neutralizing capacity of NAG materials, add flexibility to the site water balance, and minimize the cost of closure. The design parameters for the American Creek Valley WRF are summarized in Table 5-1. Slope stability and rock drain designs were completed by BGC (2011).

Table 5-1: Waste Rock Facility Design Parameters

Waste Rock Facility	Crest Elevation			Authorized Tonnage			Footprint	
	ft amsl*	m amsl		Mst	Mt		acres	ha
American Creek Valley WRF	1,705	520		2,460	2,232		2,514	1,017

The American Creek Valley WRF would have a maximum height of 1,115 ft (340 m). It would be constructed by end-dumping material in lifts up to 100 ft (30 m) in height. The toe of each dump lift would be set back 155 ft (47 m) from the crest of the previous lift to achieve the 3.0H:1.0V dump slope angle. This method of construction would result in the most cost-effective configuration for regrading and reclamation of the WRF.

As described above, waste rock types that would be placed on the American Creek Valley WRF would consist of NAG 1-4, PAG 5 waste rock, and isolated cells of PAG 6. Waste rock classified as NAG 1-4 would be blended with the PAG 5 material in the WRF and the last 80 ft (24 m) of the dump crest advancement of any lift would be limited to only NAG 1-4 waste rock.

Waste rock classified as PAG 6 would be segregated from the other waste rock types and would be placed in permanent, isolated cells in the Rob's Gulch section of the WRF. A low permeability cap consisting of terrace gravels, or similar material, would then be placed on the isolated cells in the WRFs as each 100 ft (30 m) lift is completed. NAG 1-4 waste rock would be dumped around the PAG 6 waste rock to isolate the material from the final surface of the WRF and from the surrounding natural ground.

The WRF would be constructed entirely from the bottom up. During construction of the WRF, the organic materials, loess, and ice-rich overburden would be removed from the footprint as the dump expands. The stripped materials would be replaced with coarse waste rock. This would result in a high degree of stability at the WRF toe and a very low likelihood of instability in the early stages of construction and through the life of the WRF. The materials removed from the foundation would either be placed in temporary overburden stockpiles or mixed with waste rock in the WRF.

The foundation of the WRF would require drainage control. The potential magnitude of flow in the American Creek drainage, as well as discharging springs in the valley bottoms, warrants construction of engineered rock drains in the valley bottom, with connecting secondary rock (finger) drains constructed in the smaller contributing drainages. These upstream water collection and diversion measures would be constructed during the preproduction period, and the first segments of the rock drain would be placed using NAG 1-4 rock. Utilizing larger block sizes of the broken rock from blasting in the open pit, the rock drain beneath the WRF would be sized to contain the peak instantaneous flow associated with the 100-year, 24-hour duration rainfall event for the American Creek catchment. The Lower CWD would be constructed in the American Creek valley downstream of the WRF to collect runoff and seepage water from the WRF. The surface and groundwater flow path along American Creek between the Lower CWD and ACMA pit would be toward the ore stockpile and pit dewatering wells. Surface and groundwater from this area would be pumped back to the Lower CWD and would be managed as mine contact water. Additional information on water management associated with the WRF can be found in document SRK 2016c.

5.2 Waste Rock Facility Reclamation

The WRF would be progressively reclaimed during operations by placing a cover designed to minimize infiltration over approximately 2,400 acres (970 ha). The cover would consist of a minimum 14 inches (0.35 m) of growth medium (peat mineral mix) over a minimum 12 inches (0.3 m) of terrace gravel and/or colluvium. The growth medium cover would be vegetated, and the underlying waste rock would be contoured prior to placement of the cover to provide natural drainage toward the south margin of the WRF. Contouring would also produce a natural drainage pattern of swales. The base of the swales would be allowed to develop naturally and self-armor after cover placement. Ongoing maintenance of these swales (e.g., riprap or cobble and boulder placement) would ensure the cover integrity is not compromised. Progressive reclamation during operations is expected to result in reclamation of the majority of the WRF prior to the end of mining; however, at a minimum, reclamation of haul roads and ramps would be necessary during the closure period. A more detailed description of the site-wide reclamation procedures is contained in the *Reclamation and Closure Plan, Volume IV,* SRK 2016d.

Post-closure, all surface and groundwater would be collected and directed (piped) into the lower levels of the pit lake. A majority of the reclaimed WRF would convey surface runoff to a major runoff collection channel that would be constructed along the south margin of the facility. The purpose of the channel is to collect runoff from the WRF cover system and convey it to the ACMA pit lake at closure. The collection channel would be lined to mitigate the potential for channeling of the cover and minimize potential seepage losses during low-flow periods. The channel would be lined with 40 mil linear low-density polyethylene (LLDPE) and would have a base width of 13 ft (4 m), 2H:1V side slopes, and a depth of 6.6 ft (2 m). The base of the channel would be lined with a lift of sand/pea gravel (1 ft [0.3 m]) and natural cobbles and boulders or riprap (-24 inch [600 mm]). A 1 ft (0.3 m) bedding layer would be placed on top of the waste rock before the LLDPE liner is deployed. The lining would extend one-third of the way up the side to allow side slope and tributary runoff to enter the channel rather than being forced below the lined channel. The channel would have an approximate total length of 2.2 miles (3.5 km).

Modeling of the pit lake geochemistry indicates that water quality is significantly improved when the surface runoff from the WRF and undisturbed upslope areas is separated from the seepage water that infiltrates the cover. The seepage water would have contacted waste rock, and subsequently would be expected to have higher dissolved metal concentrations than surface runoff water (Lorax 2015). The seepage flows would, therefore, be isolated by constructing four small, concrete containment structures at the outlet of the rock drains for American Creek and Rob's Gulch. A gravity-fed pipe would then direct these seepage flows to the bottom of ACMA pit, with surface runoff draining naturally to the surface of the pit lake. This segregation of flow would encourage pit lake stratification. The combined flow pipeline would require a maximum capacity of 12 cfs (0.34 m^3/s), which equates to a 24-inch (61 cm) diameter pipe. An approximate pipe length of 2.92 miles (4.7 km) would be required to convey the combined seepage flows to the edge of the pit lake. Here, the seepage water would feed into the pipeline used to convey TSF water to the base of the pit.

6.0 MONITORING AND REPORTING

This section summarizes inspections and monitoring related to waste rock and the WRF during operations and closure. Details regarding groundwater and surface water monitoring are found in the SRK 2016a.

6.1 Operational Monitoring and Reporting

The quantities and destinations of waste rock and ore would be recorded during operations, and these data would be tabulated monthly. Laboratory analyses for total sulfur and NP_{CO3} and ABA calculations would be maintained on site. This geochemical data would be processed on a monthly basis to calculate the average NP_{CO3}/AP for placed waste rock, and to record final destinations. In order to verify designated waste rock is managed as proposed, surveys of the advancing WRF lifts would be conducted to make sure the 80 ft (24.4 m) set-back of PAG material is maintained. In addition, the final slopes would be inspected for evidence of ARD to determine if PAG material was placed on the final WRF surfaces. Additional NAG 1-4 material would be placed on the surface to thoroughly cover any exposed PAG material.

Visual inspections of the WRF and associated storm water controls would be conducted to evaluate the performance and condition of the facility. Excluding the isolated cells, the toes of the WRF would be checked for seepage, and if seepage is observed, the specific location and flow rate would be recorded, and a sample would be collected for water quality analysis. These inspections would be conducted on a monthly basis and as soon as practicable after significant precipitation events.

Site staff would carry out weekly visual inspections on each area of the WRF that is undergoing active development or concurrent reclamation. The general condition of the WRF would be recorded. Items to be observed would consist of physical stability (e.g., differential settling, frost or tension cracks, etc.), presence, or absence of erosion, confirmation that lifts and slopes are within design limits, and status of any reclamation (e.g., revegetation success). Inspection of non-active areas of the facilities would be carried out on a monthly basis. Upon completion of a portion of the facility, inspections would be carried out annually until closure. The results of the inspections would be incorporated into the inspection recording and document storage system developed for the site.

6.2 Closure and Post-Closure Monitoring and Reporting

Post-closure monitoring would consist of visual inspection of the WRF, including but not limited to covered areas, areas of potential stormwater concentration, storage facility base areas where seepage would have the highest potential to occur, and storm water control facilities. Inspections would be carried out for a period of not less than five years. The frequency of inspections would be at least once annually in the spring and following any storm events exceeding the 25-year, 24-hour storm event. The purpose of the inspections would be to observe and document the following:

- the physical integrity of the growth media and terrace gravel/colluvium cover including areas of erosion
- the extent of vegetation establishment and density

- evidence of any staining, discoloration, streaking or moisture conditions indicating significant geochemical reactivity of disposal facility surfaces
- the condition of stormwater control structures
- the location and extent of any ponded stormwater.

Conditions observed that require repair, maintenance, or further evaluation would be documented and scheduled for requisite action as soon as possible. Inspections, repairs, and evaluations would be documented and submitted to the ADEC on an annual basis.

7.0 REFERENCES

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Appendix A

Summary of Mine Production Schedule

Summary of Mine Production Schedule

									Preproduction				Production	
	Life of Mine (LOM)	-01	-01	-01	-01	01	01	01	01	01	01	01	01	01
Material Type	**Unit**	**Q1**	**Q2**	**Q3**	**Q4**	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**
Ore-Mine to Crusher	kt											915	482	1,201
Ore-Mine to Stockpile	kt		62	451	1,211	255	1,658		2,579	326	2,931			1,705
Ore-Long Term Stockpile to Crusher	kt											13		
Waste – Mine to WRF	kt	-	1,603	3,162	2,289	1,339	370	2,028	5,447	8,009	5,383	7,736	8,056	5,614
Waste (NAG) –Mine/Quarry to Rockfill MTO's Foundation Prep.	kt	506	506	506	-	-	-	-	-	-	-	-	-	-
Waste (NAG) –Mine/Quarry to Rockfill MTO's Rock Drains	kt	539	354	-	-	230	230	230	-	-	-	197	197	197
Waste (NAG) –Mine/Quarry to Rockfill MTO's Roads	kt	784	162	100	-	-	-	-	-	-	-	-	-	-
Waste-Mine to Backfill	kt	-	-	-	-	-	-	-	-	-	-	-	-	-
Waste-Mine to Tailings Dam	kt		1,788	2,665	2,672	1,306	1,306	1,305	1,305	1,308	1,308	984	984	984
Overburden-Mine to WRF	kt		-	1	-	0			0	0		286	375	382
Overburden-Mine to Backfill														
Overburden-Mine to Tailings Dam	kt		-	-	-	-							-	-
Overburden-Mine to North Overburden Stockpile	kt		335	272	287	44			145	21	82	79	103	105
Overburden-Mine to South Overburden Stockpile	kt		1,212	986	1,041	161			524	77	296			
MTO's Ovb. Excavated Foundation Preparation	kt	421	362	362		-	-	-				-	-	-
MTO's Ovb. Excavated Rock Drains	kt	46	-	-		12	12	12				10	10	10
MTO's Ovb. Excavated Roads	kt	2,913	729	637										
Total Movement		**5,209**	**7,112**	**9,105**	**7,500**	**3,407**	**3,575**	**3,575**	**10,000**	**9,742**	**10,000**	**10,221**	**10,854**	**10,207**

Summary of Mine Production Schedule (Continued)

	Life of Mine (LOM)	01	01	01	02	02	02	02	03	03	03	03	04
Material Type	**Unit**	**M10**	**M11**	**M12**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	
Ore-Mine to Crusher	kt	646	1,432	1,274	4,663	4,617	4,633	4,727	4,746	4,841	4,825	4,791	15,701
Ore-Mine to Stockpile	kt		789		12	1,249		1,165	806	2,148	1,967	2,634	17,418
Ore-Long Term Stockpile to Crusher	kt	734		184			55						3,711
Waste – Mine to WRF	kt	7,798	6,366	7,403	21,248	22,654	25,023	23,639	24,420	24,176	24,382	23,770	91,631
Waste (NAG) –Mine/Quarry to Rockfill MTO’s Foundation Prep.	kt												
Waste (NAG) –Mine/Quarry to Rockfill MTO’s Rock Drains	kt	312	312	312	3,219				1,093				1,934
Waste (NAG) –Mine/Quarry to Rockfill MTO’s Roads	kt												
Waste-Mine to Backfill	kt												
Waste-Mine to Tailings Dam	kt	984	984	984									
Overburden-Mine to WRF	kt	449	336	266	3,195	1,160	270	369	1	0			6,074
Overburden-Mine to Tailings Dam	kt												
Overburden-Mine to North Overburden Stockpile	kt	124	93	73	882	320	75	102	6	18	17	12	1,676
Overburden-Mine to South Overburden Stockpile	kt								22	67	60	43	
MTO's Ovb. Excavated Foundation Preparation	kt	440	440	440									
MTO's Ovb. Excavated Rock Drains	kt	16	16	16	145				55				99
MTO's Ovb. Excavated Roads	kt												
Total Movement		**11,502**	**10,768**	**10,952**	**33,364**	**30,000**	**30,055**	**30,000**	**31,148**	**31,250**	**31,250**	**31,250**	**138,244**

Summary of Mine Production Schedule (Continued)

	Life of Mine (LOM)	05	06	07	08	09	10	11	12	13	14	15	16
Material Type	**Unit**												
Ore-Mine to Crusher	kt	19,553	18,190	18,719	16,487	19,548	19,663	19,455	19,321	19,791	15,339	14,076	11,848
Ore-Mine to Stockpile	kt	13,043	12,318	17,498	6,834	1,974	8,530	6,541	6,930	180	13	112	
Ore-Long Term Stockpile to Crusher	kt	5	1,344		2,135	35				70	3,457	4,319	7,210
Waste – Mine to WRF	kt	88,940	121,390	118,457	126,798	110,724	120,930	121,796	122,097	109,777	134,104	135,222	137,737
Waste (NAG) –Mine/Quarry to Rockfill MTO’s Foundation Prep.	kt												
Waste (NAG) –Mine/Quarry to Rockfill MTO’s Rock Drains	kt		841										
Waste (NAG) –Mine/Quarry to Rockfill MTO’s Roads	kt												
Waste-Mine to Backfill	kt												
Waste-Mine to Tailings Dam	kt	13,952				17,517				19,523			
Overburden-Mine to WRF	kt	6,427	472	0					159	565	118	152	401
Overburden-Mine to Backfill	kt												
Overburden-Mine to Tailings Dam	kt	585				30				164			
Overburden-Mine to North Overburden Stockpile	kt		130	70	245	51	190	478	199				
Overburden-Mine to South Overburden Stockpile	kt			255	886	156	687	1,730	1,295		427	438	
MTO's Ovb. Excavated Foundation Preparation	kt												
MTO's Ovb. Excavated Rock Drains	kt		44										
MTO's Ovb. Excavated Roads	kt												
Total Movement		**142,505**	**154,729**	**155,000**	**153,385**	**150,035**	**150,000**	**150,000**	**150,000**	**150,070**	**153,457**	**154,319**	**157,196**

Summary of Mine Production Schedule (Continued)

	Life of Mine (LOM)	17	18	19	20	21	22	23	24	25	26	27	Total
Material Type	**Unit**												
Ore-Mine to Crusher	kt	15,059	11,619	14,559	15,469	15,633	11,162	8,725	16,135	4,308			384,162
Ore-Mine to Stockpile	kt	4			6	2,774	4,327		201				120,649
Ore-Long Term Stockpile to Crusher	kt	4,380	7,880	4,978	4,160	2,983	7,129	10,476	3,057	15,182	19,550	16,956	120,650
Waste – Mine to WRF	kt	111,329	120,033	110,146	62,505	4,342			1	2			2,209,901
Waste (NAG) –Mine/Quarry to Rockfill MTO’s Foundation Prep.	kt												1,518
Waste (NAG) –Mine/Quarry to Rockfill MTO’s Rock Drains	kt												10,198
Waste (NAG) –Mine/Quarry to Rockfill MTO’s Roads	kt												1,046
Waste-Mine to Backfill	kt	5,000			72,000	127,230	104,011	65,523	40,663	8,676			423,103
Waste-Mine to Tailings Dam	kt	17,998											89,856
Overburden-Mine to WRF	kt	609	1,348	1,294	20	8							24,734
Overburden-Mine to Backfill	kt					13							13
Overburden-Mine to Tailings Dam	kt												779
Overburden-Mine to North Overburden Stockpile	kt												6,234
Overburden-Mine to South Overburden Stockpile	kt												10,362
MTO's Ovb. Excavated Foundation Preparation	kt												2,464
MTO's Ovb. Excavated Rock Drains	kt												504
MTO's Ovb. Excavated Roads	kt												4,279
Total Movement													**3,410,452**

Appendix B
Block Model Views

Figure 1: Year 2018 – N6878500, elevation 142 m. Ore is yellow

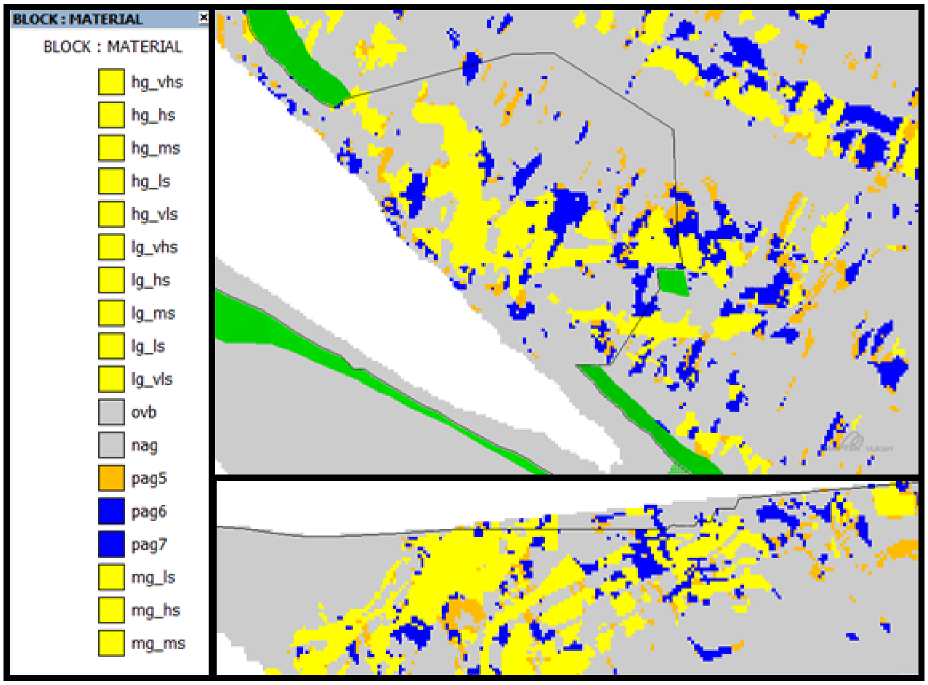

Figure 2: Year 2019 – N6878500, elevation 136 m. Ore is yellow

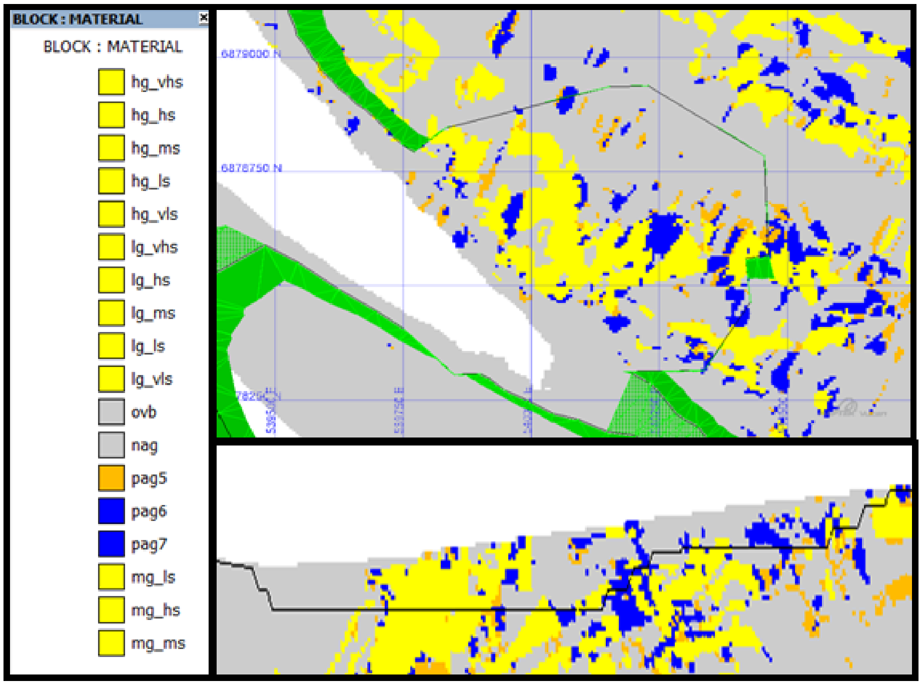

Figure 3: Year 2020 – N6878500, elevation 136 m. Ore is yellow

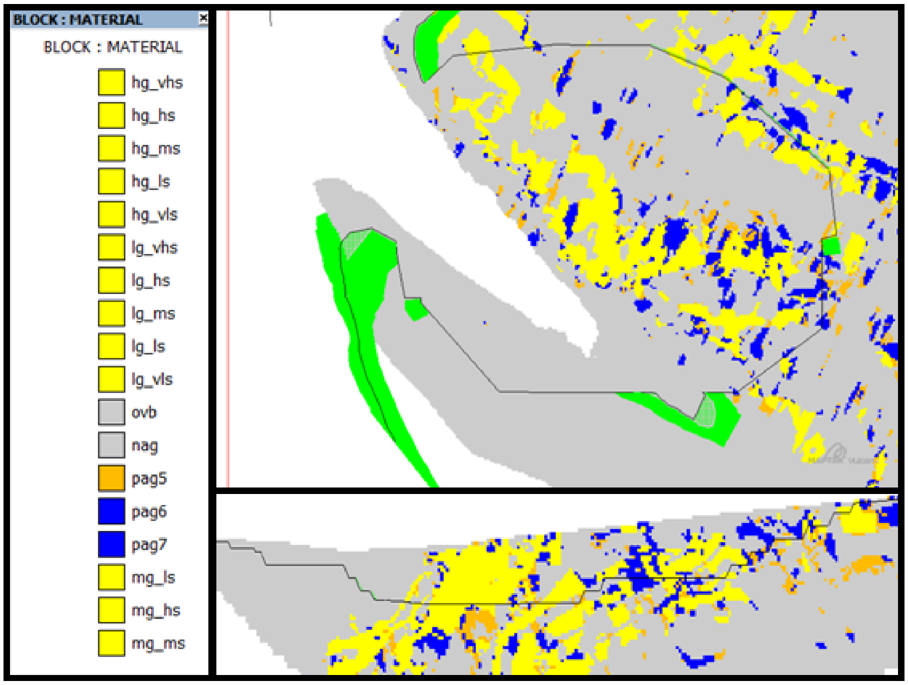

Figure 4: Year 2021 – N6878500, elevation 124 m. Ore is yellow

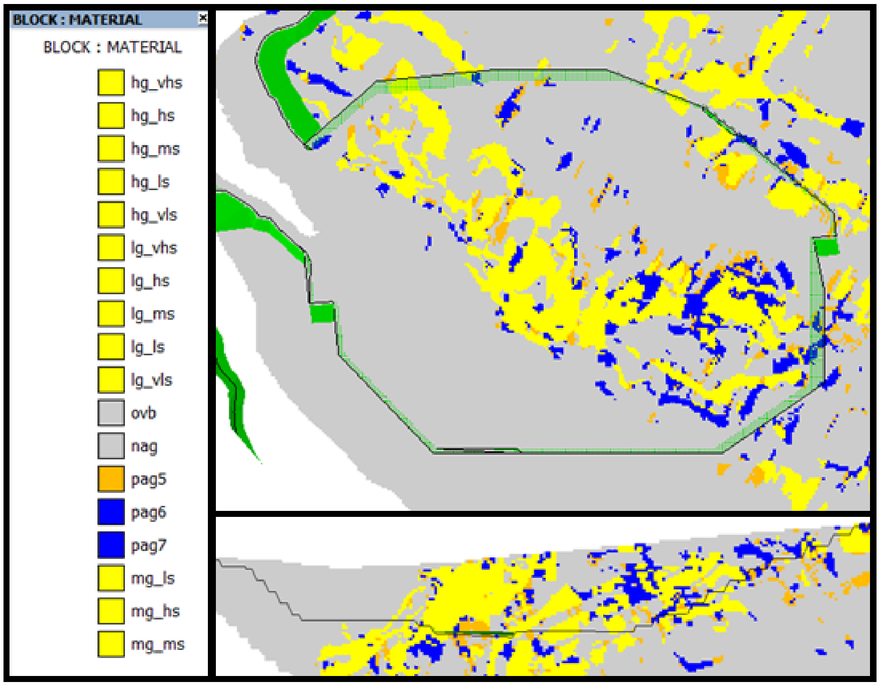

Figure 5: Year 2022 – N6878500, elevation 124 m. Ore is yellow

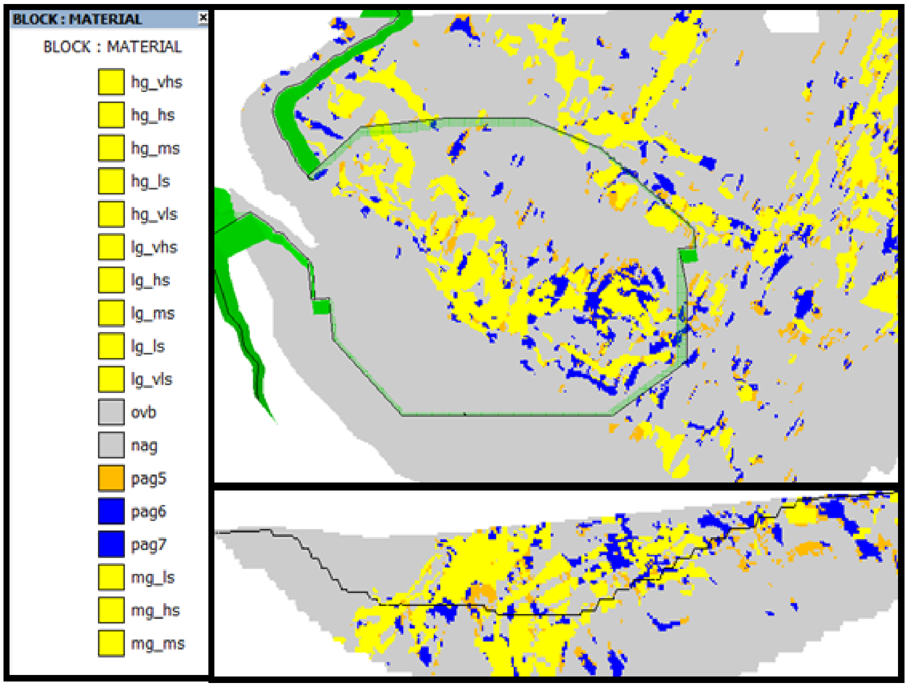

Figure 6: Year 2024 – N6878500, elevation 160 m. Ore is yellow

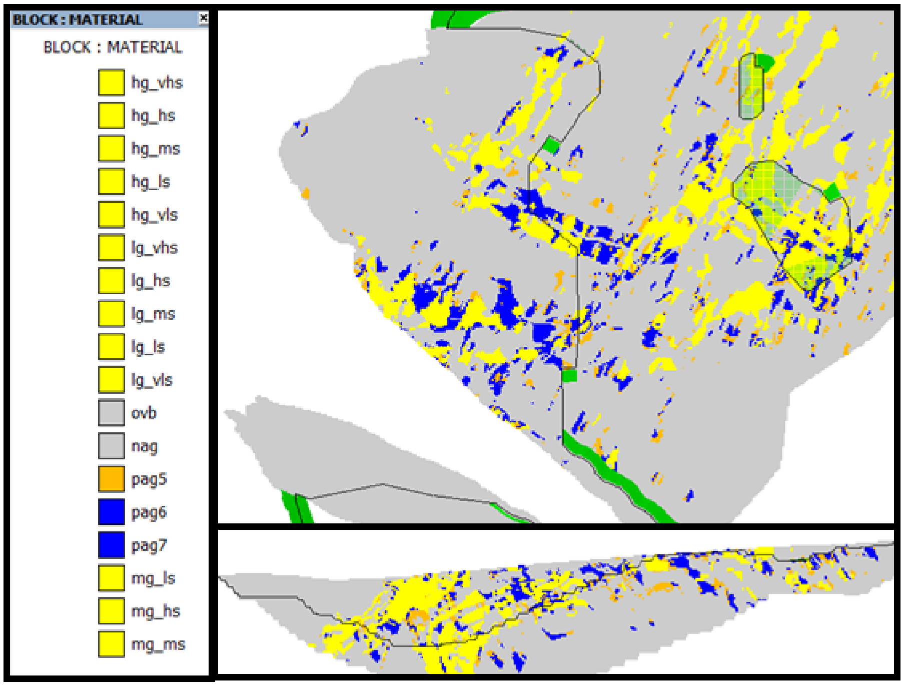

Figure 7: Year 2025 – N6878500, elevation 104 m. Ore is yellow

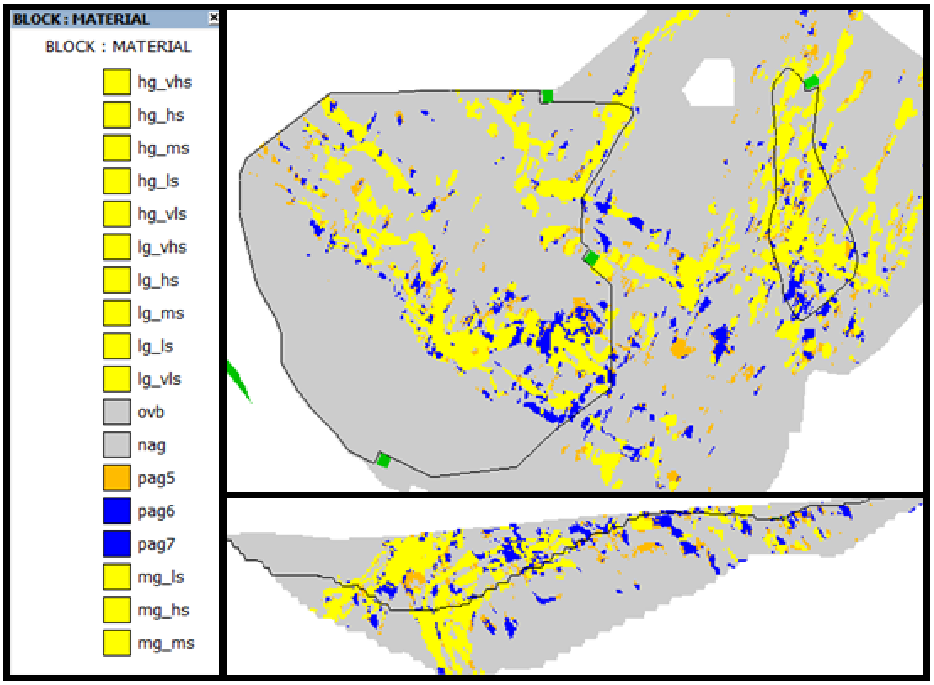

Figure 8: Year 2030 – N6878500, elevation 104 m. Ore is yellow

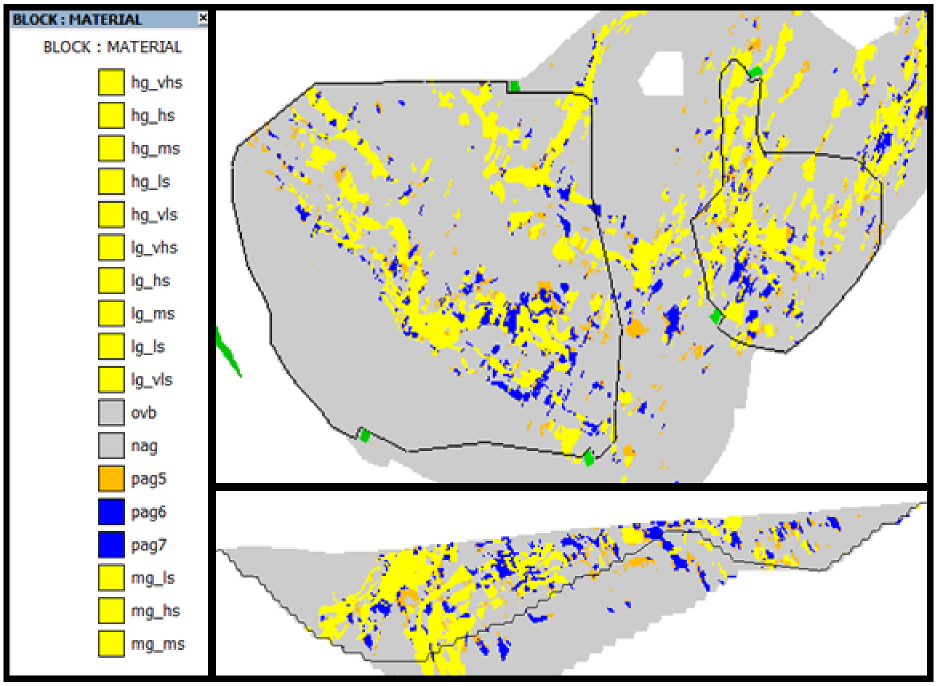

Figure 9: Year 2035 – N6878500, elevation 104 m. Ore is yellow

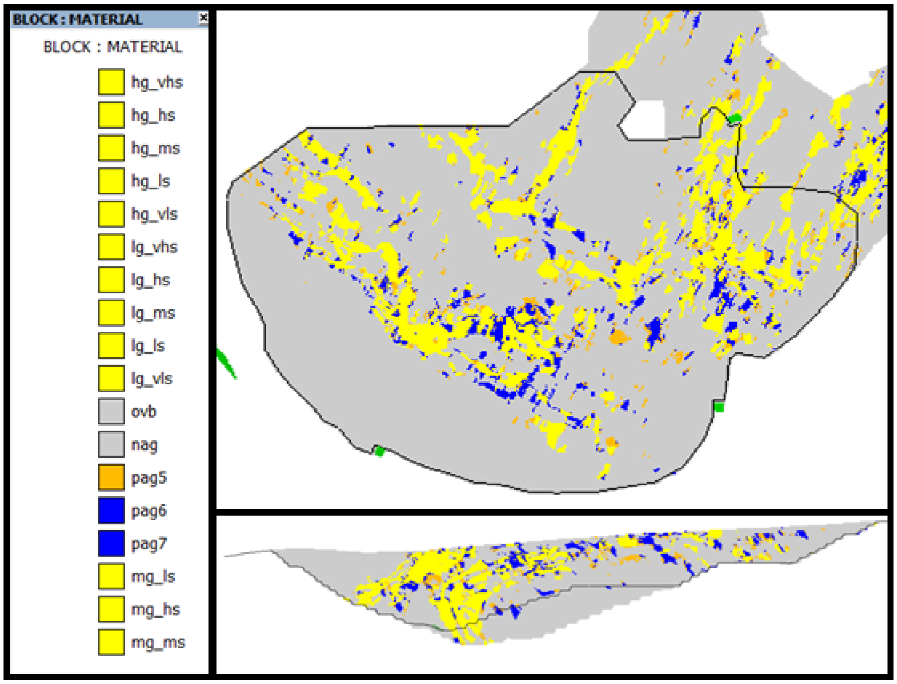

Figure 10: Year 2040 – N6878500, elevation 104 m. Ore is yellow