APPENDIX E

Geochemistry assessment and LPB Construction Rock Management Strategy

Evolution MINING

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Appendix E.1

Geochemistry assessment

COWAL GOLD OPERATIONS OPEN PIT CONTINUATION PROJECT

ENVIRONMENTAL GEOCHEMISTRY ASSESSMENT

April 2023

Prepared For:

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Executive Summary

As the owner-operator of the Cowal Gold Operations (CGO) located on the western shore of Lake Cowal, in the central west of New South Wales, Evolution Mining (Cowal) Pty Limited is seeking approval to expand the open pit mining operation through the Open Pit Continuation Project. This Project will involve an expansion of the existing E42 Pit (i.e. Stage I Cutback) and development of three additional open pits, the E46 Pit, E41 Pit and GR Pit. This environmental geochemistry assessment has been conducted by Geo-Environmental Management Pty Ltd (GEM) as a requirement of the environmental impact statement (EIS) for this Project.

Previous geochemical investigations indicated that:

- The waste rock and low-grade ore are expected to be non-acid forming (NAF). The oxide materials have high salinity and sodicity while the primary (fresh) materials typically have low salinity and sodicity.
- The tailings are also expected to be NAF. The oxide tailings typically have high salinity and, while the primary tailings are expected to only have low salinity, the salinity is expected to increase if these tailings are exposed to ongoing surface oxidation processes.
- The waste rock and low-grade ore are typically enriched in As and Sb and less commonly in Ag, Cd, Pb, Se and Zn. The tailings are typically enriched in As, Cd, Pb, Mo, Sb and Zn.

A total of 278 drill-hole samples representing the waste rock, low-grade ore and ore from the E42 (Stage I), E46, E41 and GR deposits, were included in this assessment program. The results were generally consistent with the previous findings. However, some of the primary waste rock, low-grade ore and ore samples from the E41 deposit are classified as potentially acid forming (PAF) or PAF low capacity (PAF-LC) and therefore it is predicted that some of the tailings from this deposit may also be PAF or PAF-LC.

The waste rock, low-grade ore and ore from these deposits are typically expected to be enriched in As and Sb, and less commonly in Ag, Cd and Se. Additional to these elements, Cu, Hg and Zn are expected to be enriched in some of the ore materials and therefore, it is predicted that the tailings from these deposits are likely to be enriched in As, Ag, Cd, Cu, Hg, Mo, Sb and Zn.

Waste Rock

Due to the potential impacts on revegetation success and water quality, and increased erosion/dispersion, the highly saline and/or sodic oxide waste rock should not be used for any site earthworks or construction. This material will need to be treated or suitably capped to ensure that it's not exposed on any outer waste rock emplacement (WRE) surfaces prior to revegetation.

Consistent with the open cut mining operations to-date, the waste rock is typically expected to be NAF and no selective handling will be required. However, due to the possibility of a small amount of PAF waste rock being encountered, there will be a requirement to ensure that no PAF material is placed within the outer 10 m of the intermediate or final WRE surfaces.

Low-Grade Ore and Ore Stockpiles

Although the low-grade ore and ore are typically expected to be NAF, a small amount of PAF or PAF/LC material may occur. Due to the reduced exposure period for any PAF or

PAF-LC that may occur within the ore stockpile/s, there is a reduced risk of developing acid conditions and no selective handling of this material will be required.

Tailings
Due to the increased risk of the tailings being PAF, it is recommended that a geochemical characterisation program be implemented for the future laboratory prepared, pilot plant, or process tailings, when available in order to confirm the presence of PAF materials.

E46 Pit Backfill Material
The option being assessed is to backfill the E46 Pit with primary waste rock from the E42 Pit and oxide waste rock from the GR Pit. The oxide waste rock is expected to be saline, NAF and barren, and the primary waste rock is expected to be non-saline, NAF and significantly acid consuming (AC).

The oxide and primary waste rock is typically expected to be enriched with As and Sb, and to a lesser extent with Ag, Cd and Se. Mo and Se are expected to be readily soluble under the quasi-neutral pH conditions.

Based on these findings, no special consideration will be required for backfilling the E46 Pit. However, it is recommended that the quality of the in-pit and diverted surface water is monitored during and post backfilling operations.

Lake Protection Bund Material
The suitable materials available on-site to extend the Lake Protection Bund (LPB) include the primary waste rock and the stockpiled scats produced during processing of the low-grade ore pebble material. Both of these materials are expected to have a neutral to slightly alkaline pH, and to be non- to slightly saline, non-sodic and NAF.

Water extract testing was used to identify any elements that are readily soluble in these materials under the prevailing neutral to slightly alkaline pH conditions. These results indicate that no elements are expected to be readily soluble in the scats materials and that the only elements that were found to be readily soluble in the primary waste rocks materials were Mo and Se.

Upon exposure of the waste rock materials to oxidation and infiltration during and post LPB construction, most of the contained elements are expected to remain insoluble due to the predicted near neutral to slightly alkaline pH conditions. However, Mo and to a lesser extent Se, may be flushed from the waste rock during construction of the LPB extension.

Water Quality Monitoring
The findings from these investigations are consistent with the existing water quality monitoring program, and it is recommended that this program is adopted for the proposed expanded mining areas. However, due to the predicted occurrence of PAF and PAF-LC material within some of the low-grade ore and ore, there will be a requirement to capture and monitor surface drainage from the low-grade ore and ore stockpiles, with the potential need to treat the discharge water prior to its release, if required.

Based on the use of the primary waste rock and/or scats to extend the LPB, it is recommended that the Lake Water Quality monitoring for the Project addresses the potential water quality risks posed by Mo and to a lesser extent Se, which are expected to be readily soluble under the existing pH conditions.

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1.0 Introduction

1.1 Background

Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of the Cowal Gold Operations (CGO), an existing open pit and underground gold mine approximately 38 kilometres (km) north-east of West Wyalong, in the central west region of New South Wales (NSW).

The CGO is located on the traditional lands of the Wiradjuri People and is immediately adjacent to the western shore of Lake Cowal, which is an ephemeral waterbody. The existing CGO mine is shown at a regional scale and local scale in Figure 1.1 and Figure 1.2, respectively.

CGO was first approved in 1999, and open pit mining operations commenced in 2005. Underground mining operations were approved in 2021 and development works to enable underground mining are underway.

As a requirement of the EIS, Geo-Environmental Management Pty Ltd (GEM) has conducted an environmental geochemistry assessment for the Project.

1.2 Project Overview

Evolution is seeking approval for further open pit mining operations at CGO through the Open Pit Continuation Project (the Project). The Project primarily seeks to continue the open pit operations by approximately 10 years to 2036 and extend the total mine life by approximately two years to 2042.

This will involve further development of the existing E42 Pit and the development of open pit mining in three adjacent orebodies, known as ‘E46’, ‘GR’ and ‘E41’. It is noted that the three new and adjacent ore bodies are within the existing mining lease (ML 1535). No change to the approved ore processing rate of 9.8 Mt per annum is proposed.

Other than the changes to existing approved activities as set out above, all activities that are currently approved under the existing Ministerial development consents are intended to continue. The existing activities approved under the consents are described in Chapter 3 of the EIS.

A detailed description of the Project is contained in Chapter 4 of the EIS and a conceptual Project layout is shown in Figure 1.3. The Project comprises the following key components:

- the continued operation of activities as approved under DA14/98 and SSD 10367;
- development of three new open satellite pits (the ‘E46’, ‘GR’ and ‘E41’ pits) to the north and south of the existing open pit, within the current approved mining lease;
- extending the existing open pit to the east and south via a ‘cutback’ within the current approved mine lease;

- extending open pit mining operations by approximately 10 years to 2036 and total mine life by approximately 2 years to 2042;
- expansion of the IWL to accommodate Project tailings;
- extension of the lake protection bund (LPB) system to provide continued separation and mutual protection between Lake Cowal and the mine;
- backfilling of one of the new open satellite pits (E46) with waste rock and establishment of a new waste rock emplacement on the backfilled pit to minimise the additional area required for waste rock disposal;
- expansion of the footprint of the existing WRE areas to accommodate additional waste rock;
- development of additional topsoil and subsoil stockpiles to accommodate materials from pre-stripping, with materials to be reused during progressive mine rehabilitation;
- upgrades to existing surface water drainage system, to assist with on-site water management and maximise on-site water conservation;
- modification of internal site access and haul roads;
- development of new water storages and relocation of some components of the surface water drainage system; and
- modification and relocation of some existing ancillary mining infrastructure.

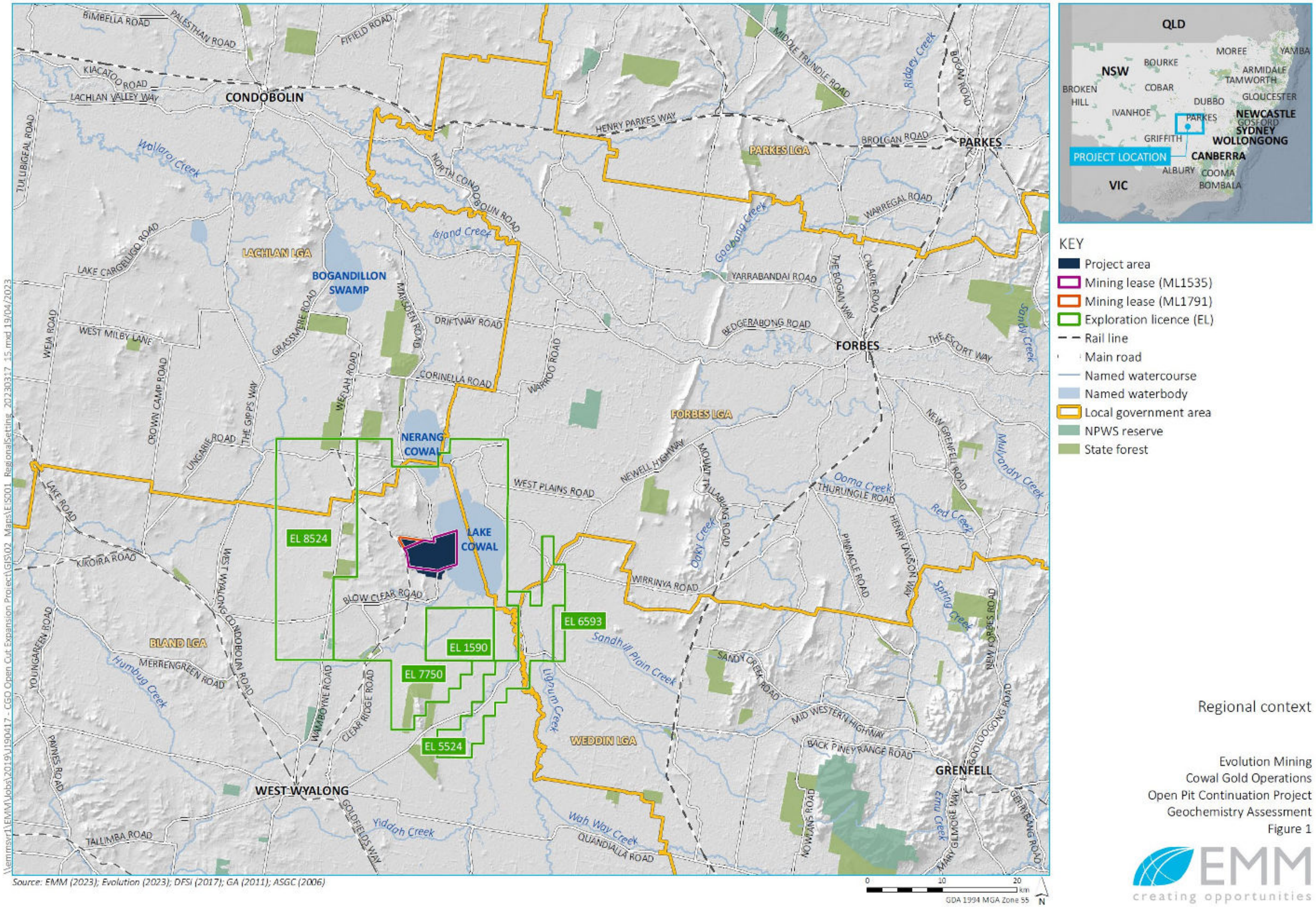
The Project will not change existing ore processing rates or methods, tailings disposal methods, main site access, water supply sources or hours of operation. The Project will also retain the existing open pit mining workforce.

1.3 Study Objectives

The objectives of this study include, but are not limited to, the following:

- Review the available information and previous geochemical investigations for the proposed Pit E42 cutback, and the E41, E46 and GR open pits, in order to identify the existing information available for the assessment and identify the additional testing that will be required.
- Review the relevant drill plans and logs and select the drill holes and intervals required to obtain representative samples of the main lithological and geochemical rock types present within the ore, low-grade ore and waste rock from the proposed open pit mining areas. (In the absence of any representative tailings samples from the target areas at the time of this assessment, selected ore samples will be used to provide an indication of the geochemical characteristics of the tailings.)
- Design the required testing program to assess the acid forming potential, salinity, sodicity, and element enrichment and solubility of the materials sampled, and coordinate the sample preparation and testing programs.
- Receive and tabulate the test results and evaluate the results in conjunction with the existing geochemical data.

- Assess the waste rock types identified suitability for construction of the LPB with reference to relevant geochemical criteria.
- Assess the potential geochemical implications for backfilling the E46 pit with waste rock, above and below the water table.
- Prepare a report on the geochemistry assessment describing the sampling and testing programs and providing the results and findings of this and previous assessments, including an evaluation of the salinity, sodicity, and acid and metalliferous drainage (AMD) risks for the ore, low-grade ore, tailings and waste rock, including waste rock types assessed to be suitable for construction of the LPB, in order to identify any implications for management and provide recommendations for geochemical security of the Open Pit Continuation Project.


QLD
NSW
VIC
BOURKE
MOREE
YAMBA
ARMIDALE
TAMWORTH
BROKEN HILL
COBAR
DUBBO
GLOUCESTER
IVANHOE
PARKES
NEWCASTLE
GOSFORD
SYDNEY
WOLLONGONG
GRIFFITH
PROJECT LOCATION
CANBERRA
ALBURY
COOMA
BOMBALA
KEY
Project area
Mining lease (ML1535)
Mining lease (ML1791)
Exploration licence (EL)
Rail line
Main road
Named watercourse
Named waterbody
Local government area
NPWS reserve
State forest
CONDOBOLIN
PARKES
FORBES
GRENFELL
WEST WYALONG
BOGANDILLON SWAMP
NERANG COWAL
LAKE COWAL
LACHLAN LGA
PARKES LGA
FORBES LGA
BLAND LGA
WEDDIN LGA
EL 8524
EL 1590
EL 7750
EL 5524
EL 6593
Regional context
Evolution Mining
Cowal Gold Operations
Open Pit Continuation Project
Geochemistry Assessment
Figure 1
Source: EMM (2023); Evolution (2023); DFSI (2017); GA (2011); ASGC (2006)
GDA 1994 MGA Zone 55
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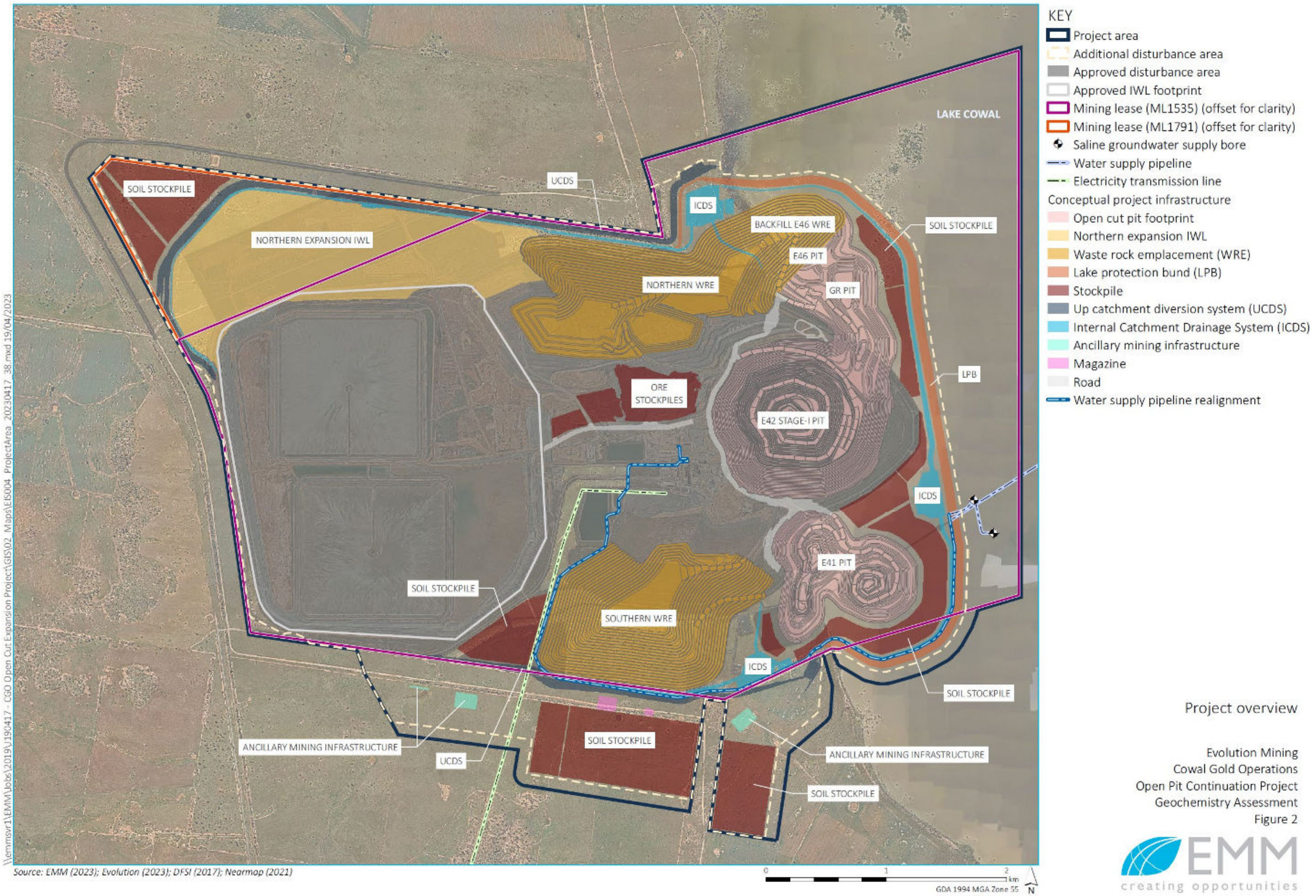
KEY
Project area
Additional disturbance area
Approved disturbance area
Approved IWL footprint
Mining lease (ML1535) (offset for clarity)
Mining lease (ML1791) (offset for clarity)
Saline groundwater supply bore
Water supply pipeline
Electricity transmission line
Conceptual project infrastructure
Open cut pit footprint
Northern expansion IWL
Waste rock emplacement (WRE)
Lake protection bund (LPB)
Stockpile
Up catchment diversion system (UCDS)
Internal Catchment Drainage System (ICDS)
Ancillary mining infrastructure
Magazine
Road
Water supply pipeline realignment
LAKE COWAL
SOIL STOCKPILE
UCDS
ICDS
BACKFILL E46 WRE
NORTHERN EXPANSION IWL
E46 PIT
NORTHERN WRE
GR PIT
ORE STOCKPILES
LPB
E42 STAGE-I PIT
E41 PIT
SOUTHERN WRE
ANCILLARY MINING INFRASTRUCTURE
Source: EMM (2023); Evolution (2023); DFSI (2017); Nearmap (2021)
0 1 2 km
GDA 1994 MGA Zone 55
N
Project overview
Evolution Mining
Cowal Gold Operations
Open Pit Continuation Project
Geochemistry Assessment
Figure 2
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2.0 Previous Geochemical Investigations

Prior to commencing mining at CGO, geochemical investigations were conducted by Environmental Geochemistry International Pty Ltd (EGi). These investigations were commissioned by North Limited and reported in the Cowal Gold Project EIS (North Limited, 1998). Subsequent geochemical investigations were commissioned by Barrick (Cowal) Limited (Barrick) to expand on the waste rock and tailings geochemical test results for mining operations, environmental management and closure planning (EGi, 2004). Since these investigations, a number of targeted geochemical investigations were conducted by GEM to address specific planning and approvals requirements, including the E42 Modification (GEM, 2008), the Augmentation Project (GEM, 2011a), the Extension Project Pre-Feasibility Study (GEM, 2011b), and the Extension Modification Project (GEM, 2013). Subsequently, GEM conducted a geochemical investigation to assist Evolution with approval of the Mine Life Modification (GEM, 2016) and the proposed underground mine development (GEM, 2020).

Table 1 provides an historical summary of the geochemical investigations carried out for CGO to-date. Sections 2.1 to 2.3 present a review of the geochemical characteristics of the waste rock, ore, low-grade ore and tailings, and the implications for environmental management and closure planning at CGO.

2.1 Salinity and Sodicity

The initial geochemical investigations (EGi, 1997) indicated that the primary (fresh) waste rock and tailings were expected to only have low salinity. However, due to the presence of reactive sulfides, the salinity of these materials was expected to increase with weathering. It was also reported that the oxide waste rock and tailings were expected to be moderately to highly saline and highly sodic. Subsequent investigations conducted by EGi and GEM (EGi, 2004; GEM, 2011a; GEM, 2011b; GEM, 2013; GEM, 2016; GEM, 2020) confirmed that the waste rock, ore, low-grade ore and tailings were expected to have low salinity and to be non-sodic, and that the oxide materials (i.e. saprock, saprolite, alluvium and transported material) were expected to have a moderate to high salinity and high sodicity.

2.2 Acid Forming Characteristics

The geochemical investigations carried out for the initial EIS (EGi, 1995; EGi, 1996; EGi, 1997) indicated that the primary (fresh) waste rock and tailings were expected to contain reactive sulfides, but due to a high acid neutralising capacity (ANC), these materials were expected to be non-acid forming (NAF). It was also reported that the oxide waste rock and tailings were expected to be NAF due to the relatively low reactive sulfide content. The later investigations conducted by EGi and GEM (EGi, 2004; GEM, 2011a; GEM, 2011b; GEM, 2013; GEM, 2016) confirmed that the waste rock, ore, low-grade ore and tailings contained reactive sulfides, but due to their high ANC, these materials were expected to be NAF. The oxide materials which were also confirmed to be NAF, were expected to have lower reactivity, due to the relatively low reactive sulfide and ANC.

Table 1: Geochemical investigations conducted for CGO to-date.

Geochemical Investigations	Samples Analysed	Test Work Conducted
Environmental Geochemical Assessment of Process Tailings, Mine Rock and Surface Zone Materials (EGi, 1995)	87 Mine Rock, Ore and Surface Materials	Salinity, ABA, NAG, Multi-Elements
	2 Tailings	Salinity, ABA, NAG, Multi-Elements, Leach Columns, CN Atten.
Environmental Geochemical Assessment of Simulated Tailings (EGi, 1996)	1 Oxide Tailings	ABA, NAG, Multi-Elements, CN Speciation and Decay
Environmental Geochemistry Assessment of Proposed Mining Activities (EGi, 1997) - Appendix C in the Cowal Gold Project EIS (North Limited, 1998)	4 Tailings	ABA, NAG, Multi-Elements, CN Decay, Leach Columns
	2 TSF Sub-Soils	ABA, Soil Chemistry, Attenuation Characteristics
	3 Construction Materials	ABA, Soil Chemistry
	2 Waste Rock Composites	Salinity, ABA, Sequential Batch Extraction
Final Void Water Chemistry (EGi, 1998)	1 Groundwater	Pit Water Chemistry Modelling
Geochemical Assessment of Waste Rock and Process Tailings (EGi, 2004)	100 Mine Rock and Ore	Salinity, ABA, NAG, Multi-Elements
	8 Tailings	ABA, NAG, Multi-Elements
Cowal Gold Mine E42 Modification, Tailings and Waste Rock Geochemical Assessment (GEM, 2008)	-	Review of existing data
Review of Cowal Gold Mine Cyanide Destruction (CSIRO Minerals, 2010)	5 Tailings	CN Speciation and Decay
Cowal Gold Mine Augmentation Project, Environmental Geochemistry Assessment of Waste Rock and Tailings (GEM, 2011a)	30 Mine Rock and Ore	Salinity, ABA, NAG, Multi-Elements
	5 Tailings (ex-mill)	Salinity, ABA, NAG, ABCC, Multi-Elements
	5 Tailings (discharge & deposited)	Salinity, ABA, NAG, Multi-Elements
	2 Tailings Decant	pH, Salinity, Multi-Element Composition
Cowal Gold Mine Extension Project Pre-Feasibility, Environmental Geochemistry Assessment of Waste Rock, Low-Grade Ore and Tailings (GEM, 2011b)	135 Waste Rock	Salinity, ABA, NAG, ABCC, Multi-Elements
	16 Low-Grade Ore	Salinity, ABA, NAG, ABCC, Multi-Elements
	30 Ore	Salinity, ABA, NAG, Multi-Elements
Cowal Gold Mine Extension Modification, Environmental Geochemistry Assessment of Waste Rock and Tailings (GEM, 2013)	54 Waste Rock	Salinity, ABA, NAG, Multi-Elements
	11 Low-Grade Ore	Salinity, ABA, NAG, Multi-Elements
	5 Ore	ABA, NAG, Multi-Elements
Cowal Gold Operations Mine Life Modification, Environmental Geochemistry Assessment of Waste Rock and Tailings (GEM, 2016)	10 Waste Rock	Salinity, ABA, NAG, Multi-Elements
	8 Ore	Salinity, ABA, NAG, Multi-Elements
Cowal Gold Operations Underground Development, Environmental Geochemistry Assessment (GEM, 2020)	34 U/G Development Waste Rock	Salinity, ABA, NAG, Multi-Elements
	18 Mine Rock	Salinity, ABA, NAG, Multi-Elements
	21 Ore and Low-Grade Ore	Salinity, ABA, NAG, Multi-Elements
Cowal Gold Operations Geochemical Assessment of Proposed Pebble Material Processing (GEM, 2020)	15 Process Residue Daily Composites	Salinity, ABA, NAG, Multi-Elements

ABA = Acid-Base Account, NAG = Net Acid Generation, ABCC = Acid Buffering Characteristic Curve

Although the assessment of mine rock, low-grade ore and ore from the proposed underground mining operations undertaken by GEM in 2020 indicated that these materials were typically expected to be NAF, a small amount of potentially acid forming (PAF) material was identified within the ore material (GEM, 2020). Due to the potential occurrence of PAF ore, it was identified that the tailings derived from these materials may also present a risk of being PAF, and based on these findings the following recommendations were provided:

Further geochemical characterisation of the ore should be undertaken to determine the nature (reactivity), quantity and distribution of PAF material within the orebody targeted by the proposed underground operations in order to ensure that no PAF materials are left exposed on the surface of the ore stockpiles, creating a risk of developing low pH conditions, with increased salinity and/or metal release.

When available, the tailings generated from the proposed underground mining operations (e.g. pilot plant or CHPP trials) should be subjected to a detailed geochemical characterisation program in order to confirm the expected range in geochemical characteristics of the tailings, and once operational a routine geochemical characterisation program should be implemented in order to monitor the occurrence of PAF tailings and provide information for preparing an inventory of geochemical material types deposited within the TSFs and for closure planning.

2.3 Metal Enrichment and Solubility

Elemental analyses carried out for the original EIS on selected waste rock, ore, low-grade ore and tailings samples (EGi, 1995; EGi, 1996; EGi, 1997) and subsequent analyses (EGi, 2004; GEM, 2011a; GEM, 2011b; GEM, 2013; GEM, 2016; GEM, 2020) indicated that the majority of the waste rock and low-grade ore were expected to have high concentrations of arsenic (As) and that some of these materials were also expected to have high concentrations of silver (Ag), cadmium (Cd), lead (Pb), selenium (Se), antimony (Sb) and zinc (Zn). These investigations also predicted high concentrations of As, Cd, Pb, molybdenum (Mo), Sb and Zn in the oxide and primary tailings.

Early investigations included the potential release of environmentally significant elements from waste rock and tailings (EGi, 1995 and 1997). Sequential batch water extractions indicated that leaching of environmentally important elements from waste rock at the CGO was unlikely to be of concern provided near neutral pH values were maintained, and column leach tests carried out on the tailings identified an initial flush of soluble copper (Cu) and Zn from the primary tailings could be expected. However, it was concluded that this release was most likely associated with the residual cyanide (CN) in the tailings liquor from the carbon-in-leach (CIL) processing procedure and did not represent a long-term concern for water quality.

3.0 Geochemical Assessment Program

With the knowledge that the GCO ore and mine waste materials (tailings, low-grade ore and waste rock), typically have moderate sulfur (S) and moderate to high ANC, with the primary material containing reactive S and the oxide material containing sulfate salts resulting in high salinity, and characteristic high sodicity, the geochemical assessment program for the Project was designed to identify the presence and distribution of any acid generating materials within the ore, low-grade ore and waste rock from the proposed open pit areas, and to assess the salinity, sodicity and metal release risks associated with the Project. No tailings samples representing the proposed mine areas of the Project were available at the time of this assessment and therefore the characteristics of the ore samples were used to predict the likely geochemical characteristics of the tailings.

3.1 Testing Methodology

The analytical program for this assessment included the following standard static geochemical tests and procedures:

- pH and electrical conductivity (EC) determination (all samples);
- total sulfur (S) assay (all samples);
- sulfide S analysis (selected samples);
- ANC determination (all samples);
- single addition net acid generation (NAG) test (all samples);
- kinetic NAG test (selected samples);
- acid buffering characteristic curve (ABCC) determination (selected samples);
- exchangeable cation analysis (selected samples); and
- multi-element scans on solids and water extracts (selected samples).

The analytical laboratories used for these analyses included:

- Australian Laboratory Services Pty Ltd (Brisbane Laboratory)
- Environmental Geochemistry International Pty Ltd,
- Genalysis Laboratories Pty Ltd.

Following is an overview of the tests and procedures used for this assessment.

3.1.1 pH, Salinity and Sodicity Determination

pH and Electrical Conductivity Determination

The sample pH and EC is determined by equilibrating a solid sample in deionised water for a minimum of two hours. Variations include mixing the solids with water at a ratio of 1:2 or 1:5 by weight (w/w), or as a saturated paste. Typically, a ratio of 1:2 is used for providing an indication of the inherent acidity and salinity of a material when it is initially exposed. The salinity rankings based on EC values from 1:5 extracts ($EC_{1:5}$), 1:2 extracts ($EC_{1:2}$) and saturation extracts (EC_{sat}) are provided below in Table 2.

Table 2: Electrical conductivity and corresponding salinity rankings for solid samples equilibrated in deionised water.

$EC_{1:5}$ (dS/m)	$EC_{1:2}$ (dS/m)	EC_{sat} (dS/m)	Salinity
< 0.2	< 0.5	< 2.0	Non-Saline
0.2 to 0.3	0.5 to 1.5	2 to 4.0	Slightly Saline
0.3 to 0.4	1.5 to 2.5	4 to 8.0	Moderately Saline
> 0.4	> 2.5	> 8.0	Highly Saline

Source: Rhoades *et al*. (1999)

Exchangeable Cation Analysis

Exchangeable cation analyses are carried out to determine the cation exchange capacity (CEC) and sodicity of a sample. Sodicity occurs in materials that have high concentrations of exchangeable Sodium (Na) relative to the other major cations Calcium (Ca) and Magnesium (Mg), causing the material to be highly dispersive. The Exchangeable Sodium Percent (ESP) is used to determine the sodicity by comparing the amount of exchangeable Na to Ca and Mg concentrations. The ESP is used to rank materials according to sodicity and likely dispersion characteristics (Table 3).

Table 3: ESP ranking criteria, and the respective sodicity and dispersion characteristics.

ESP	Sodicity	Dispersion
< 6	Non-Sodic	Not Dispersive
6 to 15	Slightly Sodic	Slightly Dispersive
15 to 30	Moderately Sodic	Moderately Dispersive
> 30	Highly Sodic	Highly Dispersive

3.1.2 Acid Forming Characteristic Evaluation

A number of test procedures are used to assess the acid forming characteristics of mine waste materials. The most widely used assessment methods are the ABA and the NAG test. These methods are referred to as static procedures because each involves a single measurement in time.

Acid-Base Account

The ABA involves laboratory procedures that evaluate the balance between acid generation processes (oxidation of sulfide minerals) and acid neutralising processes (dissolution of alkaline carbonates, displacement of exchangeable bases, and weathering of silicates). The values arising from the ABA are referred to as the maximum potential acidity (MPA) and the ANC, respectively. The difference between the MPA and ANC value is referred to as the NAPP.

The MPA is calculated using the total sulfur content of the sample. This calculation assumes that all of the sulfur measured in the sample occurs as pyrite (FeS_2) and that the pyrite reacts under oxidising conditions to generate acid according to the following reaction:

$$FeS_2 + 15/4\ O_2 + 7/2\ H_2O \Rightarrow Fe(OH)^3 + 2\ H_2SO_4$$

According to this reaction, the MPA of a sample containing 1 %S as pyrite would be 30.6 kilograms of H_2SO_4 per tonne of material (i.e. kg H_2SO_4/t). Hence the MPA of a sample is calculated from the total sulfur content using the following formula:

$$MPA\ (kg\ H_2SO_4/t) = (Total\ \%S) \times 30.6$$

The use of the total sulfur assay to estimate the MPA is a conservative approach because some sulfur may occur in forms other than pyrite. Sulfate sulfur and native sulfur, for example, are non-acid generating sulfur forms. Also, some sulfur may occur as other metal sulfides (e.g. covellite, chalcocite, sphalerite and galena) that yield less acidity than pyrite when oxidised.

The acid formed from pyrite oxidation would to some extent react with acid neutralising minerals contained within the sample. This inherent acid neutralisation is quantified in terms of the ANC and is determined using the Modified Sobek method. This method involves the addition of a known amount of standardised hydrochloric acid (HCl) to an accurately weighed sample, allowing the sample time to react (with heating), then back titrating the mixture with standardised sodium hydroxide to determine the amount of unreacted HCl. The amount of acid consumed by reaction with the sample is then calculated giving the ANC expressed in the same units as the MPA, which is kg H_2SO_4/t.

Determination of the ANC using the Modified Sobek provides an indication of the total neutralisation capacity of a material. However, in some materials not all mineral phases would be readily available to neutralise sulfide generated acidity. For these material types ABCCs can be used to determine the amount of ANC that is available to neutralise any sulfide generated acidity under more natural weathering conditions. The ABCCs are obtained by slow titration of a sample with acid while continuously monitoring pH and plotting the amount of acid added against pH. Careful evaluation of the plot provides an indication of the portion of ANC within a sample that is readily available for acid neutralisation.

The NAPP is a theoretical calculation commonly used to indicate if a material has the potential to produce acid. It represents the balance between the capacity of a sample to generate acid (MPA) and its capacity to neutralise acid (ANC). The NAPP is also expressed in units of kg H_2SO_4/t and is calculated as follows:

$$NAPP = MPA - ANC$$

If the MPA is less than the ANC then the NAPP is negative, which indicates that the sample may have sufficient ANC to prevent acid generation. Conversely, if the MPA exceeds the ANC then the NAPP is positive, which indicates that the material may be acid generating.

The ANC/MPA ratio is used as a means of assessing the risk of acid generation from mine waste materials. A positive NAPP is equivalent to an ANC/MPA ratio less than 1, and a negative NAPP is equivalent to an ANC/MPA ratio greater than 1. Generally, an ANC/MPA ratio of 3 or more signifies that there is a high probability that the material is not acid generating.

Figure 3 is an ABA plot which is commonly used to provide a graphical representation of the distribution of sulfur and ANC in a sample set. The plotted line shows where the NAPP = 0 (i.e. ANC = MPA or ANC/MPA=1). Samples that plot to the lower-right of this line have a positive NAPP and samples that plot to the upper left of it have a negative NAPP. Figure 3 also shows the plotted lines corresponding to ANC/MPA ratios of 2 and 3.

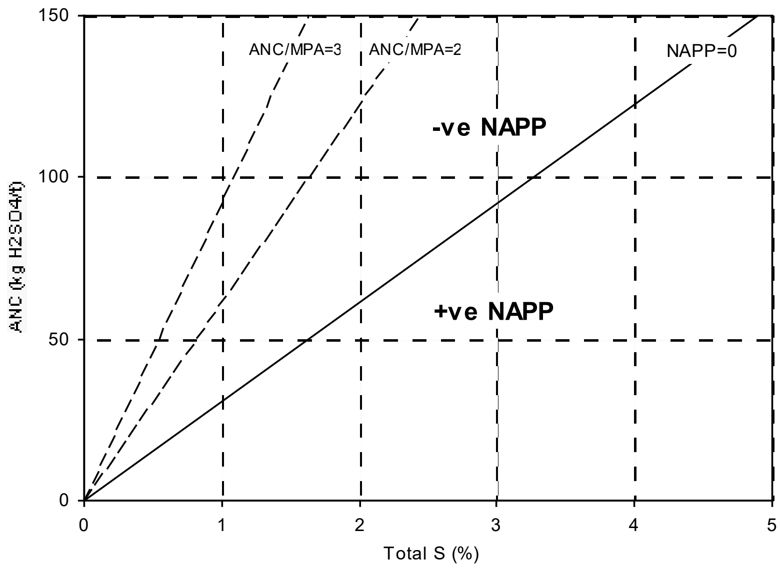

Figure 3: Acid-base account plot

Net Acid Generation Test

The single addition NAG test is used in association with the NAPP to classify the acid generating potential of a sample. The standard (single addition) NAG test involves reaction of a sample with hydrogen peroxide to oxidise any sulfide minerals contained within a sample. During the NAG test, acid generation and neutralisation reactions occur simultaneously and the end result represents a direct measurement of the net amount of acid generated by the oxidised sample. The pH of the NAG solution on completion of the oxidation reaction is referred to as the NAGpH. A NAGpH < 4.5 indicates that acid conditions remain after all acid generating and acid neutralising reactions have taken place and a NAGpH > 4.5 indicates that any generated acidity has been neutralised. An indication of the capacity of the sample to generate acid is provided by titrating the NAG solution to the pH end-points of 4.5 and 7.0. This value is commonly referred to as the NAG capacity and is expressed in the same units as the NAPP (i.e. kg H_2SO_4/t). The titration value at pH 4.5 includes the acidity produced due to free acid (i.e. H_2SO_4) as well as soluble iron and aluminium. The titration value at pH 7 also includes metallic ions that precipitate as hydroxides.

The kinetic NAG test uses the same procedure as the single addition NAG test except that the temperature and pH of the solution are recorded. Variations in these parameters during the test provide an indication of the kinetics of sulfide oxidation and acid generation during the test. This, in turn, can provide an insight into the behaviour of the material under field conditions. For example, the pH trend gives an estimate of relative reactivity and may be related to prediction of lag times and oxidation rates similar to those measured in leach columns. Also, sulfidic samples commonly produce a temperature excursion during the NAG test due to the decomposition of the peroxide solution, catalysed by sulfide surfaces and/or oxidation products.

3.1.3 Multi-Element Analysis

Multi-element scans are primarily carried out on solid samples to identify any elements that are present at concentrations that may be of environmental concern with respect to water quality and revegetation. The assay results from the solid samples are compared to the average crustal abundance for each element to provide a measure of the extent of element enrichment. The extent of enrichment is reported as the Geochemical Abundance Index. However, identified element enrichment does not necessarily mean that an element will be of concern for revegetation, water quality or public health, and is used to identify any significant element enrichments that warrant further examination.

Multi-element scans are also performed on liquor samples to determine the chemical composition of the solution and identify any elemental concerns for water quality.

3.2 Geochemical Classification

The acid forming potential of a sample is classified on the basis of the ABA and NAG test results into one of the following categories:

- Barren;
- Non-Acid Forming (NAF);
- Potentially Acid Forming (PAF);
- Acid Consuming (AC); and
- Uncertain (UC).

Barren
A sample classified as barren is essentially devoid of any acid generating or acid buffering capacity. This commonly applies to highly weathered materials. In essence, it represents an 'inert' material with respect to acid generation. The criteria used to classify a sample as barren typically applies to materials with a total S content ≤ 0.1%S and an ANC ≤ 10 kg H_2SO_4/t.

Non-Acid Forming
A sample classified as NAF contains sufficient available ANC to neutralise all the acid that could be produced by the contained sulfide minerals. As such, material classified as NAF is considered unlikely to be a source of acidic drainage. A sample is usually defined as NAF when it has a negative NAPP and a final NAGpH ≥ 4.5.

Potentially Acid Forming

A sample classified as PAF always has a significant S content, the acid generating potential of which exceeds the inherent acid neutralising capacity of the material. This means there is a high risk that such a material, even if pH circum-neutral when freshly mined or processed, could oxidise and generate acidic drainage if exposed to atmospheric conditions. A sample is usually defined as PAF when it has a positive NAPP and a final NAGpH < 4.5. Typically, if a PAF sample has a NAPP and or NAG capacity, when titrated to pH 4.5, of ≤ 5 kg H_2SO_4/t, it is considered to only have a low capacity to generate acid and is classified as PAF-LC.

Acid Consuming

A sample is classified as AC if it has the same characteristics as NAF material, but has sufficient ANC to result in a NAPP of ≤ minus 100 kg H_2SO_4/t.

Uncertain

An uncertain classification is used when there is an apparent conflict between the NAPP and NAG results (i.e. when the NAPP is positive and NAGpH > 4.5, or when the NAPP is negative and NAGpH ≤ 4.5).

Figure 4 shows a typical geochemical classification plot for mine waste materials where the NAPP values are plotted against the NAGpH values. Samples that plot in the upper left quadrate, with negative NAPP values and NAGpH values greater than 4.5, are classified as NAF and those with NAPP values ≤ minus 100 kg H_2SO_4/t are classified as AC. Samples that plot on the lower right quadrate, with positive NAPP values and NAGpH values of 4.5 or less, are classified as PAF, while those that plot in the upper right or lower left quadrates of this plot have an uncertain geochemical classification (UC) due to a contradiction in the acid-base and NAG test results. Further testing is required to determine the geochemical classification of these material types.

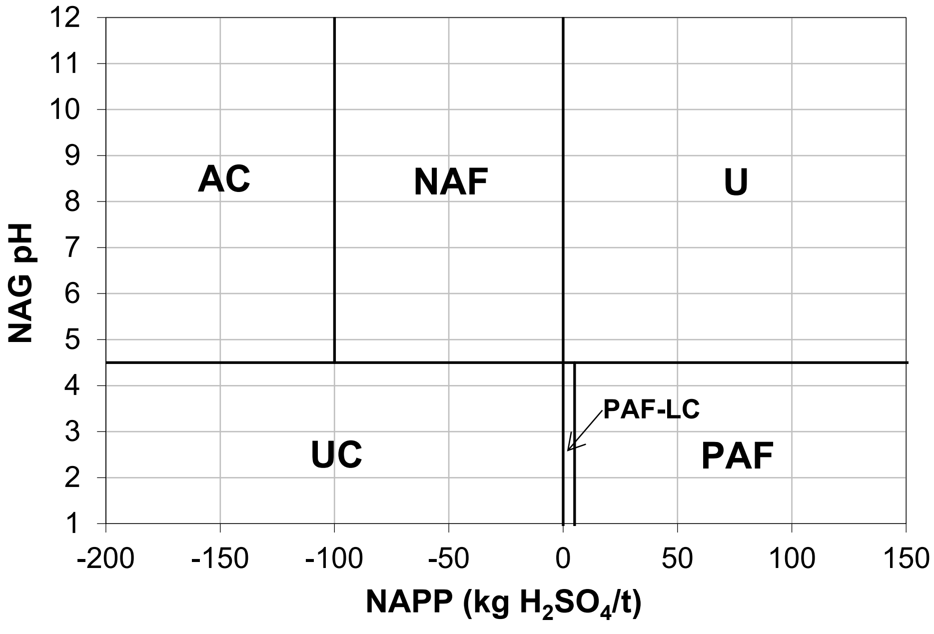

Figure 4: Geochemical classification plot.

3.3 Sample Selection and Preparation

The previous test results from 151 samples representing the low-grade ore and waste rock collected from 10 drill-holes intersecting the Project areas, including the Pit E42 Stage I cutback (E42-SI) and proposed pit areas for the E41 East (E41-E), E41 West (E41-W), E46 and Galway Regal (GR) deposits, were utilised for this assessment. The sample collection, preparation and analytical procedures for these samples are provided in the Cowal Gold Mine Extension Project Pre-Feasibility Study – Environmental Geochemistry Assessment of Waste Rock, Low-Grade Ore and Tailing, August 2011 report. prepared by GEM (GEM, 2011).

Additional to the previous test results, 127 samples representing the ore, low-grade ore and waste rock were collected from an additional 11 drill-holes intersecting the Project areas, for this assessment. These samples were collected by Evolution personnel under instruction from GEM. The drill-holes and sample intervals were selected in order to provide representative samples of the major lithologies occurring as waste rock, low-grade ore and ore material through the E42 Stage I cutback and the proposed satellite pit areas, E41-E, E41-W, E46 and GR. Depending on the selected sample interval thickness, the sample weights typically ranged from 1 to 5 kilograms (kg). Each sample was crushed to <4 millimetres (mm) and a 500 gram (g) sub-sample pulverised to <75 micrometres (µm) for analysis.

The drill-hole locations and sample details are provided in Attachment A (Figure A1 and Table A1) and a summary of the sample material types collected from the cutback and proposed pit areas, is provided in Table 4. The material types assessed include the primary lithologies occurring as waste rock and the low-grade ore and ore material.

Table 4: Summary of drill-hole samples included in the assessment program for the E42 cutback and new pit areas.

Material Type Sampled	Cutback/Pit				
	E42-SI	E41-E	E41-W	E46	GR
Alluvial	-	10	6	18	5
Saprolite	3	4	3	5	2
Saprock	5	18	9	5	9
Volcaniclastic	3	3	-	6	18
Intrusives	2	20	25	17	1
Extrusives	-	1	-	3	4
Fault/Shear Zone	1	5	2	1	1
Low-Grade Ore	1	12	9	9	6
Ore	-	10	10	2	4
All Lithologies	**15**	**83**	**64**	**66**	**50**

4.0 Waste Rock, Low-Grade Ore and Ore Geochemistry

The geochemical test results for the waste rock, low-grade ore and ore samples are provided in Attachment B for the pH, EC and acid forming characteristics, in Attachment C for the exchangeable cations, CEC and ESP results, and in Attachment D for the multi-element scans. A summary of the pH, EC and acid forming characteristics for the ore, low-grade ore and waste rock samples, and for the primary waste rock types is provided in Table 5.

Table 5: Summary of the pH, EC and acid forming characteristics for the ore, low-grade ore and waste rock samples.

Material Type		$pH_{1:2}$	$EC_{1:2}$ (dS/m)	Total S (%S)	MPA (kg H_2SO_4/t)	ANC	NAPP	NAGpH
All Material Types	*Min*	5.6	0.030	0.01	0	0	-287	2.6
	Max	9.7	12.019	3.90	119	287	43	11.6
(278 Samples)	*Aver*	8.3	1.375	0.40	12	49	-36	8.9
Ore	*Min*	6.7	0.053	0.01	0	1	-106	2.6
	Max	9.7	1.697	3.90	119	148	30	11.5
(26 Samples)	*Aver*	9.0	0.271	1.13	34	62	-28	9.8
Low-Grade Ore	*Min*	6.2	0.065	0.01	0	0	-204	2.6
	Max	9.5	9.510	3.64	111	242	43	11.3
(37 Samples)	*Aver*	8.3	1.015	0.71	22	58	-36	8.9
Waste Rock	*Min*	5.6	0.030	0.01	0	0	-287	2.6
	Max	9.7	12.019	2.12	65	287	27	11.6
(215 Samples)	*Aver*	8.3	1.571	0.26	8	45	-38	8.8
Alluvial	*Min*	5.6	0.057	0.01	0	0	-11	6.3
	Max	8.5	10.360	0.07	2	12	1	8.4
(39 Samples)	*Aver*	7.3	2.332	0.03	1	4	-3	7.2
Saprolite	*Min*	5.6	0.038	0.01	0	0	-4	5.8
	Max	7.7	12.019	0.08	2	5	1	7.9
(17 Samples)	*Aver*	6.5	3.870	0.03	1	2	-1	6.6
Saprock	*Min*	5.8	0.030	0.01	0	0	-287	6.0
	Max	9.2	11.827	0.22	7	287	1	9.2
(46 Samples)	*Aver*	7.1	3.019	0.03	1	16	-15	8.0
Volcaniclastic	*Min*	8.3	0.079	0.01	0	27	-152	2.6
	Max	9.4	0.691	1.80	55	163	27	10.8
(30 Samples)	*Aver*	8.8	0.451	0.34	11	72	-62	9.5
Intrusives	*Min*	7.4	0.067	0.01	0	11	-262	6.0
	Max	9.6	1.279	1.86	57	269	0	11.6
(65 Samples)	*Aver*	8.8	0.288	0.45	14	74	-60	10.4
Extrusives	*Min*	8.1	0.112	0.41	13	40	-123	8.6
	Max	9.3	0.577	2.12	65	141	6	10.9
(8 Samples)	*Aver*	8.7	0.330	0.92	28	62	-33	10.1
Fault/Shear Zone	*Min*	8.0	0.067	0.06	2	76	-176	9.3
	Max	9.7	2.044	1.20	37	191	-70	11.4
(10 Samples)	*Aver*	8.5	0.723	0.54	17	137	-120	10.8

NOTE: Average values for $pH_{1:2}$ and NAGpH are median values

4.1 pH, Salinity and Sodicity

The $pH_{1:2}$ of these samples ranges from 5.6 to 9.7 and is typically slightly to moderately alkaline with median values of 9.0 for the ore samples, and 8.3 for the waste rock and low-grade ore samples. The pH of the primary waste rock types, including the volcaniclastics, intrusives, extrusives and fault/shear zone materials, is typically slightly alkaline with $pH_{1:2}$ values ranging from 7.4 to 9.7 and median values ranging from 8.5 to 8.8. Differing from this, the pH of oxide waste rock types, including the alluvials, saprolite and saprock, is lower with $pH_{1:2}$ values ranging from 5.6 to 9.2 and median values ranging from 6.5 to 7.3.

The $EC_{1:2}$ values for these samples ranges widely from 0.030 to 12.019 dS/m, with median values from 0.288 to 3.870 dS/m. The primary waste rock types, with median $EC_{1:2}$ values from 0.288 to 0.723 dS/m are typically expected to be non-saline to slightly saline, while the oxide waste rock types, with median $EC_{1:2}$ values from 2.332 to 3.870 dS/m are typically expected to be moderately to highly saline.

A total of 52 samples representing the range of waste rock types within the Project areas were selected for exchangeable cations and cation exchange capacity analyses (CEC), and determination of the exchangeable sodium percent (ESP). The results from these analyses are provided in Attachment C (Table C1) and the ESP is plotted against the $EC_{1:2}$ values on Figure 5. These results indicate that the oxide waste rock types, including the alluvials, saprolite and saprock, typically have ESP >15% and are expected to be moderately to highly sodic, and that the primary waste rock types, including the volcaniclastics, intrusives, extrusives and fault/shear zone materials, typically have ESP <15% and are expected to be non-sodic to slightly sodic.

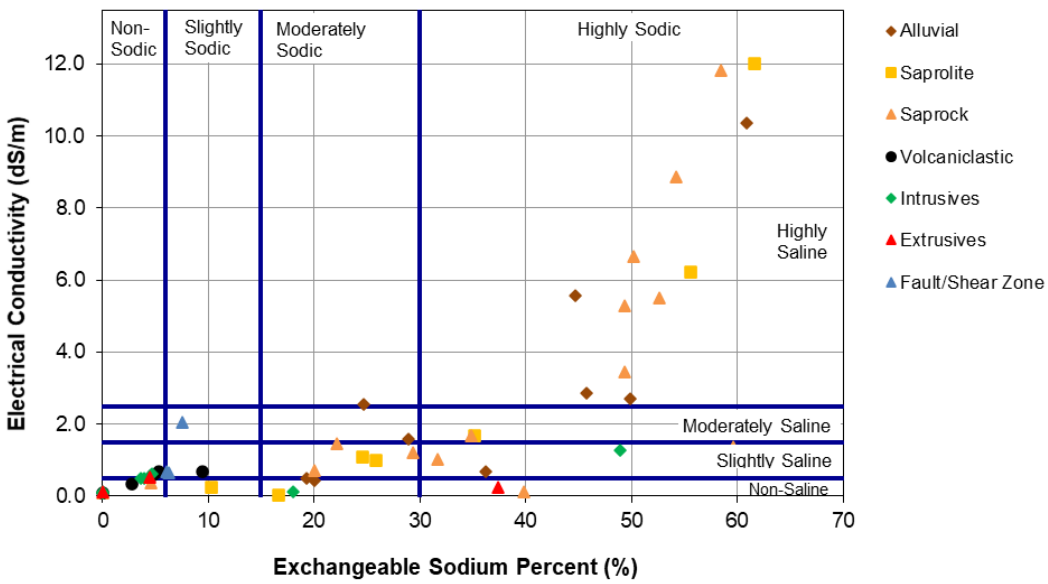

Figure 5: Salinity and sodicity ranking for selected samples representing the range of waste rock types within the E42 cutback and new pit areas.

4.2 Acid Forming Characteristics

The acid forming characteristics of the drill-hole samples from each of the Project areas are provided in Attachment B (Tables B1 to B5) and additional to the acid forming characteristics for the ore, low-grade ore and waste rock provided in Table 5, the acid forming characteristics according to the major material type within each Project area are provided in Table 6.

Table 6: Summary of the pH, EC and acid forming characteristics for the major material types within the E42 cutback and new pit areas.

Material Type		$pH_{1:2}$	$EC_{1:2}$ (dS/m)	Total S (%S)	MPA (kg H_2SO_4/t)	ANC	NAPP	NAGpH
E42 Stage I Cutback	*Min*	7.2	0.354	0.01	0	1	-287	6.3
	Max	9.2	6.022	0.49	15	287	1	9.0
(15 Samples)	*Aver*	8.0	2.318	0.10	3	52	-49	7.2
Saprolite	*Min*	7.3	2.861	0.03	1	1	-1	6.3
	Max	7.7	6.022	0.04	1	2	1	7.9
(3 Samples)	*Aver*	7.5	4.913	0.04	1	1	0	6.4
Saprock	*Min*	7.2	0.704	0.01	0	3	-287	-
	Max	9.2	5.299	0.02	1	287	-3	-
(5 Samples)	*Aver*	7.6	2.721	0.01	0	67	-67	-
Volcaniclastic	*Min*	8.4	0.453	0.14	4	27	-71	9.0
	Max	8.6	0.603	0.38	12	76	-16	9.0
(3 Samples)	*Aver*	8.5	0.537	0.27	8	48	-39	9.0
Intrusives	*Min*	8.5	0.354	0.01	0	51	-52	-
	Max	8.6	0.366	0.01	0	53	-51	-
(2 Samples)	*Aver*	8.6	0.360	0.01	0	52	-51	-
Fault/Shear Zone (1 Sample)		8.4	0.595	0.49	15	186	-171	-
Low-Grade Ore (1 Sample)		7.7	3.498	0.01	0	15	-14	-
E41 East Deposit	*Min*	5.6	0.055	0.01	0	0	-176	2.6
	Max	9.7	12.019	3.64	111	187	43	11.0
(83 Samples)	*Aver*	8.3	2.149	0.49	15	49	-33	8.0
Alluvial	*Min*	5.6	0.421	0.02	1	0	-11	6.4
	Max	7.7	10.360	0.07	2	12	1	7.3
(10 Samples)	*Aver*	6.3	4.017	0.05	1	4	-3	6.9
Saprolite	*Min*	5.6	0.554	0.02	1	0	-2	5.8
	Max	6.6	12.019	0.08	2	4	1	7.2
(4 Samples)	*Aver*	6.4	4.714	0.05	1	2	-1	6.5
Saprock	*Min*	5.8	0.055	0.01	0	0	-39	6.0
	Max	8.9	11.827	0.08	2	40	1	8.8
(18 Samples)	*Aver*	6.6	5.276	0.04	1	9	-8	7.4
Volcaniclastic	*Min*	9.0	0.079	0.20	6	28	-44	2.6
	Max	9.4	0.100	1.80	55	64	27	9.8
(3 Samples)	*Aver*	9.4	0.088	0.93	29	47	-19	9.7
Intrusives	*Min*	8.2	0.067	0.07	2	26	-158	6.0
	Max	9.5	0.626	1.86	57	167	0	10.6
(20 Samples)	*Aver*	8.9	0.256	0.47	14	82	-68	10.2
Extrusives (1 Sample)		9.3	0.112	0.45	14	52	-38	10.9
Fault/Shear Zone	*Min*	8.0	0.067	0.22	7	103	-176	10.8
	Max	9.7	1.541	0.68	21	187	-96	10.8
(5 Samples)	*Aver*	8.4	0.663	0.48	15	141	-126	10.8
Low-Grade Ore	*Min*	6.4	0.065	0.01	0	3	-139	2.6
	Max	9.3	9.510	3.64	111	156	43	10.6
(12 Samples)	*Aver*	8.5	0.242	0.35	11	47	-25	8.9
Ore	*Min*	6.7	0.071	0.01	0	1	-69	2.6
	Max	9.6	1.697	2.90	89	138	30	11.0
(10 Samples)	*Aver*	9.0	0.271	1.50	46	60	-14	9.3

NOTE: Average values for $pH_{1:2}$ and NAGpH are median values *Page 1 of 3*

Table 6: Summary of the pH, EC and acid forming characteristics for the major material types within the E42 cutback and new pit areas. CONTINUED

Material Type		$pH_{1:2}$	$EC_{1:2}$ (dS/m)	Total S (%S)	MPA (kg H_2SO_4/t)	ANC	NAPP	NAGpH
E41 West Deposit	*Min*	6.3	0.030	0.01	0	0	-262	6.1
	Max	9.6	3.847	3.90	119	269	28	11.6
(64 Samples)	*Aver*	8.5	0.500	0.66	20	61	-41	10.2
Alluvial	*Min*	6.3	0.057	0.02	1	0	-8	6.3
	Max	7.9	3.847	0.04	1	9	1	8.0
(6 Samples)	*Aver*	7.5	1.568	0.03	1	3	-3	7.2
Saprolite	*Min*	6.5	0.038	0.01	0	0	-4	6.6
	Max	7.4	2.545	0.03	1	5	1	7.2
(3 Samples)	*Aver*	7.1	1.051	0.02	1	2	-1	6.9
Saprock	*Min*	6.6	0.030	0.01	0	0	-24	6.1
	Max	8.2	1.376	0.08	2	24	0	9.2
(9 Samples)	*Aver*	7.8	0.577	0.02	1	8	-7	8.5
Intrusives	*Min*	8.1	0.068	0.07	2	26	-262	9.1
	Max	9.6	0.607	1.72	53	269	0	11.6
(25 Samples)	*Aver*	8.9	0.231	0.65	20	73	-54	10.7
Fault/Shear Zone	*Min*	8.0	0.240	0.26	8	78	-154	9.3
	Max	9.0	2.044	1.20	37	191	-70	11.4
(2 Samples)	*Aver*	8.5	1.142	0.73	22	135	-112	10.4
Low-Grade Ore	*Min*	7.6	0.098	0.01	0	4	-204	8.1
	Max	9.5	1.214	3.32	102	242	28	11.3
(9 Samples)	*Aver*	8.7	0.313	1.36	42	102	-61	10.6
Ore	*Min*	7.0	0.053	0.02	1	6	-106	8.8
	Max	9.5	1.653	3.90	119	148	-5	11.5
(10 Samples)	*Aver*	9.0	0.337	1.21	37	79	-41	10.5
E46 Deposit	*Min*	6.1	0.137	0.01	0	0	-142	6.9
	Max	9.7	6.216	2.12	65	183	6	11.2
(66 Samples)	*Aver*	8.2	1.286	0.21	6	35	-29	8.6
Alluvial	*Min*	6.1	0.327	0.01	0	0	-7	6.9
	Max	8.5	3.601	0.04	1	8	1	8.4
(18 Samples)	*Aver*	7.6	1.790	0.02	1	4	-3	7.6
Saprolite	*Min*	6.1	1.001	0.02	1	0	-4	6.9
	Max	6.5	6.216	0.03	1	5	1	7.8
(5 Samples)	*Aver*	6.4	3.548	0.02	1	3	-2	6.9
Saprock	*Min*	6.5	0.380	0.01	0	0	-93	8.0
	Max	9.1	3.569	0.22	7	100	1	8.0
(5 Samples)	*Aver*	6.7	2.039	0.06	2	28	-26	8.0
Volcaniclastic	*Min*	8.3	0.158	0.09	3	38	-82	9.1
	Max	9.2	0.649	0.63	19	85	-19	10.8
(6 Samples)	*Aver*	8.5	0.409	0.42	13	63	-50	10.5
Intrusives	*Min*	7.4	0.137	0.01	0	11	-98	10.3
	Max	9.6	1.279	0.81	25	104	-10	11.2
(17 Samples)	*Aver*	8.5	0.389	0.20	6	63	-57	10.9
Extrusives	*Min*	8.1	0.437	1.00	31	40	-9	8.6
	Max	8.3	0.577	2.12	65	59	6	10.1
(3 Samples)	*Aver*	8.2	0.509	1.59	49	48	1	9.6
Fault/Shear Zone (1 Sample)		8.6	0.376	0.06	2	76	-74	
Low-Grade Ore	*Min*	6.2	0.149	0.01	0	0	-142	7.1
	Max	9.2	3.778	1.34	41	183	0	11.1
(9 Samples)	*Aver*	7.0	1.473	0.26	8	38	-30	8.6
Ore	*Min*	7.1	0.166	0.02	1	2	-93	7.4
	Max	9.7	0.320	0.02	1	94	-1	11.1
(2 Samples)	*Aver*	8.4	0.243	0.02	1	48	-47	9.3

NOTE: Average values for $pH_{1:2}$ and NAGpH are median values *Page 2 of 3*

Table 6: Summary of the pH, EC and acid forming characteristics for the major material types within the E42 cutback and new pit areas. CONTINUED

Material Type		$pH_{1:2}$	$EC_{1:2}$ (dS/m)	Total S (%S)	MPA	ANC	NAPP	NAGpH
					(kg H_2SO_4/t)			
Galway Regal Deposit	*Min*	5.9	0.070	0.01	0	0	-152	6.1
	Max	9.0	5.794	1.37	42	163	0	10.9
(50 Samples)	*Aver*	8.5	1.046	0.24	7	49	-42	8.5
Alluvial	*Min*	6.0	0.262	0.01	0	0	-9	6.7
	Max	7.9	3.557	0.03	1	9	0	8.0
(5 Samples)	*Aver*	7.3	1.828	0.02	1	3	-3	7.3
Saprolite	*Min*	5.9	5.500	0.01	0	0	0	6.6
	Max	6.1	5.794	0.04	1	2	0	6.6
(2 Samples)	*Aver*	6.0	5.647	0.03	1	1	0	6.6
Saprock	*Min*	6.2	0.089	0.01	0	0	-9	7.4
	Max	7.4	5.500	0.03	1	9	0	8.8
(9 Samples)	*Aver*	6.6	1.655	0.02	0	4	-3	8.6
Volcaniclastic	*Min*	8.4	0.314	0.01	0	27	-152	9.3
	Max	9.0	0.691	0.56	17	163	-21	9.3
(18 Samples)	*Aver*	8.9	0.512	0.23	7	84	-77	9.3
Intrusives (1 Sample)		9.0	0.475	0.10	3	153	-150	
Extrusives	*Min*	8.5	0.116	0.41	13	47	-123	9.8
	Max	8.9	0.534	0.68	21	141	-26	10.9
(4 Samples)	*Aver*	8.9	0.251	0.53	16	74	-58	10.6
Fault/Shear Zone (1 Sample)		8.9	0.660	1.00	31	134	-103	
Low-Grade Ore	*Min*	6.4	0.125	0.01	0	4	-63	7.8
	Max	8.6	2.383	0.97	30	88	0	9.0
(6 Samples)	*Aver*	8.0	0.851	0.34	11	33	-22	8.4
Ore	*Min*	7.2	0.070	0.01	0	3	-42	6.1
	Max	8.8	0.189	1.37	42	65	-3	10.1
(4 Samples)	*Aver*	7.9	0.123	0.54	16	33	-17	7.7

NOTE: Average values for $pH_{1:2}$ and NAGpH are median values *Page 3 of 3*

The total S contents range widely in these samples from <0.01 to 3.90 %S, however, the oxide waste rock, including the alluvials, saprolite and saprock, typically has a low S content, while that of the primary waste rock, including the volcaniclastics, intrusives, extrusives and fault/shear zone materials, and the low-grade ore and ore material range from low to relatively high. The total S content of the oxide waste rock ranges from <0.01 to 0.22 %S with average contents of 0.03 %S; while that of the primary waste rock ranges from <0.01 to 2.12 %S with average contents from 0.34 to 0.92 %S. The total S content for the low-grade ore ranges from <0.01 to 3.64 %S with an average of 0.71 %S and for the ore ranges from 0.01 to 3.90 %S with an average of 1.13 %S.

Sulfide S analyses were carried out on 104 selected oxide and primary drill-hole samples and figure 6 compares the total S content to the sulfide S content for these samples. As expected, only a relatively small proportion of the S within the oxide material occurs in sulfide form, typically ranging from 10 to 25%. However, a significant proportion of the S contained within the primary material occurs in the reactive sulfide form, typically ranging from 70 to 100%.

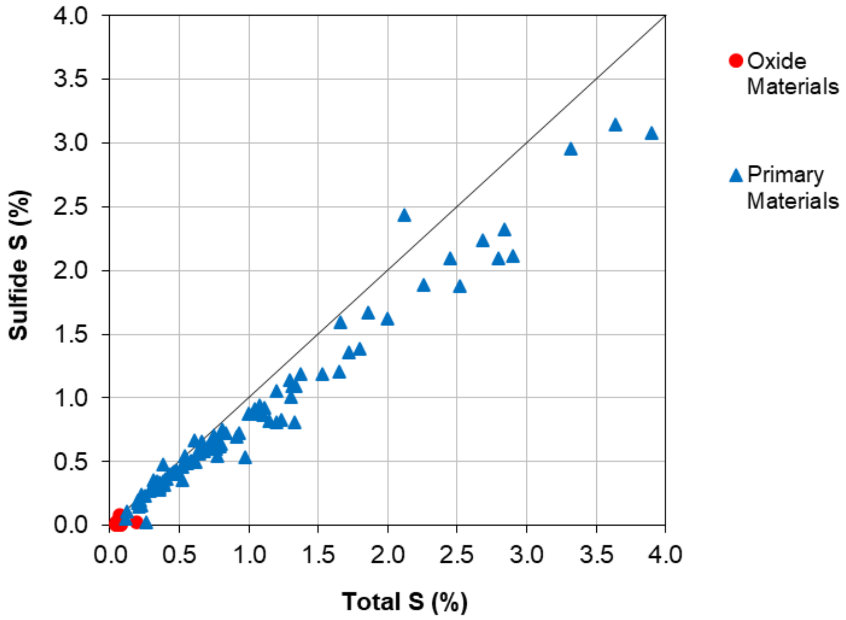

Figure 6: The total S compared to sulfide S for selected oxide and primary materials.

The ANC of these samples also ranges widely from 0 to 287 kg H_2SO_4/t. The oxide waste rock types typically have low ANC with average values ranging from 2 to 16 kg H_2SO_4/t, while those for the primary waste rock types range from 62 to 137 kg H_2SO_4/t, and for the low-grade ore and ore materials are 58 kg H_2SO_4/t and 62 kg H_2SO_4/t, respectively. Acid buffering characteristic curve determinations were performed on 11 samples representing the different material types and these plots are provided in Attachment B (Figure B-1). The ABCC plots confirm that a significant proportion of the contained ANC in these materials, 70 to 100%, is expected to be readily available to neutralise any sulfide generated acidity.

The acid-base account plots for the Project areas, including the E42 Stage I Cutback, and the E41 East, E41 West, E46 and Galway Regal Deposits, where the total S contents are plotted against the ANC values, are provided in Figure 7a and 7b. These plots show that the oxide waste rock types are typically barren, with a total S content $\leq$ 0.1%S and an ANC $\leq$ 10 kg H_2SO_4/t, and that the primary waste rock types, low-grade ore and ore, are typically NAPP negative. However, a number of NAPP positive samples were identified, including three ore samples, two low-grade ore samples and one volcaniclastic waste rock sample from E41 East, one low-grade ore sample from the E41 West, and two extrusive waste rock samples from E46. The NAPP values for these samples range from 6 to 43 kg H_2SO_4/t.

Twenty-eight of the 278 samples included in this assessment have NAPP values of $\leq$ minus 100 kg H_2SO_4/t. These samples predominantly comprise the primary waste rock and low-grade ore samples from each of the Project areas, and are classified as acid consuming (AC).

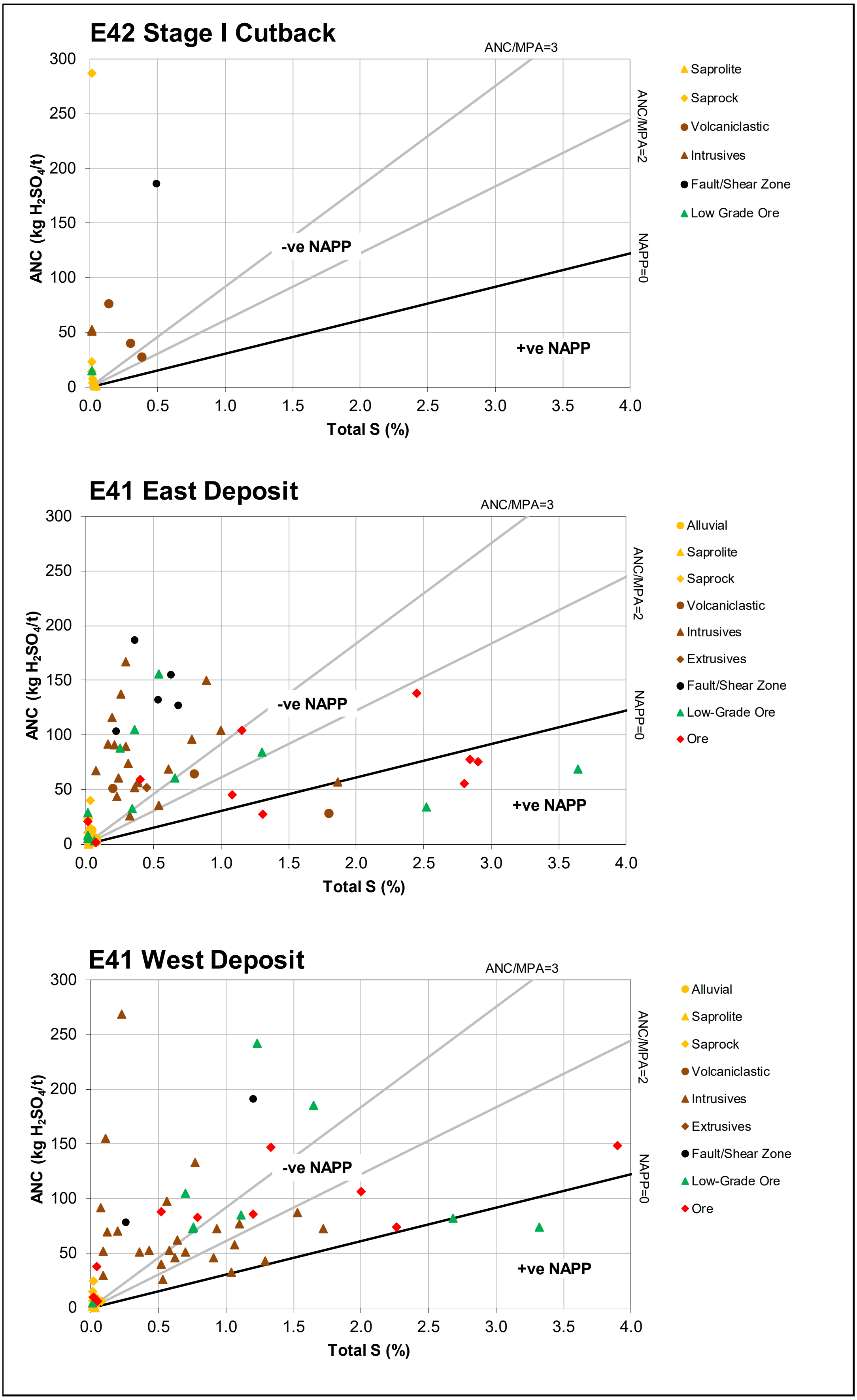

Figure 7a: Acid-base account plot for the major material types occurring within the Project areas (E42 Stage I Cutback, and E41 East and E42 West Deposits).

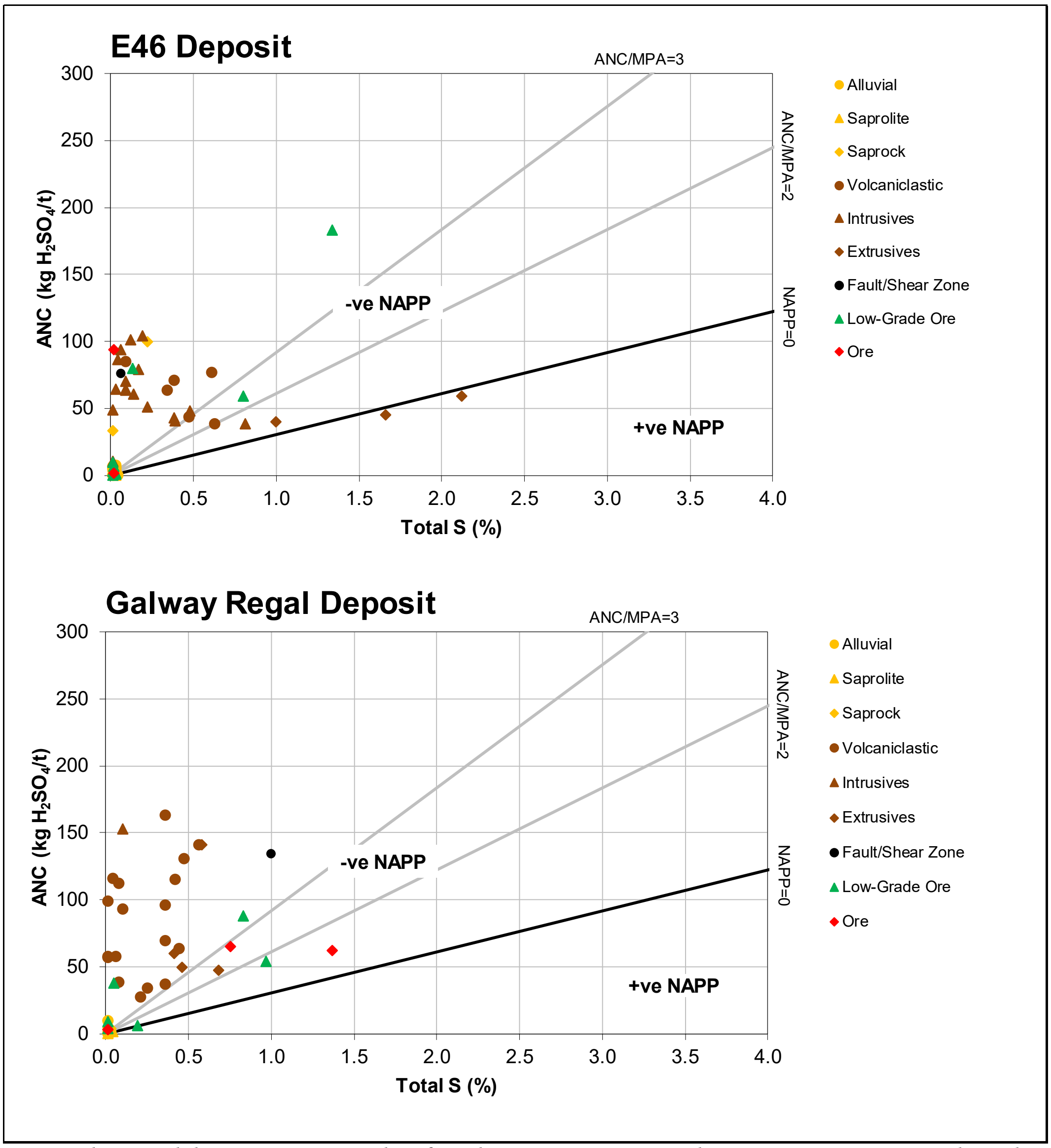

Figure 7b: Acid-base account plot for the major material types occurring within the Project areas (E46 and Galway Regal Deposits).

The geochemical classification plots for the different material types within the Project areas, where the NAPP values are plotted against the NAGpH, are provided in Figure 8a and 8b. These plots show that all of the oxide waste rock samples are NAF and that these material types are typically barren in terms of acid generation and neutralisation. Although the primary waste rock, low-grade ore and ore samples are predominantly classified as NAF, being NAPP negative with NAGpH values >4.5, six of these samples from the E41 East deposit are NAPP positive with NAGpH <4.5 and these samples, are classified as PAF. These samples include three ore samples, two low-grade ore samples and one primary waste rock (volcaniclastic) sample. One of the PAF ore samples, representing the quartz sulfide breccia, has a NAGpH of 4.0 and a NAG capacity when titrated to pH 4.5 of only 1 kg H_2SO_4/t, therefore this sample only has a low capacity to generate acid and is classified as PAF/LC.

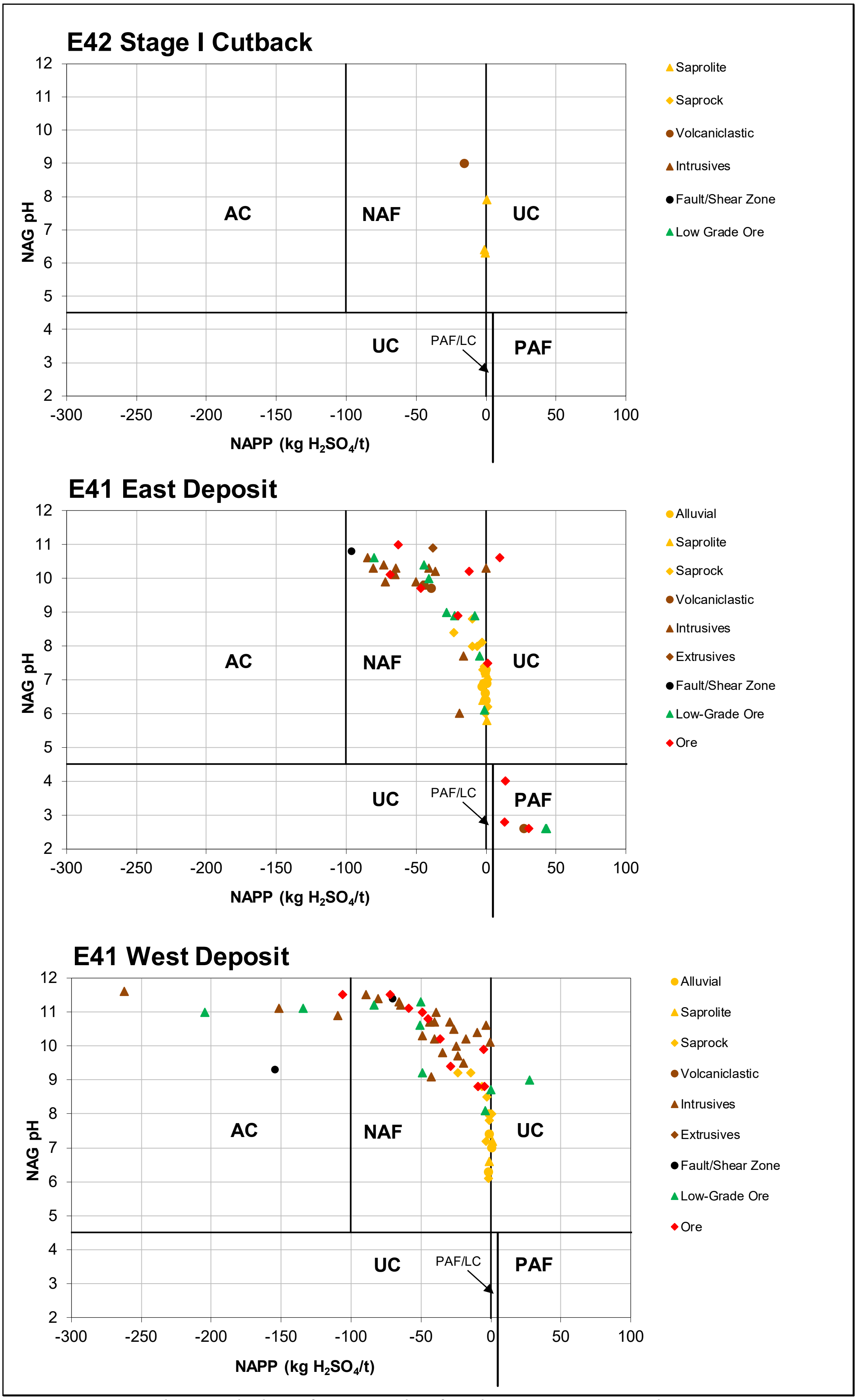

Figure 8a: Geochemical classification plot for the major material types occurring within the Project areas (E42 Stage I Cutback, and E41 East and E42 West Deposits).

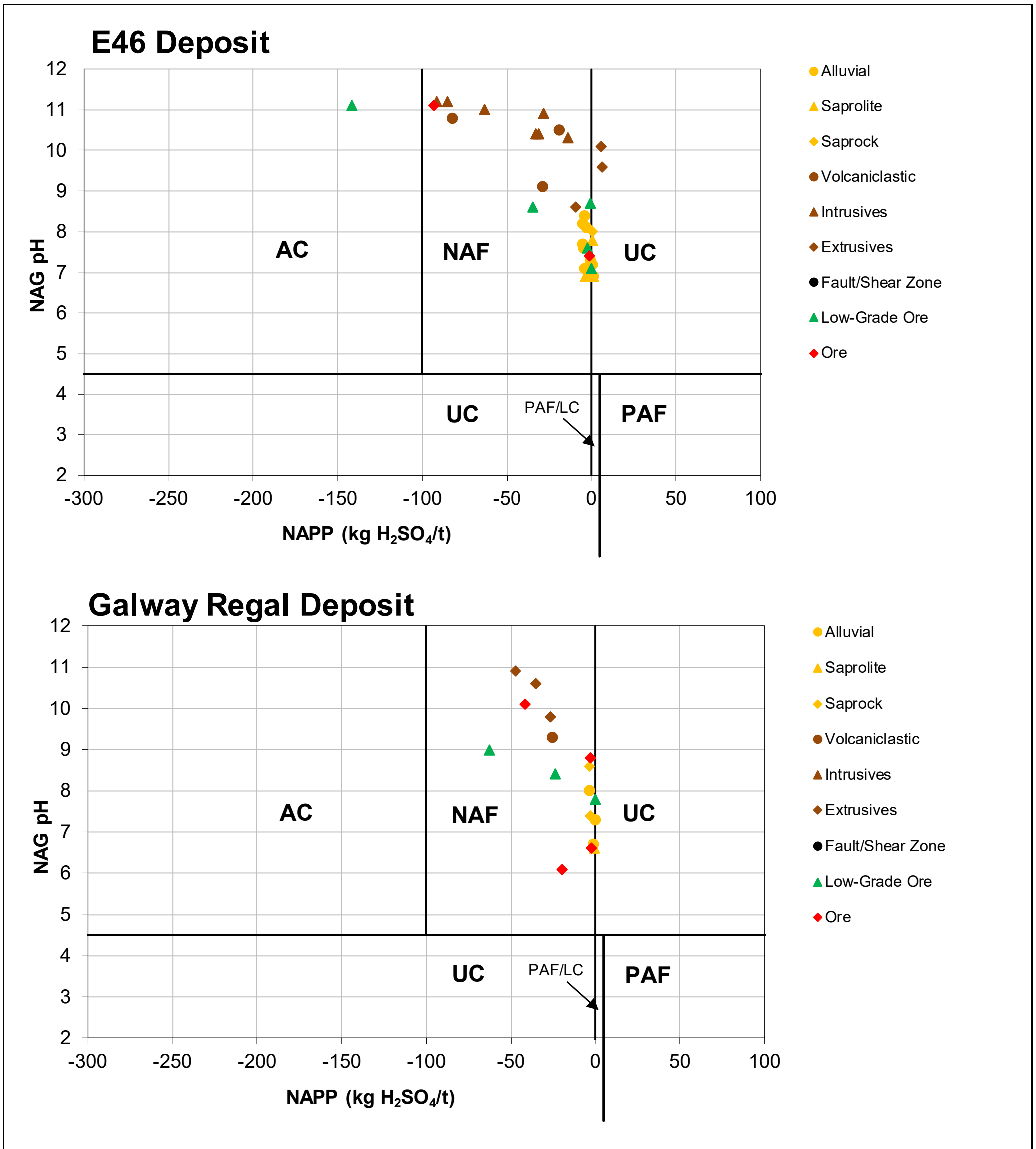

Figure 8b: Geochemical classification plot for the major material types occurring within the Project areas (E46 and Galway Regal Deposits).

The six PAF and PAF-LC samples, including the volcaniclastic waste rock (sample E41D2893-10), the monzodiorite and dyke low-grade ores (samples E41D2888-14 and E41D2893-12), and the monzodiorite, quartz sulfide breccia and diorite ores (samples E41D2886-11, E41D2888-17 and E41D2893-21), were selected for KNAG testing. The pH and temperature profiles from these tests are provided in Attachment C (Figure C-2) and indicate that these materials are expected to have slow reactivity.

Four of the samples from this assessment, including one ore sample from E41 East, one low-grade ore sample from E41 West and two primary waste rock (extrusives) samples from the E46 deposit are NAPP positive with NAGpH >4.5 and these samples have an uncertain (UC) geochemical classification. However, based on the NAGpH, sulfide S contents and findings from the ABCC determination, it is expected that the materials represented by these samples are NAF.

Based on these results, consistent with the previous findings, the oxide waste rocks from each of the Project areas are expected to be NAF and relatively barren in terms of acid generation and neutralisation. The primary waste rocks, and low-grade ore and ore samples typically have a moderately high reactive sulfide content, but due to the relatively high available ANC, these materials are typically expected to be NAF. Due to the relatively high ANC, a proportion of these materials from each Project area is expected to be AC. However, some of the primary waste rock, low-grade ore and ore from the proposed E41 East pit have a risk of being PAF or PAF-LC.

The ore and tailings from the mining operations to-date have remained NAF, characterised by a moderate S content and significantly higher ANC. However, these investigations have identified the potential occurrence of a small amount of PAF ore and low-grade ore within the E41 East deposit, and therefore there is a risk that some of the tailings from the expended operations may also be PAF or PAF-LC.

4.3 Metal Enrichment and Solubility

Multi-element scans were performed on the solids and deionised water extracts from a total of 54 samples selected from the Project areas, including 31 samples representing the waste rock, 17 representing the low-grade ore, and 6 representing the ore. The results from these analyses are provided in Attachment D, including the results from the solids analyses (Tables D-1), the calculated geochemical abundance indices (Table D-2) and the water extract analyses (Table D-3).

Consistent with the findings from previous investigations referred to in Table 1 (EGi, 1995; EGi, 2004; GEM, 2011a; GEM, 2011b; GEM, 2013 and GEM, 2016), these results confirm that, all of the materials from each of the Project areas are expected to be significantly enriched in As and Sb, and some materials are expected to be significantly enriched in Ag, Cd and Se. Additional to these, Cu, Hg and Zn are expected to be enriched in some of the low-grade ore and ore materials.

The results of multi-element scans performed on the water extracts from these samples indicate that the primary materials have a relatively equal proportion of Cl and SO_4 salts, ranging from 6 to 245 mg/L and 5.3 to 336.7 mg/L respectively, contributing to the EC, with $EC_{1:2}$ values ranging from 0.067 to 0.929 dS/m. However, the high EC typical of the oxide materials, with $EC_{1:2}$ values ranging from 0.106 to 11.267 dS/m, is due primarily to increased Cl salts ranging from 18 to 1967 mg/L, and to a lesser degree SO_4 salts, ranging from 9.1 to 429.5 mg/L.

The water extracts indicate that, under the test pH conditions with $pH_{1:2}$ values ranging from 5.8 to 9.7, these materials generally have low element solubility. However, As, Mo and Se, were found to be relatively soluble in some of the samples. Table 7 provides a comparison between the concentration of these dissolved elements in the waste rock, low-grade ore and ore samples, and the ANZECC irrigation water quality guidelines (ANZECC, 2000). This comparison indicates that the dissolved As and Se concentrations do not exceed the short-term exposure guidelines in any of the samples and only exceed the long-term guidelines in some of the low-grade ore and ore samples for the As, and in some of the waste rock and low-grade ore samples for the Se. The dissolved Mo concentrations exceed the long-term exposure guidelines in material types and only exceed the short-term guidelines in some of the waste rock samples.

Table 7: The range in dissolved As, Mo and Se concentrations in the waste rock, low-grade ore and ore extracts, compared to the ANZECC (2000) irrigation water quality guidelines.

Element		Concentration Range			Irrigation Water Quality Guideline (ANZECC, 2000)	
		Waste Rock	Low-Grade Ore	Ore	Short-Term Exposure (up to 20 years)	Long-Term Exposure (up to 100 years)
As	µg/L	0.8 to 50.6	1.1 to 178.6	2.3 to 130.3	2000	100
Mo	µg/L	0.05 to 71.48	0.09 to 22.36	0.52 to 35.97	50	10
Se	µg/L	<0.5 to 31.4	<0.5 to 17.3	<0.5	50	10

5.0 Geochemistry of E46 Pit Backfill Material

The option being assessed to backfill the E46 Pit with waste rock from the adjacent pits involves primary waste rock sourced from the E42 Pit and oxide waste rock sourced from the GR Pit. The major primary and oxide waste rock types will include:

Primary Waste Rock

- Diorite (DI);
- Monzodiorite (MODI);
- Volcaniclastic (VC); and
- Lava (LAVA).

Oxide Waste Rock

- Transported Material (TR);
- Soft Oxide (SOX);
- Hard Oxide (HOX)

It is understood that the excavation (source) bench RL (Relative Level) for these materials will correspond with the placement (destination) bench RL. Table 8 provides the estimated proportion of source waste rock to be backfilled according to the bench RL and in total. The Transported Material (TR) includes all of the alluvial materials, the Soft Oxide (SOX) includes all of the saprolite materials, and the Hard Oxide (HOX) includes all of the saprock materials. It is also understood that, additional to the extrusive lithologies, the LAVA unit includes all of the fault and shear zone materials when proportioning the different waste rock types.

Table 8: Estimated proportion of the source primary and oxide waste rock to be backfilled according to bench RL and in total.

Bench RL	E42 Pit (Primary Waste Rock)				GR Pit (Oxide Waste Rock)		
	DI	MODI	VC	LAVA	TR	SOX	HOX
1200	-	-	-	-	100%	0%	0%
1191	-	-	-	-	89%	11%	0%
1182	-	-	-	-	60%	40%	0%
1173	-	-	-	-	34%	60%	6%
1011	65%	27%	8%	0%	-	-	-
1002	72%	23%	5%	0%	-	-	-
993	61%	33%	6%	0%	-	-	-
984	66%	31%	3%	0%	-	-	-
975	72%	20%	8%	0%	-	-	-
966	83%	5%	12%	0%	-	-	-
957	69%	9%	22%	0%	-	-	-
948	60%	19%	21%	0%	-	-	-
939	56%	20%	24%	0%	-	-	-
930	61%	16%	23%	0%	-	-	-
921	58%	12%	30%	0%	-	-	-
912	56%	14%	25%	5%	-	-	-
903	68%	6%	26%	0%	-	-	-
Total	**65.2%**	**18.0%**	**16.4%**	**0.4%**	**70.8%**	**27.8%**	**1.5%**

The pH, EC and acid forming characteristics of samples representing oxide waste rock from the GR Pit and primary waste rock from the E42 Pit, from the previous and current geochemical investigations, are provided in Attachment B (Table B-6) and are summarized in Table 9.

Table 9: Summary of the pH, EC and acid forming characteristics for the proposed backfill source waste rock types.

Material Type		$pH_{1:2}$	$EC_{1:2}$ (dS/m)	Total S (%S)	MPA	ANC	NAPP
					(kg H_2SO_4/t)		
Oxide Waste Rock - GR Pit							
TR	*Min*	6.0	0.262	<0.01	0	0	-9
	Max	7.9	3.557	0.03	1	9	0
(5 Samples)	*Aver*	7.3	1.828	0.02	1	3	-3
SOX	*Min*	5.9	5.500	<0.01	0	0	0
	Max	6.1	5.794	0.04	1	2	0
(2 Samples)	*Aver*	6.0	5.647	0.03	1	1	0
HOX	*Min*	6.2	0.089	<0.01	0	0	-9
	Max	7.4	5.500	0.03	1	9	0
(9 Samples)	*Aver*	6.6	1.655	0.02	0	4	-3
Primary Waste Rock - E42 Pit							
DI	*Min*	8.1	0.298	<0.01	0	51	-150
	Max	9.0	0.518	0.60	18	153	-51
(45 Samples)	*Aver*	8.4	0.402	0.28	8	91	-83
VC	*Min*	8.4	0.314	<0.01	0	27	-152
	Max	9.0	0.691	0.56	17	163	-16
(21 Samples)	*Aver*	8.8	0.516	0.28	7	79	-71
LAVA	*Min*	8.3	0.508	0.49	15	134	-171
	Max	8.9	0.660	1.00	31	186	-103
(5 Samples)	*Aver*	8.4	0.564	0.75	23	160	-137

NOTE: Average values for $pH_{1:2}$ are median values

These results indicate that, consistent with previous findings for the general waste rock material, the oxide waste rock from the GR Pit is expected to be saline, NAF and relatively barren, and the primary waste rock from the E42 Pit is expected to be non-saline and NAF, with a sufficiently high ANC so that a significant proportion of this material is expected to be acid consuming. However, due to the reactive sulfide content of this material, it has a risk of becoming highly saline when oxidised.

The multi-element scans for the solids and deionised water extracts from the oxide waste rock from the GR Pit and primary waste rock from the E42 Pit, from the previous and current geochemical investigations, are provided in Attachment D (Table D-4, D-5 and D-6). Consistent with previous findings, the oxide and primary waste rock is expected to typically be enriched with As and Sb, and some of it may also be enriched with Ag, Cd and Se, and Mo and Se are expected to be readily soluble under the quasi-neutral pH conditions.

6.0 Geochemistry of Lake Protection Bund Source Material

It is understood that approximately 1.1M m^3 of geochemically suitable earth-fill material will be required to construct the proposed extension to the LPB. The identified materials available on-site in sufficient quantities for this include the primary (fresh) waste rock and the scats produced during processing of the low-grade ore pebble material. The various primary waste rock sources include:

- the existing primary waste rock located within the WRE;
- the future primary waste rock from the E42 H cutback; and
- the future primary waste rock from the underground development.

The previous detailed geochemical investigation confirm that the primary waste rock and scats materials are expected to have a pH ranging from neutral to slightly alkaline at the time of placement, and to be non- to slightly saline, non-sodic and NAF. However, due to the oxide waste rock's geochemical characteristics, with high salinity and sodicity resulting in a significant risk of high sediment dispersion and increased erosion, this material is not geochemically suitable for the construction of the LPB extension.

The test results for the multi-element scans performed on the waste rock and scats samples representing the potential LPB extension construction materials, and their water extracts are provided in Attachment D (Table D-7, D-8, D-9, D-10, D-11, D-12, D-13 and D-14). Table 11 provides the average and maximum concentrations for selected elements within the identified potential LPB construction materials. Additional to these samples, three samples of the scats stockpile material were submitted for analysis and the relevant results from these analyses are included in Table 10.

The chemical composition of 1:2 (1 part sample:2 parts deionised water) water extracts collected from the waste rock and scats samples provide an indication of the element solubility under the prevailing pH test condition of these materials and are used identify any elements of concern due to flushing of readily soluble elements during construction of the LPB extension. The chemical composition of the water extracts from the waste rock (i.e. existing waste rock, E42 H cutback waste rock and underground development waste rock) and the scats samples, are presented in Attachment D (Table D-8, D-10, D-12 and D-14), and indicate that most of the elements analysed are not readily soluble under the expected prevailing neutral to slightly alkaline pH conditions. The only elements that were found to be readily soluble in the primary waste rocks types included Mo, ranging from 1.6 to 288.0 µg/L, and to a lesser extend Se, ranging from <0.5 to 31.4 µg/L. The test results indicate that no elements are expected to be readily soluble in the scats materials.

Table 10: Summary of selected element concentrations in the primary waste rock and scats materials.

Element		Primary (Fresh) Waste Rock						Scats			
		Existing (49 samples)		E42 H-Cutback (11 samples)		Underground (11 samples)		Trials (3 samples)		Stockpile (5 samples)	
		Aver.	Max.	Aver.	Max.	Aver.	Max.	Aver.	Max.	Aver.	Max.
Ag	mg/kg	0.4	0.8	0.6	1.5	0.3	0.6	2.5	5.7	-	-
As	mg/kg	47.6	300.0	37.2	129.4	27.3	89.8	26.8	32.7	39.3	70.0
B	mg/kg	64.9	124.0	59.5	124.0	50.0	50.0	50.0	50.0	-	-
Be	mg/kg	0.62	2.60	0.86	1.29	0.96	1.15	0.88	0.90	-	-
Cd	mg/kg	1.30	15.50	0.43	2.20	0.11	0.21	1.62	2.97	1.00	1.00
Co	mg/kg	16.4	33.0	18.8	25.0	23.3	36.1	16.4	16.7	-	-
Cr	mg/kg	14	61	11	31	67	170	12	17	17	30
Cu	mg/kg	125	648	162	345	117	254	189	218	159	289
Hg	mg/kg	0.03	0.31	0.02	0.07	0.01	0.03	0.09	0.22	0.10	0.10
Mn	mg/kg	1634	2360	1685	2587	1458	1837	1286	1330	-	-
Mo	mg/kg	0.8	4.0	0.9	2.9	0.8	1.4	0.8	0.9	-	-
Ni	mg/kg	7	33	8	21	18	46	9	9	8	13
Pb	mg/kg	56.0	664	18.1	97.1	4.9	6.3	13.3	16.3	12.0	22.0
Se	mg/kg	0.15	3.60	0.19	0.69	0.11	0.20	0.16	0.16	-	-
Zn	mg/kg	276	1850	141	242	101	154	303	440	129	170

7.0 Conclusions and Recommendations

A total of 278 drill-hole samples were utilized for this assessment, including 15 samples from the E42 Stage I Cutback, 83 samples from the E41 East deposit, 64 from the E41 West deposit, 66 from the E46 deposit and 50 samples from the Galway Regal deposit. The sample intervals collected represent the major waste rock types, the low-grade ore and the ore types present within the Project areas. These samples were assessed to determine the salinity, sodicity, and acid and metalliferous drainage (AMD) risks associated with the proposed expanded open pit mining operations.

The findings from this assessment are compared to those from the previous geochemical investigations, and based on this, recommendations for environmental management of the waste rock, low-grade ore and ore stockpiles, tailings and water quality monitoring are provided for the proposed mining activities.

7.1 Waste Rock

It is planned that the bulk of the waste rock to be excavated from the proposed E42 Stage I cutback and open pits (i.e. E41-E, E41-W, E46 and GR pits) will be placed within the existing northern and southern WREs which will be expanded to accommodate waste rock from the Project. Some waste rock from the E42 and GR pits will also be used to backfill the E46 pit. The findings of this waste rock assessment are generally consistent with the findings from the previous investigations, with the exception that one of the primary waste rock samples was identified as PAF. Following is a summary of these findings:

- The oxide waste rock is expected to be saline and sodic. Due to the low reactive sulfide content and low ANC, this material is expected to be NAF and barren in terms acid generation and neutralisation, and the development of increased salinity.
- The primary (fresh) waste rock is expected to be non- to slightly saline and non- to slightly sodic. However, due to the relatively high reactive sulfide content, this material has a risk of becoming highly saline when oxidised.
- The primary waste rock contains relatively high reactive S, but due to the characteristic high ANC, this material is typically NAF. However, one sample of the primary volcaniclastic waste rock from the E41 East deposit has a high S with a lower ANC and this sample is classified as PAF. This occurrence confirms the risk of PAF material occurring within the waste rock, in particular waste rock from the proposed E41 East pit.
- Due to the typically high ANC of the primary waste rock, a significant proportion of the waste rock within each of the proposed pits is expected to be acid consuming (AC).
- The waste rock is expected to typically be enriched with As and Sb, and some of it may also be enriched with Ag, Cd and Se. Additional to this, Mo and Se were found to be readily soluble under the prevailing near neutral to slightly alkaline pH conditions.

Recommendations for Waste Rock

These results confirm that the oxide and primary waste rock from the proposed cutback and open pits are geochemically similar to the waste rock from the current open pit operations, apart from the identification of one PAF primary waste rock sample. Due to the high ANC in the bulk of the primary waste rock, the presence of significant AC material and the predicted small proportion of PAF material, it is expected that the ROM blended waste rock will be NAF and although the management strategies currently employed would not need to be modified, there will be a requirement to ensure that no PAF material is left exposed on the final outer surfaces of the WRE. Based on these findings the following recommendations are provided:

- Due to the low AMD risk and occurrence of significant AC material within the waste rock, it is expected that the ROM blended waste rock will remain NAF and that no selective handling will be required during waste rock placement. However, there will be a requirement to ensure that no PAF waste rock is exposed within the surface of the emplacements, by ensuring that no PAF material is placed within the outer 10 m of the intermediate or final surfaces of the WREs.
- The oxide waste rock has a significant risk of being highly saline and/or highly sodic. High salinity has implications for revegetation success and water quality, and high sodicity can cause increased sediment dispersion and surface erosion if these materials are left exposed on the surface of any emplacements and/or earthworks. Therefore, highly saline and/or sodic oxide waste rock should not be used for any site earthworks or construction and should be treated or suitably capped prior to soil placement and revegetation.
- Due to the predicted enrichment of As and Sb, and Ag, Cd and Se, and the solubility of Mo and Se, it is recommended that these elements are included in the WREs water quality monitoring program, as outlined in Section 7.6.

7.2 E46 Pit Backfill

The source material identified for backfilling the E46 Pit, including the primary waste rock from the E42 cutback and oxide waste rock from the GR Pit, to backfill the E46 Pit, has been confirmed to be NAF, and while the oxide material is expected to be saline, the primary material has a risk of becoming saline if it is allowed to oxidise. Consistent with the typical waste rock characteristics, these materials are expected to be enriched with As and Sb, and some of these materials may also be enriched with Ag, Cd and Se. Similarly, Mo and Se are expected to be readily soluble in both the oxide and primary waste rock.

Recommendations for E46 Pit Backfilling

Based on these findings and given that the oxide waste rock will form the upper benches, from 1173 to 1200 m (i.e. 27 m), of the in-pit emplacement, no special consideration will be required for backfilling the E46 Pit. However, it is recommended that the quality of the in-pit and diverted surface water is monitored during and post backfilling operations (see Section 7.6).

7.3 Lake Protection Bund

The materials that are available in sufficient quantities on-site and have suitable geotechnical and geochemical characteristics for construction of the LPB extension, include the existing primary waste rock, E42 Pit cutback primary waste rock, underground development primary waste rock and the scats material. These materials are expected to have a pH ranging from neutral to slightly alkaline at the time of placement, and to be non- to slightly saline, non-sodic and NAF and, based on these characteristics, these materials are considered to be suitable for construction of the LPB extension.

The bulk of the waste rock comprises the primary diorite and volcaniclastic material (i.e. >80%). The water extracts for these materials indicate that most of the elements are not readily soluble under the expected prevailing neutral to slightly alkaline pH conditions. The only elements that were found to be readily soluble in the primary waste rocks types included Mo, ranging from 1.6 to 288.0 µg/L, and Se, ranging from <0.5 to 31.4 µg/L.

The test results indicate that no elements are expected to be readily soluble in the scats materials.

Recommendations for Lake Protection Bund
Upon exposure of the waste rock materials to oxidation and infiltration during and post LPB construction, most of the contained elements are expected to remain insoluble due to the predicted near neutral to slightly alkaline pH conditions that will be maintained. However, Mo and to a lesser extent Se, are expected to be flushed from the waste rock during construction of the LPB extension.

7.4 Low-Grade Ore and Ore Stockpiles

The findings from this assessment are generally consistent with the previous open pit investigations for the low-grade ore and ore, except that a number of PAF samples were identified within the E41 East deposit. Following is a summary of the findings from the assessment of the low-grade ore and ore materials:

- The low-grade ore and ore are expected to be non-saline, however, due to the presence of reactive sulfides, an increase in salinity may occur if these materials are left exposed on the surface of their respective stockpiles.
- The low-grade ore and ore materials from the assessed deposits are generally expected to be NAF, apart from the E41 East deposit where a number of PAF and PAF-LC low-grade ore and ore samples were identified.
- The low-grade ore and ore materials are expected to be enriched with As and Sb, and some may also be enriched with Ag, Cd, Cu, Hg, Se and Zn. Additionally, As, Mo and Se were found to be readily soluble.

Recommendations for Low-Grade Ore and Ore Stockpiles

It is expected that the stockpiled ROM ore would only be exposed to surface oxidation conditions for periods of short duration within the ore stockpile. Whereas the low-grade ore is likely to be stockpiled and exposed to surface oxidation conditions for extended periods, presenting a risk of developing acid conditions and impacting water quality if this material is not managed correctly. Based on this, the following recommendations are provided for the low-grade ore and ore stockpiles:

- Because a small amount of the low-grade ore, in particular from the E41 East deposit, has a risk of being PAF and the stockpiled material is likely to be exposed to surface oxidation processes for extended periods, there is a requirement to ensure that no PAF materials are left exposed on the outer surface of the stockpile. To reduce the risk of developing acid conditions, no PAF or PAF-LC material should be placed within the outer 5 m of the stockpile surface.
- Due to the expected short time period of potential exposure of the identified PAF and PAF-LC material within the surface of the ore stockpile, development of acid conditions and acidic drainage is not expected to be a concern for the stockpile and no selective handling of these materials will be required.
- Because of the potential enrichment and/or solubility of Ag, As, Cd, Cu, Hg, Mo, Sb, Se and Zn in the low-grade ore and ore materials, it is recommended that these metals are included in the water quality monitoring as discussed in Section 7.6.

7.5 Tailings

Because no suitable laboratory prepared tailings samples were available at the time of this assessment, the geochemical characteristics of the ore samples were used to help determine the expected characteristics of the tailings. Although the ore and tailings have remained NAF throughout the mining operations to-date, these investigations have identified the potential occurrence of a small amount of PAF ore and low-grade ore within the E41 East deposit. Therefore, there is a risk that some of the tailings from the expanded mining operations will be PAF or PAF-LC.

Recommendations for Tailings

Based on these findings, the following recommendations are provided:

- Because of the increased risk that some of the tailings from the proposed open pit developments will be PAF or PAF-LC, it is recommended that a program be undertaken to geochemically characterise any future laboratory prepared, pilot plant tailings and/or any process tailings as soon as they are available. The characterisation program for the process tailings would most likely involve the routine collection of the discharge tailings over a period of time.
- Previous investigations have identified the risk of the tailings from the open-pit operations being saline and developing saline conditions within the tailings storage facility (TSF). It was therefore recommended that the TSF design include a cover in order to avoid development of a salt-pan.

- Based on the similar geochemical characteristics of the ore between the previous and current investigations, it is predicted that the tailings would be enriched in Ag, As, Cd, Pb, Sb, Se and Zn, and it is recommended that these metals be included in the TSF water quality monitoring program as discussed in Section 7.6.

7.6 Water Quality Monitoring

The findings of the previous geochemical investigations at CGO have been used to help develop the site water quality monitoring programs for the open pit, WREs, low-grade ore stockpile, ROM ore stockpiles, TSF (IWL) and Lake Cowal. Surface water monitoring is currently undertaken at CGO in accordance with Development Consent Condition SSD 10367 B9 (d) (ii), DA14/98 Condition 4.5 (b) and the approved Water Management Plan (Evolution 2022) and will continue for the Project.

The parameters for the existing site water quality monitoring programs include pH, EC, total dissolved solids (TDS), turbidity, dissolved oxygen (DO), temperature, biological oxygen demand, faecal indicators, total hardness, total suspended solids (TSS), Ca, Mg, K, Na, Cl, SO_4, Ag, As, Cd, Mo, Pb, Sb, Se and Zn.

The findings from these investigations are consistent with the current water quality monitoring program and it is recommended that current water quality monitoring program is adopted for the proposed expanded mining areas and the backfilled E46 Pit.

Exposure of the oxide and primary mine rock within the proposed open pits is expected to generate increased salinity. However, considering the regional groundwater has a TDS of around 40,000 to 45,000 mg/L, the contribution of increased Cl and SO_4 salts from the open pit developments is expected to be negligible.

Due to the predicted occurrence of PAF and PAF-LC material within some of the low-grade ore and ore, there will be a requirement to capture and monitor surface drainage from the low-grade ore and ore stockpiles, with the potential need to treat the discharge water prior to its release, if required.

Based on the use of the primary waste rock and/or scats for the construction of the LPB extension and the findings of these geochemical investigations (refer to Section 6), it is recommended that the Lake Water Quality monitoring for the Project addresses the potential water quality risks posed by Mo and to a lesser extent Se, which are expected to be readily soluble under the existing pH conditions.

8.0 References

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Attachment A

Sample Details

Table A-1: Drill hole sample information for the CGO Open Cut Expansion Project.

Figure A-1: Drill hole locations.

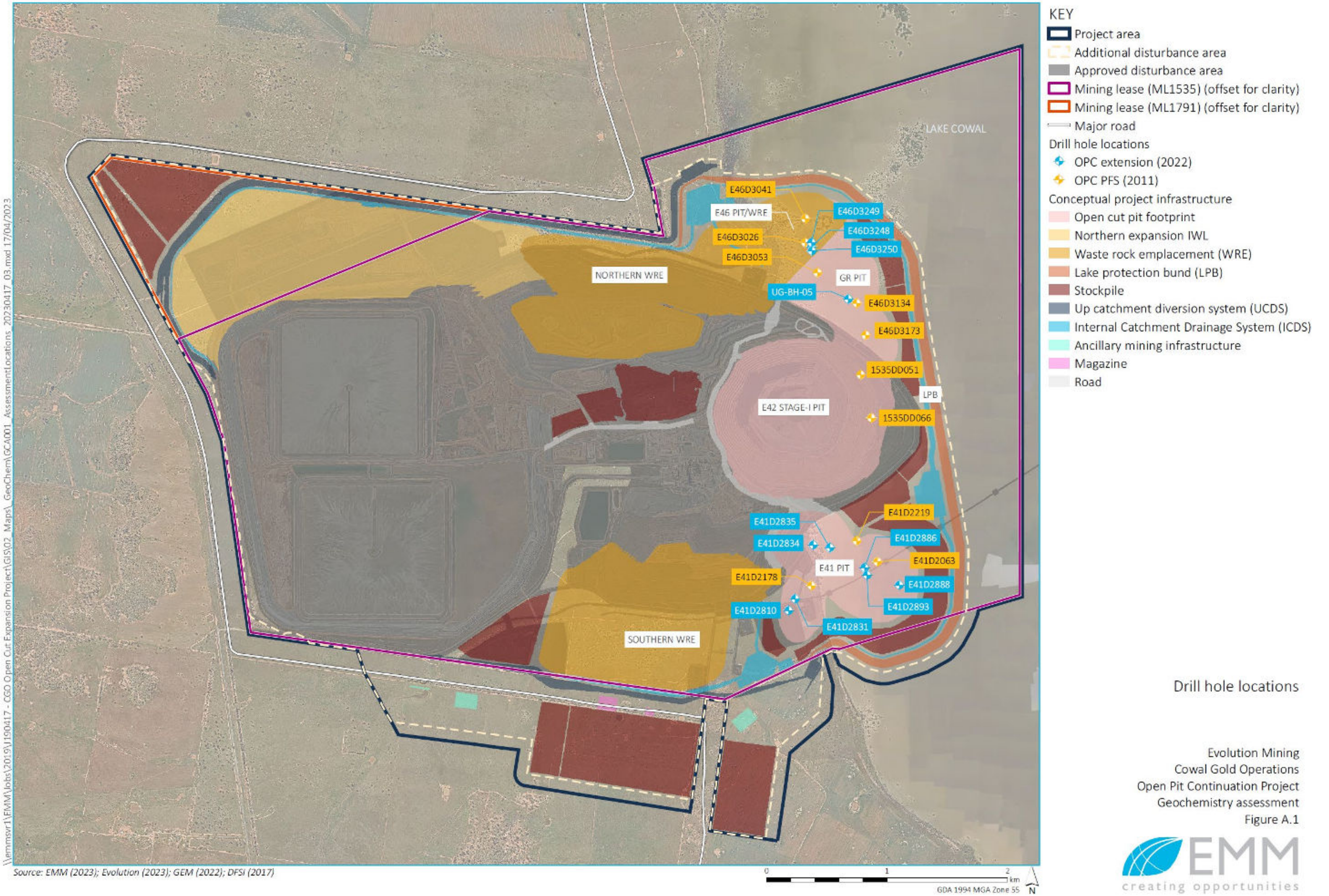
KEY
Project area
Additional disturbance area
Approved disturbance area
Mining lease (ML1535) (offset for clarity)
Mining lease (ML1791) (offset for clarity)
Major road
Drill hole locations
OPC extension (2022)
OPC PFS (2011)
Conceptual project infrastructure
Open cut pit footprint
Northern expansion IWL
Waste rock emplacement (WRE)
Lake protection bund (LPB)
Stockpile
Up catchment diversion system (UCDS)
Internal Catchment Drainage System (ICDS)
Ancillary mining infrastructure
Magazine
Road
LAKE COWAL
E46D3041
E46 PIT/WRE
E46D3249
E46D3248
E46D3026
E46D3250
E46D3053
NORTHERN WRE
GR PIT
UG-BH-05
E46D3134
E46D3173
1535DD051
LPB
E42 STAGE-I PIT
1535DD066
E41D2219
E41D2835
E41D2886
E41D2834
E41D2063
E41 PIT
E41D2178
E41D2888
E41D2810
E41D2893
E41D2831
SOUTHERN WRE
Drill hole locations
Evolution Mining
Cowal Gold Operations
Open Pit Continuation Project
Geochemistry assessment
Figure A.1
Source: EMM (2023); Evolution (2023); GEM (2022); DFSI (2017)
0 1 2 km
GDA 1994 MGA Zone 55
N

Table A-1: Drill hole sample information for the CGO Open Cut Expansion Project.

Program	Deposit	Drill-Hole ID	Sample ID	Depth (m)			Material Type	Lith. Group	Lithology
				from	to	inter.			
O/C PFS	E42 Stage I	1535DD051	1535DD051-2	23	49	26	Waste	Saprolite	Saprolite
O/C PFS	E42 Stage I	1535DD051	1535DD051-3	50	63	13	Waste	Saprolite	Saprolite
O/C PFS	E42 Stage I	1535DD051	1535DD051-4	64	80	16	Waste	Saprock	Saprock
O/C PFS	E42 Stage I	1535DD051	1535DD051-5	84	95	11	Waste	Saprock	Saprock
O/C PFS	E42 Stage I	1535DD051	1535DD051-6	87	88	1	Low Grade Ore	Low Grade Ore	Diorite
O/C PFS	E42 Stage I	1535DD051	1535DD051-7	96	99	3	Waste	Saprock	Saprock
O/C PFS	E42 Stage I	1535DD051	1535DD051-8	100	110	10	Waste	Intrusives	Diorite
O/C PFS	E42 Stage I	1535DD051	1535DD051-9	180	183	3	Waste	Intrusives	Diorite
O/C PFS	E42 Stage I	1535DD051	1535DD051-10	184	189	5	Waste	Fault/Shear Zone	Faul Zone
O/C PFS	E42 Stage I	1535DD051	1535DD051-12	228	238	10	Waste	Volcaniclastic	Mudstone
O/C PFS	E42 Stage I	1535DD066	1535DD066-2	38	62	24	Waste	Saprolite	Saprolite
O/C PFS	E42 Stage I	1535DD066	1535DD066-3	62	97	35	Waste	Saprock	Saprock
O/C PFS	E42 Stage I	1535DD066	1535DD066-4	100	129	29	Waste	Saprock	Saprock
O/C PFS	E42 Stage I	1535DD066	1535DD066-5	129	134	5	Waste	Volcaniclastic	Sandstone
O/C PFS	E42 Stage I	1535DD066	1535DD066-6	141	159.8	18.8	Waste	Volcaniclastic	Mudstone
O/C PFS	E41 East	E41D2063	E41D2063-1	0	1	1	Waste Rock	Alluvial	Alluvium
O/C PFS	E41 East	E41D2063	E41D2063-2	2	7	5	Waste Rock	Alluvial	Lacustrine
O/C PFS	E41 East	E41D2063	E41D2063-3	8	11	3	Waste Rock	Alluvial	Lacustrine
O/C PFS	E41 East	E41D2063	E41D2063-4	12	14	2	Waste Rock	Alluvial	Alluvium
O/C PFS	E41 East	E41D2063	E41D2063-5	16	17	1	Waste Rock	Alluvial	Alluvium
O/C PFS	E41 East	E41D2063	E41D2063-6	18	19	1	Waste Rock	Saprolite	Saprolite
O/C PFS	E41 East	E41D2063	E41D2063-7	19	29	10	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2063	E41D2063-8	30	47	17	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2063	E41D2063-9	36	37	1	Low-Grade Ore	Low-Grade Ore	Saprock
O/C PFS	E41 East	E41D2063	E41D2063-10	47	53	6	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2063	E41D2063-11	55	56	1	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2063	E41D2063-12	57	82	25	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2063	E41D2063-13	98	108	10	Waste Rock	Intrusives	Monzodiorite
O/C PFS	E41 East	E41D2063	E41D2063-14	109	115	6	Waste Rock	Fault/Shear Zone	Shear Zone
O/C PFS	E41 East	E41D2063	E41D2063-15	116	118	2	Waste Rock	Intrusives	Dyke
O/C PFS	E41 East	E41D2063	E41D2063-16	119	122	3	Waste Rock	Intrusives	Diorite
O/C PFS	E41 East	E41D2063	E41D2063-17	122	127	5	Waste Rock	Fault/Shear Zone	Shear Zone
O/C PFS	E41 East	E41D2063	E41D2063-18	127	128	1	Low-Grade Ore	Low-Grade Ore	Shear Zone
O/C PFS	E41 East	E41D2063	E41D2063-19	137	148	11	Waste Rock	Intrusives	Diorite
O/C PFS	E41 East	E41D2063	E41D2063-20	149	150	1	Waste Rock	Intrusives	Dyke
O/C PFS	E41 East	E41D2063	E41D2063-21	156	159	3	Waste Rock	Fault/Shear Zone	Shear Zone
O/C PFS	E41 East	E41D2063	E41D2063-22	160	161	1	Waste Rock	Fault/Shear Zone	Shear Zone
O/C PFS	E41 East	E41D2063	E41D2063-23	164	175	11	Waste Rock	Intrusives	Diorite
O/C PFS	E41 East	E41D2063	E41D2063-24	176	205	29	Waste Rock	Intrusives	Diorite
O/C PFS	E41 East	E41D2063	E41D2063-25	208	209	1	Low-Grade Ore	Low-Grade Ore	Diorite
O/C PFS	E41 East	E41D2063	E41D2063-26	209	248	39	Waste Rock	Intrusives	Diorite
O/C PFS	E41 East	E41D2219	E41D2219-1	0	13	13	Waste Rock	Alluvial	Lacustrine
O/C PFS	E41 East	E41D2219	E41D2219-2	14	16	2	Waste Rock	Alluvial	Lacustrine
O/C PFS	E41 East	E41D2219	E41D2219-3	17	18	1	Waste Rock	Saprolite	Saprolite
O/C PFS	E41 East	E41D2219	E41D2219-4	19	33	14	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2219	E41D2219-5	34	41	7	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2219	E41D2219-6	43	46	3	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2219	E41D2219-7	47	49	2	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2219	E41D2219-8	56	87	31	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2219	E41D2219-9	88	100	12	Waste Rock	Saprock	Saprock
O/C PFS	E41 East	E41D2219	E41D2219-10	102	115.5	13.5	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 East	E41D2886	E41D2886-1	2.0	10.0	8.0	Waste Rock	Alluvial	Alluvium
O/C Expansion	E41 East	E41D2886	E41D2886-2	13.0	19.0	6.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 East	E41D2886	E41D2886-3	45.0	47.0	2.0	Ore	Ore	Saprock
O/C Expansion	E41 East	E41D2886	E41D2886-4	74.0	77.0	3.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 East	E41D2886	E41D2886-5	80.0	83.0	3.0	Waste Rock	Saprock	Saprock

Table A-1: Drill hole sample information for the CGO Open Cut Expansion Project.

Program	Deposit	Drill-Hole ID	Sample ID	Depth (m)			Material Type	Lith. Group	Lithology
				from	to	inter.			
O/C Expansion	E41 East	E41D2886	E41D2886-6	83.0	84.3	1.3	Low-Grade Ore	Low-Grade Ore	Saprock
O/C Expansion	E41 East	E41D2886	E41D2886-7	92.0	98.0	6.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 East	E41D2886	E41D2886-8	150.0	160.0	10.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 East	E41D2886	E41D2886-9	170.0	180.0	10.0	Waste Rock	Intrusives	Dyke
O/C Expansion	E41 East	E41D2886	E41D2886-10	188.0	189.0	1.0	Low-Grade Ore	Low-Grade Ore	Dyke
O/C Expansion	E41 East	E41D2886	E41D2886-11	216.0	217.0	1.0	Ore	Ore	Monzodiorite
O/C Expansion	E41 East	E41D2886	E41D2886-12	265.0	275.0	10.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 East	E41D2888	E41D2888-1	2.0	12.0	10.0	Waste Rock	Alluvial	Alluvium
O/C Expansion	E41 East	E41D2888	E41D2888-2	20.0	30.0	10.0	Waste Rock	Saprolite	Saprolite
O/C Expansion	E41 East	E41D2888	E41D2888-3	52.0	58.0	6.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 East	E41D2888	E41D2888-4	69.0	70.0	1.0	Low-Grade Ore	Low-Grade Ore	Saprock
O/C Expansion	E41 East	E41D2888	E41D2888-5	79.0	82.0	3.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 East	E41D2888	E41D2888-6	120.0	121.0	1.0	Ore	Ore	Volcaniclastic
O/C Expansion	E41 East	E41D2888	E41D2888-7	125.0	127.81	2.8	Waste Rock	Volcaniclastic	Volcaniclastic
O/C Expansion	E41 East	E41D2888	E41D2888-8	127.8	129.6	1.8	Waste Rock	Fault/Shear Zone	Fault Zone
O/C Expansion	E41 East	E41D2888	E41D2888-9	130	134	4.0	Waste Rock	Intrusives	Dyke
O/C Expansion	E41 East	E41D2888	E41D2888-10	143.0	144.0	1.0	Low-Grade Ore	Low-Grade Ore	Volcaniclastic
O/C Expansion	E41 East	E41D2888	E41D2888-11	165.0	175.0	10.0	Waste Rock	Volcaniclastic	Volcaniclastic
O/C Expansion	E41 East	E41D2888	E41D2888-12	178.0	187.0	9.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 East	E41D2888	E41D2888-13	210.0	218.96	9.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 East	E41D2888	E41D2888-14	244.0	245.25	1.3	Low-Grade Ore	Low-Grade Ore	Monzodiorite
O/C Expansion	E41 East	E41D2888	E41D2888-15	248.0	249.0	1.0	Ore	Ore	Monzodiorite
O/C Expansion	E41 East	E41D2888	E41D2888-16	258.0	259.0	1.0	Low-Grade Ore	Low-Grade Ore	Diorite
O/C Expansion	E41 East	E41D2888	E41D2888-17	266.0	273.0	7.0	Ore	Ore	Quartz Sulphide Breccia
O/C Expansion	E41 East	E41D2888	E41D2888-18	283.0	287.0	4.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 East	E41D2888	E41D2888-19	320.0	329.0	9.0	Ore	Ore	Dyke
O/C Expansion	E41 East	E41D2888	E41D2888-20	332.0	337.0	5.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 East	E41D2888	E41D2888-21	370.0	380.0	10.0	Waste Rock	Extrusives	Dacite
O/C Expansion	E41 East	E41D2893	E41D2893-1	5.1	11.6	6.5	Waste Rock	Alluvial	Transported
O/C Expansion	E41 East	E41D2893	E41D2893-2	11.6	13.8	2.2	Waste Rock	Saprolite	Saprolite
O/C Expansion	E41 East	E41D2893	E41D2893-3	18.2	21.0	2.8	Waste Rock	Saprock	Saprock
O/C Expansion	E41 East	E41D2893	E41D2893-4	37.0	40.0	3.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 East	E41D2893	E41D2893-5	44.0	45.0	1.0	Low-Grade Ore	Low-Grade Ore	Saprock
O/C Expansion	E41 East	E41D2893	E41D2893-6	56.0	60.0	4.0	Ore	Ore	Saprock
O/C Expansion	E41 East	E41D2893	E41D2893-10	116.0	118.0	2.0	Waste Rock	Volcaniclastic	Volcaniclastic
O/C Expansion	E41 East	E41D2893	E41D2893-11	144.0	152.0	8.0	Ore	Ore	Volcaniclastic
O/C Expansion	E41 East	E41D2893	E41D2893-12	160.0	161.0	1.0	Low-Grade Ore	Low-Grade Ore	Dyke
O/C Expansion	E41 East	E41D2893	E41D2893-17	222.0	223.2	1.2	Ore	Ore	Diorite
O/C Expansion	E41 East	E41D2893	E41D2893-18	253.0	255.0	2.0	Low-Grade Ore	Low-Grade Ore	Diorite
O/C Expansion	E41 East	E41D2893	E41D2893-19	301.0	310.0	9.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 East	E41D2893	E41D2893-20	327.0	337.0	10.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 East	E41D2893	E41D2893-21	397.0	401.0	4.0	Ore	Ore	Diorite
O/C PFS	E41 West	E41D2178	E41D2178-1	0	6	6	Waste Rock	Alluvial	Lacustrine
O/C PFS	E41 West	E41D2178	E41D2178-2	8	9	1	Waste Rock	Alluvial	Lacustrine
O/C PFS	E41 West	E41D2178	E41D2178-3	11	12	1	Waste Rock	Saprolite	Saprolite
O/C PFS	E41 West	E41D2178	E41D2178-4	13	14	1	Waste Rock	Saprock	Saprock
O/C PFS	E41 West	E41D2178	E41D2178-5	50	51	1	Waste Rock	Intrusives	Diorite
O/C PFS	E41 West	E41D2178	E41D2178-6	58	72	14	Waste Rock	Intrusives	Monzodiorite
O/C PFS	E41 West	E41D2178	E41D2178-7	120	138	18	Waste Rock	Intrusives	Monzodiorite
O/C PFS	E41 West	E41D2178	E41D2178-8	139	169	30	Waste Rock	Intrusives	Monzodiorite
O/C PFS	E41 West	E41D2178	E41D2178-9	171	213	42	Waste Rock	Intrusives	Monzodiorite
O/C PFS	E41 West	E41D2178	E41D2178-10	213	214	1	Low-Grade Ore	Low-Grade Ore	Monzodiorite
O/C PFS	E41 West	E41D2178	E41D2178-11	217	238	21	Waste Rock	Intrusives	Monzodiorite
O/C PFS	E41 West	E41D2178	E41D2178-12	239	250.85	11.85	Waste Rock	Intrusives	Granodiorite
O/C Expansion	E41 West	E41D2810	E41D2810-1	4.2	10.2	6.0	Waste Rock	Alluvial	Alluvium
O/C Expansion	E41 West	E41D2810	E41D2810-2	10.2	13.4	3.2	Waste Rock	Saprolite	Saprolite

Page 2 of 5

Table A-1: Drill hole sample information for the CGO Open Cut Expansion Project.

Program	Deposit	Drill-Hole ID	Sample ID	Depth (m) from	to	inter.	Material Type	Lith. Group	Lithology
O/C Expansion	E41 West	E41D2810	E41D2810-3	13.4	19.5	6.1	Waste Rock	Saprock	Saprock
O/C Expansion	E41 West	E41D2810	E41D2810-4	37.0	38.0	1.0	Ore	Ore	Saprock
O/C Expansion	E41 West	E41D2810	E41D2810-5	83.0	89.0	6.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 West	E41D2810	E41D2810-6	114.0	116.0	2.0	Ore	Ore	Diorite
O/C Expansion	E41 West	E41D2810	E41D2810-7	132.0	133.0	1.0	Low-Grade Ore	Low-Grade Ore	Monzodiorite
O/C Expansion	E41 West	E41D2810	E41D2810-8	155.0	159.0	4.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 West	E41D2810	E41D2810-9	177.0	182.0	5.0	Ore	Ore	Monzodiorite
O/C Expansion	E41 West	E41D2810	E41D2810-10	210.0	211.0	1.0	Low-Grade Ore	Low-Grade Ore	Monzodiorite
O/C Expansion	E41 West	E41D2810	E41D2810-11	230.0	240.0	10.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 West	E41D2810	E41D2810-12	262.0	263.0	1.0	Ore	Ore	Fault Zone
O/C Expansion	E41 West	E41D2810	E41D2810-13	274.0	284.0	10.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 West	E41D2810	E41D2810-14	294.3	297.0	2.7	Waste Rock	Fault/Shear Zone	Fault Zone
O/C Expansion	E41 West	E41D2810	E41D2810-15	327.0	328.0	1.0	Low-Grade Ore	Low-Grade Ore	Monzodiorite
O/C Expansion	E41 West	E41D2810	E41D2810-16	419.0	425.0	6.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 West	E41D2831	E41D2831-1	1.7	5.7	4.0	Waste Rock	Alluvial	Alluvium
O/C Expansion	E41 West	E41D2831	E41D2831-2	7.0	17.0	10.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 West	E41D2831	E41D2831-4	44.0	46.0	2.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 West	E41D2831	E41D2831-5	58.0	65.0	7.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 West	E41D2831	E41D2831-6	68.0	69.0	1.0	Low-Grade Ore	Low-Grade Ore	Monzodiorite
O/C Expansion	E41 West	E41D2831	E41D2831-8	117.0	121.0	4.0	Ore	Ore	Monzodiorite
O/C Expansion	E41 West	E41D2831	E41D2831-9	133.0	143.0	10.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 West	E41D2831	E41D2831-10	205.0	211.0	6.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 West	E41D2831	E41D2831-12	232.0	236.0	4.0	Waste Rock	Intrusives	Monzodiorite
O/C Expansion	E41 West	E41D2834	E41D2834-1	10.0	20.0	10.0	Waste Rock	Alluvial	Alluvium
O/C Expansion	E41 West	E41D2834	E41D2834-2	35.0	39.9	4.9	Waste Rock	Saprolite	Saprolite
O/C Expansion	E41 West	E41D2834	E41D2834-3	48.0	50.0	2.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 West	E41D2834	E41D2834-4	55.0	58.0	3.0	Ore	Ore	Saprock
O/C Expansion	E41 West	E41D2834	E41D2834-5	63.0	66.0	3.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 West	E41D2834	E41D2834-6	78.0	88.0	10.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 West	E41D2834	E41D2834-7	98.0	105.0	7.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 West	E41D2834	E41D2834-8	115.0	116.0	1.0	Low-Grade Ore	Low-Grade Ore	Fault Zone
O/C Expansion	E41 West	E41D2834	E41D2834-9	116.5	118.26	1.8	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 West	E41D2834	E41D2834-10	144.75	146.0	1.3	Ore	Ore	Diorite
O/C Expansion	E41 West	E41D2834	E41D2834-11	154.3	155.8	1.5	Waste Rock	Fault/Shear Zone	Fault Zone
O/C Expansion	E41 West	E41D2834	E41D2834-12	159.0	162.5	3.5	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 West	E41D2834	E41D2834-13	184.0	185.5	1.5	Ore	Ore	Fault Zone
O/C Expansion	E41 West	E41D2834	E41D2834-14	185.5	193.1	7.6	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 West	E41D2835	E41D2835-1	5.0	15.0	10.0	Waste Rock	Alluvial	Alluvium
O/C Expansion	E41 West	E41D2835	E41D2835-2	21.0	26.0	5.0	Waste Rock	Saprock	Saprock
O/C Expansion	E41 West	E41D2835	E41D2835-3	45.4	50.1	4.7	Waste Rock	Saprock	Saprock
O/C Expansion	E41 West	E41D2835	E41D2835-4	50.1	56.6	6.5	Waste Rock	Saprock	Saprock
O/C Expansion	E41 West	E41D2835	E41D2835-5	62.0	63.0	1.0	Ore	Ore	Saprock
O/C Expansion	E41 West	E41D2835	E41D2835-6	69.0	70.0	1.0	Low-Grade Ore	Low-Grade Ore	Saprock
O/C Expansion	E41 West	E41D2835	E41D2835-7	89.4	97.9	8.6	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 West	E41D2835	E41D2835-8	118.0	119.0	1.0	Low-Grade Ore	Low-Grade Ore	Diorite
O/C Expansion	E41 West	E41D2835	E41D2835-9	129.69	130.5	0.8	Low-Grade Ore	Low-Grade Ore	Fault Zone
O/C Expansion	E41 West	E41D2835	E41D2835-10	131.0	132.0	1.0	Ore	Ore	Dyke
O/C Expansion	E41 West	E41D2835	E41D2835-11	133.0	141.0	8.0	Waste Rock	Intrusives	Dyke
O/C Expansion	E41 West	E41D2835	E41D2835-16	166.3	169.0	2.7	Waste Rock	Intrusives	Diorite
O/C Expansion	E41 West	E41D2835	E41D2835-17	228.3	231.6	3.3	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3026	E46D3026-1	1	3	2	Waste Rock	Alluvial	Lacustrine
O/C PFS	E46	E46D3026	E46D3026-2	5	17	12	Waste Rock	Alluvial	Colluvium
O/C PFS	E46	E46D3026	E46D3026-3	18	19	1	Waste Rock	Alluvial	Colluvium
O/C PFS	E46	E46D3026	E46D3026-4	20	24	4	Waste Rock	Alluvial	Lacustrine
O/C PFS	E46	E46D3026	E46D3026-5	25	27	2	Waste Rock	Alluvial	Colluvium
O/C PFS	E46	E46D3026	E46D3026-6	28	32	4	Waste Rock	Saprolite	Saprolite

Table A-1: Drill hole sample information for the CGO Open Cut Expansion Project.

Program	Deposit	Drill-Hole ID	Sample ID	Depth (m)			Material Type	Lith. Group	Lithology
				from	to	inter.			
O/C PFS	E46	E46D3026	E46D3026-7	33	53	20	Waste Rock	Saprolite	Saprolite
O/C PFS	E46	E46D3026	E46D3026-8	53	68	15	Low-Grade Ore	Low-Grade Ore	Saprolite
O/C PFS	E46	E46D3026	E46D3026-9	71	83	12	Waste Rock	Saprock	Saprock
O/C PFS	E46	E46D3026	E46D3026-10	105	109	4	Waste Rock	Saprock	Saprock
O/C PFS	E46	E46D3026	E46D3026-11	114	117	3	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3026	E46D3026-12	118	134	16	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3026	E46D3026-13	138	161	23	Waste Rock	Intrusives	Monzodiorite
O/C PFS	E46	E46D3026	E46D3026-15	166	175	9	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3026	E46D3026-16	176	204	28	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3026	E46D3026-17	204	208	4	Waste Rock	Fault/Shear Zone	Fault Zone
O/C PFS	E46	E46D3026	E46D3026-18	208	235	27	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3026	E46D3026-19	210	211	1	Low-Grade Ore	Low-Grade Ore	Diorite
O/C PFS	E46	E46D3026	E46D3026-20	236	245	9	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3026	E46D3026-21	246	261	15	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3041	E46D3041-1	2	7	5	Waste Rock	Alluvial	Lacustrine
O/C PFS	E46	E46D3041	E46D3041-2	8	17	9	Waste Rock	Alluvial	Lacustrine
O/C PFS	E46	E46D3041	E46D3041-3	18	23	5	Waste Rock	Alluvial	Lacustrine
O/C PFS	E46	E46D3041	E46D3041-4	24	60	36	Waste Rock	Alluvial	Lacustrine
O/C PFS	E46	E46D3041	E46D3041-5	55	56	1	Low-Grade Ore	Low-Grade Ore	Lacustrine
O/C PFS	E46	E46D3041	E46D3041-6	61	77	16	Waste Rock	Saprolite	Saprolite
O/C PFS	E46	E46D3041	E46D3041-7	77	106	29	Waste Rock	Saprock	Saprock
O/C PFS	E46	E46D3041	E46D3041-8	114	115	1	Low-Grade Ore	Low-Grade Ore	Saprock
O/C PFS	E46	E46D3041	E46D3041-9	119	134	15	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	E46	E46D3041	E46D3041-10	135	144	9	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	E46	E46D3041	E46D3041-11	148	149	1	Low-Grade Ore	Low-Grade Ore	Sandstone
O/C PFS	E46	E46D3041	E46D3041-12	149	160	11	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	E46	E46D3041	E46D3041-13	161	166	5	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3041	E46D3041-14	168	211.2	43.2	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3053	E46D3053-1	0	2	2	Waste Rock	Alluvial	Lacustrine
O/C PFS	E46	E46D3053	E46D3053-2	3	7	4	Waste Rock	Alluvial	Lacustrine
O/C PFS	E46	E46D3053	E46D3053-3	8	23	15	Waste Rock	Alluvial	Lacustrine
O/C PFS	E46	E46D3053	E46D3053-4	24	25	1	Waste Rock	Saprolite	Saprolite
O/C PFS	E46	E46D3053	E46D3053-5	26	104	78	Waste Rock	Saprock	Saprock
O/C PFS	E46	E46D3053	E46D3053-6	56	57	1	Low-Grade Ore	Low-Grade Ore	Saprock
O/C PFS	E46	E46D3053	E46D3053-7	105	106	1	Waste Rock	Intrusives	Dyke
O/C PFS	E46	E46D3053	E46D3053-8	107	108	1	Low-Grade Ore	Low-Grade Ore	Saprock
O/C PFS	E46	E46D3053	E46D3053-9	108	114	6	Waste Rock	Saprock	Saprock
O/C PFS	E46	E46D3053	E46D3053-10	115	129	14	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3053	E46D3053-11	130	138	8	Waste Rock	Intrusives	Dyke
O/C PFS	E46	E46D3053	E46D3053-12	139	157	18	Waste Rock	Intrusives	Diorite
O/C PFS	E46	E46D3053	E46D3053-13	158	177	19	Waste Rock	Extrusives	Trachyandesite
O/C PFS	E46	E46D3053	E46D3053-14	179	222	43	Waste Rock	Extrusives	Trachyandesite
O/C PFS	E46	E46D3053	E46D3053-15	223	227	4	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	E46	E46D3053	E46D3053-16	228	248	20	Waste Rock	Extrusives	Trachyandesite
O/C PFS	E46	E46D3053	E46D3053-17	250	280.2	30.2	Waste Rock	Volcaniclastic	Volcaniclastic
O/C Expansion	E46	E46D3248	E46D3248-1	5.0	9.25	4.3	Waste Rock	Alluvial	Alluvium
O/C Expansion	E46	E46D3248	E46D3248-2	9.25	29.3	20.1	Waste Rock	Alluvial	Alluvium
O/C Expansion	E46	E46D3248	E46D3248-3	31.0	32.0	1.0	Ore	Ore	Saprolite
O/C Expansion	E46	E46D3248	E46D3248-4	32.0	33.0	1.0	Low-Grade Ore	Low-Grade Ore	Saprolite
O/C Expansion	E46	E46D3249	E46D3249-1	4.9	9.6	4.7	Waste Rock	Alluvial	Alluvium
O/C Expansion	E46	E46D3249	E46D3249-2	10.0	20.0	10.0	Waste Rock	Alluvial	Alluvium
O/C Expansion	E46	E46D3249	E46D3249-3	25.0	35.0	10.0	Waste Rock	Saprolite	Saprolite
O/C Expansion	E46	E46D3249	E46D3249-17	133.0	135.0	2.0	Waste Rock	Volcaniclastic	Volcaniclastic
O/C Expansion	E46	E46D3250	E46D3250-1	5.4	14.0	8.6	Waste Rock	Alluvial	Alluvium
O/C Expansion	E46	E46D3250	E46D3250-2	14.0	22.5	8.5	Waste Rock	Alluvial	Alluvium
O/C Expansion	E46	E46D3250	E46D3250-10	92.0	97.0	5.0	Waste Rock	Intrusives	Diorite

Table A-1: Drill hole sample information for the CGO Open Cut Expansion Project.

Program	Deposit	Drill-Hole ID	Sample ID	Depth (m)			Material Type	Lith. Group	Lithology
				from	to	inter.			
O/C Expansion	E46	E46D3250	E46D3250-11	97.0	99.0	2.0	Ore	Ore	Diorite
O/C Expansion	E46	E46D3250	E46D3250-12	102.0	110.0	8.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E46	E46D3250	E46D3250-13	123.0	129.0	6.0	Waste Rock	Intrusives	Diorite
O/C Expansion	E46	E46D3250	E46D3250-14	129.0	130.0	1.0	Low-Grade Ore	Low-Grade Ore	Diorite
O/C PFS	Galway Regal	E46D3134	E46D3134-1	1	3	2	Waste Rock	Alluvial	Lacustrine
O/C PFS	Galway Regal	E46D3134	E46D3134-2	3	5	2	Waste Rock	Alluvial	Lacustrine
O/C PFS	Galway Regal	E46D3134	E46D3134-3	6	18	12	Waste Rock	Alluvial	Lacustrine
O/C PFS	Galway Regal	E46D3134	E46D3134-4	19	54	35	Waste Rock	Saprolite	Saprolite
O/C PFS	Galway Regal	E46D3134	E46D3134-5	55	68	13	Waste Rock	Saprock	Saprock
O/C PFS	Galway Regal	E46D3134	E46D3134-6	69	76	7	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3134	E46D3134-7	77	83	6	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3134	E46D3134-8	84	89.4	5.4	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-1	23	25	2	Waste Rock	Alluvial	Alluvium
O/C PFS	Galway Regal	E46D3173	E46D3173-2	27	33	6	Waste Rock	Saprolite	Saprolite
O/C PFS	Galway Regal	E46D3173	E46D3173-3	43	52	9	Waste Rock	Saprock	Saprock
O/C PFS	Galway Regal	E46D3173	E46D3173-4	67	71	4	Waste Rock	Saprock	Saprock
O/C PFS	Galway Regal	E46D3173	E46D3173-5	73	78	5	Low-Grade Ore	Low-Grade Ore	Saprock
O/C PFS	Galway Regal	E46D3173	E46D3173-6	92	104	12	Waste Rock	Saprock	Saprock
O/C PFS	Galway Regal	E46D3173	E46D3173-7	110	114	4	Waste Rock	Saprock	Saprock
O/C PFS	Galway Regal	E46D3173	E46D3173-8	115	119	4	Waste Rock	Saprock	Saprock
O/C PFS	Galway Regal	E46D3173	E46D3173-9	117	118	1	Low-Grade Ore	Low-Grade Ore	Saprock
O/C PFS	Galway Regal	E46D3173	E46D3173-10	124	130	6	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-11	130	132	2	Low-Grade Ore	Low-Grade Ore	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-12	133	134	1	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-13	134	142	8	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-14	143	146	3	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-15	147	149	2	Waste Rock	Intrusives	Dyke
O/C PFS	Galway Regal	E46D3173	E46D3173-16	150	152	2	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-17	153	157	4	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-18	158	164	6	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-19	165	167	2	Waste Rock	Fault/Shear Zone	Fault Zone
O/C PFS	Galway Regal	E46D3173	E46D3173-20	170	173	3	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-21	182	186	4	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-22	187	196	9	Waste Rock	Extrusives	Trachyandesite
O/C PFS	Galway Regal	E46D3173	E46D3173-23	197	198	1	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-24	199	221	22	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-25	227	238	11	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-26	238	240	2	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-27	242	246	4	Waste Rock	Volcaniclastic	Volcaniclastic
O/C PFS	Galway Regal	E46D3173	E46D3173-28	246	248	2	Low-Grade Ore	Low-Grade Ore	Mudstone
O/C PFS	Galway Regal	E46D3173	E46D3173-29	250	255.4	5.4	Waste Rock	Volcaniclastic	Volcaniclastic
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-1	5.0	15.0	10.0	Waste Rock	Alluvial	Alluvium
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-2	18	23	5.0	Waste Rock	Saprock	Saprock
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-3	23.0	24.0	1.0	Ore	Ore	Saprock
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-4	30.0	35.0	5.0	Waste Rock	Saprock	Saprock
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-5	36.0	42.0	6.0	Waste Rock	Saprock	Saprock
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-6	42.0	43.2	1.2	Ore	Ore	Saprock
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-7	59.0	60.0	1.0	Low-Grade Ore	Low-Grade Ore	Saprock
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-8	75.0	77.0	2.0	Waste Rock	Extrusives	Trachyandesite
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-9	77.0	82.0	5.0	Ore	Ore	Trachyandesite
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-10	82.0	83.0	1.0	Low-Grade Ore	Low-Grade Ore	Trachyandesite
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-11	85.0	88.0	3.0	Waste Rock	Extrusives	Trachyandesite
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-12	95.0	98.0	3.0	Waste Rock	Extrusives	Trachyandesite
O/C Expansion	Galway Regal	UG-BH-05	UG-BH-05-13	98.0	102.0	4.0	Ore	Ore	Trachyandesite

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Attachment B

Acid Forming Characteristic Test Results

Table B-1: Acid forming characteristics of drill-hole samples from the E42 Stage I cutback (E42-SI) for the CGO Open Cut Expansion Project.

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E42-SI	1535DD051/2	23.0	49.0	26.0	Waste	Saprolite	7.5	5.857	0.04	0.01	1	2	-1	-2	1.9	6.4	0	1	NAF
E42-SI	1535DD051/3	50.0	63.0	13.0	Waste	Saprolite	7.3	6.022	0.04	0.006	1	1	1	0	0.4	7.9	0	0	NAF
E42-SI	1535DD051/4	64.0	80.0	16.0	Waste	Saprock	7.2	5.299	0.02		1	7	-7		12.1				NAF
E42-SI	1535DD051/5	84.0	95.0	11.0	Waste	Saprock	7.5	3.056	0.01		0	14	-14		46.7				NAF
E42-SI	1535DD051/6	87.0	88.0	1.0	Low Grade Ore	Diorite	7.7	3.498	0.01		0	15	-14		48.0				NAF
E42-SI	1535DD051/7	96.0	99.0	3.0	Waste	Saprock	9.2	0.704	0.01		0	23	-23		75.2				NAF
E42-SI	1535DD051/8	100.0	110.0	10.0	Waste	Diorite	8.6	0.366	0.01		0	51	-51		166.3				NAF
E42-SI	1535DD051/9	180.0	183.0	3.0	Waste	Diorite	8.5	0.354	0.01		0	53	-52		172.2				NAF
E42-SI	1535DD051/10	184.0	189.0	5.0	Waste	Faul Zone	8.4	0.595	0.49		15	186	-171		12.4				NAF
E42-SI	1535DD051/12	228.0	238.0	10.0	Waste	Mudstone	8.5	0.453	0.30		9	40	-30		4.3				NAF
E42-SI	1535DD066/2	38.0	62.0	24.0	Waste	Saprolite	7.7	2.861	0.03		1	1	0		1.4	6.3	0	2	NAF
E42-SI	1535DD066/3	62.0	97.0	35.0	Waste	Saprock	7.6	2.658	0.02		1	3	-3		5.6				NAF
E42-SI	1535DD066/4	100.0	129.0	29.0	Waste	Saprock	8.0	1.889	0.01		0	287	-287		937.9				NAF
E42-SI	1535DD066/5	129.0	134.0	5.0	Waste	Sandstone	8.6	0.603	0.14		4	76	-71		17.7				NAF
E42-SI	1535DD066/6	141.0	159.8	18.8	Waste	Mudstone	8.4	0.554	0.38	0.33	12	27	-16	-17	2.3	9.0	0	0	NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)

MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)

NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-2: Acid forming characteristics of drill-hole samples from the E41 East (E41-E) deposit for the CGO Open Cut Expansion Project.

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E41-E	E41D2063-1	0.0	1.0	1.0	Waste Rock	Alluvium	7.6	5.500	0.04		1	12	-11		10.1				NAF
E41-E	E41D2063-2	2.0	7.0	5.0	Waste Rock	Lacustrine	5.8	5.446	0.07	0.077	2	5	-3	-3	2.4	6.8	0	0	NAF
E41-E	E41D2063-3	8.0	11.0	3.0	Waste Rock	Lacustrine	5.6	5.558	0.06	0.013	2	2	0	-2	1.2	6.6	0	1	NAF
E41-E	E41D2063-4	12.0	14.0	2.0	Waste Rock	Alluvium	6.1	6.167	0.04	0.006	1	3	-2	-3	2.6	6.9	0	1	NAF
E41-E	E41D2063-5	16.0	17.0	1.0	Waste Rock	Alluvium	5.7	10.360	0.07	0.013	2	2	0	-2	1.1	6.4	0	1	NAF
E41-E	E41D2063-6	18.0	19.0	1.0	Waste Rock	Saprolite	5.6	12.019	0.08	0.010	2	4	-1	-4	1.6	6.5	0	1	NAF
E41-E	E41D2063-7	19.0	29.0	10.0	Waste Rock	Saprock	5.8	11.267	0.08	0.010	2	3	0	-3	1.2	6.0	0	1	NAF
E41-E	E41D2063-8	30.0	47.0	17.0	Waste Rock	Saprock	6.2	10.808	0.05	0.006	2	4	-2	-4	2.5	7.3	0	0	NAF
E41-E	E41D2063-9	36.0	37.0	1.0	Low-Grade Ore	Saprock	6.4	9.510	0.06	0.006	2	3	-1	-3	1.5	6.1	0	0	NAF
E41-E	E41D2063-10	47.0	53.0	6.0	Waste Rock	Saprock	6.5	11.827	0.05		2	5	-3		3.1	8.1	0	0	NAF
E41-E	E41D2063-11	55.0	56.0	1.0	Waste Rock	Saprock	6.9	6.671	0.03		1	8	-7		9.2				NAF
E41-E	E41D2063-12	57.0	82.0	25.0	Waste Rock	Saprock	7.3	3.113	0.03		1	15	-14		15.8				NAF
E41-E	E41D2063-13	98.0	108.0	10.0	Waste Rock	Monzodiorite	8.8	0.542	0.16		5	92	-87		18.8				NAF
E41-E	E41D2063-14	109.0	115.0	6.0	Waste Rock	Shear Zone	8.5	0.667	0.68		21	127	-106		6.1				AC
E41-E	E41D2063-15	116.0	118.0	2.0	Waste Rock	Dyke	8.4	0.500	0.29		9	167	-158		18.8				AC
E41-E	E41D2063-16	119.0	122.0	3.0	Waste Rock	Diorite	8.5	0.455	1.00	0.875	31	104	-73	-77	3.4	10.4	0	0	NAF
E41-E	E41D2063-17	122.0	127.0	5.0	Waste Rock	Shear Zone	8.4	0.427	0.36		11	187	-176		17.0				AC
E41-E	E41D2063-18	127.0	128.0	1.0	Low-Grade Ore	Shear Zone	8.3	0.515	0.54		17	156	-139		9.4				AC
E41-E	E41D2063-19	137.0	148.0	11.0	Waste Rock	Diorite	8.3	0.536	0.26		8	137	-129		17.2				AC
E41-E	E41D2063-20	149.0	150.0	1.0	Waste Rock	Dyke	8.2	0.626	1.86	1.670	57	57	0	-6	1.0	10.3	0	0	NAF
E41-E	E41D2063-21	156.0	159.0	3.0	Waste Rock	Shear Zone	8.3	0.615	0.53		16	132	-116		8.1				AC
E41-E	E41D2063-22	160.0	161.0	1.0	Waste Rock	Shear Zone	8.0	1.541	0.63		19	155	-136		8.0				AC
E41-E	E41D2063-23	164.0	175.0	11.0	Waste Rock	Diorite	8.2	0.343	0.89		27	150	-123		5.5				AC
E41-E	E41D2063-24	176.0	205.0	29.0	Waste Rock	Diorite	8.4	0.372	0.19		6	116	-110		20.0				AC
E41-E	E41D2063-25	208.0	209.0	1.0	Low-Grade Ore	Diorite	8.3	0.307	0.36		11	105	-94		9.5				NAF
E41-E	E41D2063-26	209.0	248.0	39.0	Waste Rock	Diorite	8.4	0.319	0.24		7	61	-53		8.3				NAF

KEY
$pH_{1:2}$ = pH of 1:2 extract
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MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

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AC = Acid Consuming
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PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-2: Acid forming characteristics of drill-hole samples from the E41 East (E41-E) deposit for the CGO Open Cut Expansion Project. CONTINUED

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E41-E	E41D2219-1	0.0	13.0	13.0	Waste Rock	Lacustrine	7.7	2.556	0.04		1	7	-5		5.3				NAF
E41-E	E41D2219-2	14.0	16.0	2.0	Waste Rock	Lacustrine	6.4	2.485	0.03		1	4	-3		4.6				NAF
E41-E	E41D2219-3	17.0	18.0	1.0	Waste Rock	Saprolite	6.1	5.192	0.05	0.013	2	4	-2	-3	2.5	6.4	0	0	NAF
E41-E	E41D2219-4	19.0	33.0	14.0	Waste Rock	Saprock	5.9	8.551	0.07	0.006	2	4	-2	-4	1.8	6.8	0	0	NAF
E41-E	E41D2219-5	34.0	41.0	7.0	Waste Rock	Saprock	6.1	8.855	0.06	0.006	2	3	-1	-3	1.8	7.3	0	0	NAF
E41-E	E41D2219-6	43.0	46.0	3.0	Waste Rock	Saprock	6.2	8.348	0.05	<0.005	2	3	-1	-3	2.0	7.4	0	0	NAF
E41-E	E41D2219-7	47.0	49.0	2.0	Waste Rock	Saprock	6.5	8.855	0.05		2	6	-5		4.1				NAF
E41-E	E41D2219-8	56.0	87.0	31.0	Waste Rock	Saprock	7.1	5.357	0.02		1	24	-23		38.6				NAF
E41-E	E41D2219-9	88.0	100.0	12.0	Waste Rock	Saprock	8.9	1.334	0.03		1	40	-39		43.2				NAF
E41-E	E41D2219-10	102.0	115.5	13.5	Waste Rock	Monzodiorite	8.5	0.413	0.38		12	56	-45		4.9				NAF
E41-E	E41D2886-1	2.0	10.0	8.0	Waste Rock	Alluvium	5.8	0.483	0.02		1	0	1		0.0	6.9	0	0	NAF
E41-E	E41D2886-2	13.0	19.0	6.0	Waste Rock	Saprock	6.5	2.853	0.03		1	0	1		0.0	7.0	0	0	NAF
E41-E	E41D2886-3	45.0	47.0	2.0	Ore	Saprock	6.7	1.697	0.07		2	1	1		0.6	7.5	0	0	NAF
E41-E	E41D2886-4	74.0	77.0	3.0	Waste Rock	Saprock	7.2	1.751	<0.01		0	10	-10		33.7	8.0	0	0	NAF
E41-E	E41D2886-5	80.0	83.0	3.0	Waste Rock	Saprock	6.6	3.224	0.01		0	24	-23		77.1	8.4	0	0	NAF
E41-E	E41D2886-6	83.0	84.3	1.3	Low-Grade Ore	Saprock	7.3	0.671	<0.01		0	29	-28		93.1	9.0	0	0	NAF
E41-E	E41D2886-7	92.0	98.0	6.0	Waste Rock	Diorite	9.3	0.103	0.07		2	67	-65		31.4	10.1	0	0	NAF
E41-E	E41D2886-8	150.0	160.0	10.0	Waste Rock	Monzodiorite	9.1	0.073	0.61	0.664	19	69	-50	-48	3.7	9.9	0	0	NAF
E41-E	E41D2886-9	170.0	180.0	10.0	Waste Rock	Dyke	9.0	0.079	0.38	0.483	12	57	-46	-42	4.9	9.8	0	0	NAF
E41-E	E41D2886-10	188.0	189.0	1.0	Low-Grade Ore	Dyke	9.0	0.130	0.66	0.662	20	61	-41	-41	3.0	10.0	0	0	NAF
E41-E	E41D2886-11	216.0	217.0	1.0	Ore	Monzodiorite	9.0	0.136	2.80	2.100	86	55	30	9	0.6	2.6	33	41	PAF
E41-E	E41D2886-12	265.0	275.0	10.0	Waste Rock	Monzodiorite	8.8	0.167	0.31	0.360	9	74	-64	-63	7.8	10.3	0	0	NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
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ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

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Table B-2: Acid forming characteristics of drill-hole samples from the E41 East (E41-E) deposit for the CGO Open Cut Expansion Project. CONTINUED

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E41-E	E41D2888-1	2.0	12.0	10.0	Waste Rock	Alluvium	6.9	1.197	0.04		1	2	-1		1.6	7.2	0	0	NAF
E41-E	E41D2888-2	20.0	30.0	10.0	Waste Rock	Saprolite	6.6	0.554	0.02		1	0	1		0.0	5.8	0	1	NAF
E41-E	E41D2888-3	52.0	58.0	6.0	Waste Rock	Saprock	7.1	0.231	<0.01		0	2	-1		5.6	7.4	0	0	NAF
E41-E	E41D2888-4	69.0	70.0	1.0	Low-Grade Ore	Saprock	6.8	0.914	0.01		0	5	-5		16.3	7.7	0	0	NAF
E41-E	E41D2888-5	79.0	82.0	3.0	Waste Rock	Saprock	8.1	0.055	0.02		1	7	-6		11.3	8.0	0	0	NAF
E41-E	E41D2888-6	120.0	121.0	1.0	Ore	Volcaniclastic	9.6	0.117	1.15	0.823	35	104	-69	-79	3.0	10.1	0	0	NAF
E41-E	E41D2888-7	125.0	127.8	2.8	Waste Rock	Volcaniclastic	9.4	0.100	0.20	0.179	6	51	-44	-45	8.3	9.8	0	0	NAF
E41-E	E41D2888-8	127.8	129.6	1.8	Waste Rock	Fault Zone	9.7	0.067	0.22	0.197	7	103	-96	-97	15.3	10.8	0	0	NAF
E41-E	E41D2888-9	130.0	134.0	4.0	Waste Rock	Dyke	9.4	0.080	0.29	0.269	9	89	-80	-81	10.1	10.3	0	0	NAF
E41-E	E41D2888-10	143.0	144.0	1.0	Low-Grade Ore	Volcaniclastic	9.3	0.065	0.25	0.233	8	88	-80	-80	11.4	10.6	0	0	NAF
E41-E	E41D2888-11	165.0	175.0	10.0	Waste Rock	Volcaniclastic	9.4	0.079	0.80	0.643	24	64	-39	-44	2.6	9.7	0	0	NAF
E41-E	E41D2888-12	178.0	187.0	9.0	Waste Rock	Diorite	9.4	0.074	0.21	0.145	6	91	-84	-86	14.1	10.6	0	0	NAF
E41-E	E41D2888-13	210.0	219.0	9.0	Waste Rock	Monzodiorite	9.5	0.109	0.78	0.661	24	96	-72	-76	4.0	9.9	0	0	NAF
E41-E	E41D2888-14	244.0	245.3	1.3	Low-Grade Ore	Monzodiorite	8.7	0.213	3.64	3.150	111	69	43	28	0.6	2.6	40	52	PAF
E41-E	E41D2888-15	248.0	249.0	1.0	Ore	Monzodiorite	9.4	0.079	0.40	0.368	12	59	-47	-48	4.8	9.7	0	0	NAF
E41-E	E41D2888-16	258.0	259.0	1.0	Low-Grade Ore	Diorite	9.2	0.074	1.30	1.010	40	84	-44	-53	2.1	10.4	0	0	NAF
E41-E	E41D2888-17	266.0	273.0	7.0	Ore	Qtz Sulf.Breccia	8.8	0.119	2.90	2.120	89	75	14	-10	0.8	4.0	1	5	PAF-LC
E41-E	E41D2888-18	283.0	287.0	4.0	Waste Rock	Diorite	9.3	0.069	0.36	0.335	11	52	-41	-41	4.7	10.3	0	0	NAF
E41-E	E41D2888-19	320.0	329.0	9.0	Ore	Dyke	8.7	0.098	2.84	2.320	87	77	10	-6	0.9	10.6	0	0	UC(NAF)
E41-E	E41D2888-20	332.0	337.0	5.0	Waste Rock	Diorite	9.2	0.078	0.23	0.240	7	44	-36	-36	6.2	10.2	0	0	NAF
E41-E	E41D2888-21	370.0	380.0	10.0	Waste Rock	Dacite	9.3	0.112	0.45	0.409	14	52	-38	-39	3.8	10.9	0	0	NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
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$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
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Table B-2: Acid forming characteristics of drill-hole samples from the E41 East (E41-E) deposit for the CGO Open Cut Expansion Project. CONTINUED

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E41-E	E41D2893-1	5.1	11.6	6.5	Waste Rock	Transported	7.4	0.421	0.04		1	1	0		1.1	7.3	0	0	NAF
E41-E	E41D2893-2	11.6	13.8	2.2	Waste Rock	Saprolite	6.6	1.089	0.04		1	1	0		1.0	7.2	0	0	NAF
E41-E	E41D2893-3	18.2	21.0	2.8	Waste Rock	Saprock	6.5	1.449	0.03		1	0	1		0.0	6.2	0	1	NAF
E41-E	E41D2893-4	37.0	40.0	3.0	Waste Rock	Saprock	7.7	0.424	0.01		0	10	-10		34.0	8.8	0	0	NAF
E41-E	E41D2893-5	44.0	45.0	1.0	Low-Grade Ore	Saprock	8.2	0.270	0.01		0	8	-8		26.8	8.9	0	0	NAF
E41-E	E41D2893-6	56.0	60.0	4.0	Ore	Saprock	7.9	0.191	0.01		0	20	-20		66.7	8.9	0	0	NAF
E41-E	E41D2893-10	116.0	118.0	2.0	Waste Rock	Volcaniclastic	9.0	0.084	1.80	1.390	55	28	27	15	0.5	2.6	20	23	PAF
E41-E	E41D2893-11	144.0	152.0	8.0	Ore	Volcaniclastic	9.3	0.071	1.08	0.941	33	45	-12	-17	1.4	10.2	0	0	NAF
E41-E	E41D2893-12	160.0	161.0	1.0	Low-Grade Ore	Dyke	9.3	0.073	2.52	1.880	77	34	43	24	0.4	2.6	40	50	PAF
E41-E	E41D2893-17	222.0	223.2	1.2	Ore	Diorite	9.1	0.099	2.45	2.100	75	138	-63	-74	1.8	11.0	0	0	NAF
E41-E	E41D2893-18	253.0	255.0	2.0	Low-Grade Ore	Diorite	9.1	0.136	0.34	0.342	10	33	-22	-22	3.2	8.9	0	0	NAF
E41-E	E41D2893-19	301.0	310.0	9.0	Waste Rock	Diorite	9.1	0.106	0.32	0.307	10	26	-16	-17	2.7	7.7	0	0	NAF
E41-E	E41D2893-20	327.0	337.0	10.0	Waste Rock	Diorite	9.1	0.067	0.54	0.544	17	36	-19	-19	2.1	6.0	0	1	NAF
E41-E	E41D2893-21	397.0	401.0	4.0	Ore	Diorite	9.0	0.102	1.31	1.090	40	27	13	6	0.7	2.8	14	18	PAF

KEY
$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key
AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-3: Acid forming characteristics of drill-hole samples from the E41 West (E41-W) deposit for the CGO Open Cut Expansion Project.

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E41-W	E41D2178-1	0.0	6.0	6.0	Waste Rock	Lacustrine	7.9	2.552	0.03		1	9	-8		9.4				NAF
E41-W	E41D2178-2	8.0	9.0	1.0	Waste Rock	Lacustrine	6.3	3.847	0.04		1	5	-4		4.4				NAF
E41-W	E41D2178-3	11.0	12.0	1.0	Waste Rock	Saprolite	6.5	2.545	0.03		1	5	-4		5.2				NAF
E41-W	E41D2178-4	13.0	14.0	1.0	Waste Rock	Saprock	7.8	0.991	0.08		2	6	-4		2.5	7.2	0	0	NAF
E41-W	E41D2178-5	50.0	51.0	1.0	Waste Rock	Diorite	8.6	0.607	1.29	1.140	39	43	-3	-8	1.1	10.6	0	0	NAF
E41-W	E41D2178-6	58.0	72.0	14.0	Waste Rock	Monzodiorite	8.4	0.449	0.53	0.485	16	26	-10	-11	1.6	10.4	0	0	NAF
E41-W	E41D2178-7	120.0	138.0	18.0	Waste Rock	Monzodiorite	8.2	0.589	1.04	0.911	32	32	0	-4	1.0	10.1	0	0	NAF
E41-W	E41D2178-8	139.0	169.0	30.0	Waste Rock	Monzodiorite	8.1	0.490	0.52	0.357	16	40	-24	-29	2.5	9.7	0	0	NAF
E41-W	E41D2178-9	171.0	213.0	42.0	Waste Rock	Monzodiorite	8.2	0.478	0.58	0.507	18	52	-34	-37	2.9	9.8	0	0	NAF
E41-W	E41D2178-10	213.0	214.0	1.0	Low-Grade Ore	Monzodiorite	8.4	0.460	0.75	0.656	23	72	-49	-52	3.1	9.2	0	0	NAF
E41-W	E41D2178-11	217.0	238.0	21.0	Waste Rock	Monzodiorite	8.3	0.505	0.64	0.560	20	62	-42	-45	3.2	9.1	0	0	NAF
E41-W	E41D2178-12	239.0	250.9	11.9	Waste Rock	Granodiorite	8.4	0.313	0.09		3	30	-27		10.8				NAF
E41-W	E41D2810-1	4.2	10.2	6.0	Waste Rock	Alluvium	7.3	0.057	0.02		1	0	1		0.0	7.0	0	0	NAF
E41-W	E41D2810-2	10.2	13.4	3.2	Waste Rock	Saprolite	7.1	0.038	0.03		1	0	1		0.0	7.2	0	0	NAF
E41-W	E41D2810-3	13.4	19.5	6.1	Waste Rock	Saprock	6.9	0.030	0.01		0	0	0		0.0	8.0	0	0	NAF
E41-W	E41D2810-4	37.0	38.0	1.0	Ore	Saprock	9.5	0.101	0.04		1	38	-36		30.8	10.2	0	0	NAF
E41-W	E41D2810-5	83.0	89.0	6.0	Waste Rock	Diorite	9.3	0.080	1.10	0.867	34	77	-43	-50	2.3	10.7	0	0	NAF
E41-W	E41D2810-6	114.0	116.0	2.0	Ore	Diorite	9.0	0.053	0.79	0.623	24	83	-59	-64	3.4	11.1	0	0	NAF
E41-W	E41D2810-7	132.0	133.0	1.0	Low-Grade Ore	Monzodiorite	9.5	0.128	3.32	2.960	102	74	28	17	0.7	9.0	0	0	UC(NAF)
E41-W	E41D2810-8	155.0	159.0	4.0	Waste Rock	Monzodiorite	9.2	0.075	0.93	0.728	28	73	-44	-50	2.5	10.7	0	0	NAF
E41-W	E41D2810-9	177.0	182.0	5.0	Ore	Monzodiorite	9.0	0.106	2.26	1.890	69	74	-5	-16	1.1	9.9	0	0	NAF
E41-W	E41D2810-10	210.0	211.0	1.0	Low-Grade Ore	Monzodiorite	8.8	0.098	1.11	0.921	34	85	-51	-57	2.5	10.6	0	0	NAF
E41-W	E41D2810-11	230.0	240.0	10.0	Waste Rock	Monzodiorite	9.0	0.082	0.91	0.698	28	46	-18	-24	1.6	10.2	0	0	NAF
E41-W	E41D2810-12	262.0	263.0	1.0	Ore	Fault Zone	8.6	0.367	2.00	1.620	61	106	-45	-56	1.7	10.8	0	0	NAF
E41-W	E41D2810-13	274.0	284.0	10.0	Waste Rock	Monzodiorite	9.2	0.114	1.53	1.190	47	87	-40	-51	1.9	10.7	0	0	NAF
E41-W	E41D2810-14	294.3	297.0	2.7	Waste Rock	Fault Zone	9.0	0.240	1.20	0.810	37	191	-154	-166	5.2	9.3	0	0	AC
E41-W	E41D2810-15	327.0	328.0	1.0	Low-Grade Ore	Monzodiorite	8.7	0.137	2.68	2.240	82	82	0	-13	1.0	8.7	0	0	NAF
E41-W	E41D2810-16	419.0	425.0	6.0	Waste Rock	Monzodiorite	9.0	0.068	1.06	0.880	32	58	-25	-31	1.8	10.0	0	0	NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-3: Acid forming characteristics of drill-hole samples from the E41 West (E41-W) deposit for the CGO Open Cut Expansion Project. CONTINUED

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E41-West	E41D2831-1	1.7	5.7	4.0	Waste Rock	Alluvium	7.6	0.528	0.02		1	2	-1		2.9	8.0	0	0	NAF
E41-West	E41D2831-2	7.0	17.0	10.0	Waste Rock	Saprock	7.8	0.108	0.03		1	2	-1		2.3	7.8	0	0	NAF
E41-West	E41D2831-4	44.0	46.0	2.0	Waste Rock	Monzodiorite	9.0	0.087	0.62	0.502	19	46	-27	-30	2.4	10.5	0	0	NAF
E41-West	E41D2831-5	58.0	65.0	7.0	Waste Rock	Monzodiorite	8.4	0.152	0.70	0.611	21	51	-29	-32	2.4	10.7	0	0	NAF
E41-West	E41D2831-6	68.0	69.0	1.0	Low-Grade Ore	Monzodiorite	8.8	0.208	0.70	0.614	21	105	-84	-86	4.9	11.2	0	0	NAF
E41-West	E41D2831-8	117.0	121.0	4.0	Ore	Monzodiorite	9.1	0.160	1.20	1.060	37	86	-49	-53	2.3	11.0	0	0	NAF
E41-West	E41D2831-9	133.0	143.0	10.0	Waste Rock	Monzodiorite	8.8	0.090	0.43	0.406	13	53	-39	-40	4.0	11.0	0	0	NAF
E41-West	E41D2831-10	205.0	211.0	6.0	Waste Rock	Monzodiorite	8.8	0.091	0.20	0.196	6	70	-64	-64	11.5	11.2	0	0	NAF
E41-West	E41D2831-12	232.0	236.0	4.0	Waste Rock	Monzodiorite	8.8	0.104	1.72	1.360	53	72	-20	-31	1.4	9.5	0	0	NAF
E41-West	E41D2834-1	10.0	20.0	10.0	Waste Rock	Alluvium	7.3	2.186	0.02		1	3	-2		4.1	6.3	0	2	NAF
E41-West	E41D2834-2	35.0	39.9	4.9	Waste Rock	Saprolite	7.4	0.570	0.01		0	2	-1		5.6	6.6	0	1	NAF
E41-West	E41D2834-3	48.0	50.0	2.0	Waste Rock	Saprock	7.8	0.223	<0.01		0	7	-6		21.9	8.8	0	0	NAF
E41-West	E41D2834-4	55.0	58.0	3.0	Ore	Saprock	8.1	0.126	0.05		2	6	-5		4.1	8.8	0	0	NAF
E41-West	E41D2834-5	63.0	66.0	3.0	Waste Rock	Saprock	8.2	0.384	<0.01		0	15	-14		47.7	9.2	0	0	NAF
E41-West	E41D2834-6	78.0	88.0	10.0	Waste Rock	Saprock	7.1	1.376	0.02		1	24	-24		39.9	9.2	0	0	NAF
E41-West	E41D2834-7	98.0	105.0	7.0	Waste Rock	Diorite	9.6	0.413	0.11	0.049	3	155	-152	-154	46.0	11.1	0	0	AC
E41-West	E41D2834-8	115.0	116.0	1.0	Low-Grade Ore	Fault Zone	8.0	0.234	1.23	0.832	38	242	-204	-217	6.4	11.0	0	0	AC
E41-West	E41D2834-9	116.5	118.3	1.8	Waste Rock	Diorite	8.6	0.091	0.23	0.158	7	269	-262	-264	38.2	11.6	0	0	AC
E41-West	E41D2834-10	144.8	146.0	1.3	Ore	Diorite	9.3	0.154	1.33	0.810	41	147	-106	-122	3.6	11.5	0	0	AC
E41-West	E41D2834-11	154.3	155.8	1.5	Waste Rock	Fault Zone	8.0	2.044	0.26	0.027	8	78	-70	-77	9.8	11.4	0	0	NAF
E41-West	E41D2834-12	159.0	162.5	3.5	Waste Rock	Diorite	9.5	0.185	0.07		2	91	-89		42.6	11.5	0	0	NAF
E41-West	E41D2834-13	184.0	185.5	1.5	Ore	Fault Zone	9.2	0.200	0.52	0.457	16	88	-72	-74	5.5	11.5	0	0	NAF
E41-West	E41D2834-14	185.5	193.1	7.6	Waste Rock	Diorite	9.4	0.215	0.09		3	52	-49		18.7	10.3	0	0	NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)

MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)

NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key
AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-3: Acid forming characteristics of drill-hole samples from the E41 West (E41-W) deposit for the CGO Open Cut Expansion Project. CONTINUED

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E41-W	E41D2835-1	5.0	15.0	10.0	Waste Rock	Alluvium	7.7	0.237	0.02		1	2	-1		3.3	7.4	0	0	NAF
E41-W	E41D2835-2	21.0	26.0	5.0	Waste Rock	Saprock	7.8	0.125	0.02		1	2	-2		3.6	6.1	0	2	NAF
E41-W	E41D2835-3	45.4	50.1	4.7	Waste Rock	Saprock	6.6	1.260	0.02		1	4	-3		5.7	8.5	0	0	NAF
E41-W	E41D2835-4	50.1	56.6	6.5	Waste Rock	Saprock	7.3	0.696	0.01		0	10	-9		31.4	8.8	0	0	NAF
E41-W	E41D2835-5	62.0	63.0	1.0	Ore	Saprock	7.0	1.653	0.02		1	10	-9		15.7	8.8	0	0	NAF
E41-W	E41D2835-6	69.0	70.0	1.0	Low-Grade Ore	Saprock	7.6	0.240	0.01		0	4	-4		13.7	8.1	0	0	NAF
E41-W	E41D2835-7	89.4	97.9	8.6	Waste Rock	Diorite	9.2	0.147	0.36	0.280	11	51	-40	-43	4.7	10.2	0	0	NAF
E41-W	E41D2835-8	118.0	119.0	1.0	Low-Grade Ore	Diorite	9.1	0.100	0.76	0.599	23	74	-50	-55	3.2	11.3	0	0	NAF
E41-W	E41D2835-9	129.7	130.5	0.8	Low-Grade Ore	Fault Zone	8.1	1.214	1.65	1.210	50	185	-135	-148	3.7	11.1	0	0	AC
E41-W	E41D2835-10	131.0	132.0	1.0	Ore	Dyke	9.0	0.446	3.90	3.080	119	148	-29	-54	1.2	9.4	0	0	NAF
E41-W	E41D2835-11	133.0	141.0	8.0	Waste Rock	Dyke	9.3	0.152	0.77	0.545	24	133	-109	-116	5.6	10.9	0	0	AC
E41-W	E41D2835-16	166.3	169.0	2.7	Waste Rock	Diorite	9.2	0.131	0.56	0.487	17	98	-80	-83	5.7	11.4	0	0	NAF
E41-W	E41D2835-17	228.3	231.6	3.3	Waste Rock	Diorite	8.9	0.074	0.12	0.113	4	69	-66	-66	18.9	11.3	0	0	NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-4: Acid forming characteristics of drill-hole samples from the E46 deposit for the CGO Open Cut Expansion Project.

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E46	E46D3026-1	1.0	3.0	2.0	Waste Rock	Lacustrine	8.3	1.216	0.02		1	4	-3		6.0				NAF
E46	E46D3026-2	5.0	17.0	12.0	Waste Rock	Colluvium	7.6	2.613	0.03		1	8	-7		8.4				NAF
E46	E46D3026-3	18.0	19.0	1.0	Waste Rock	Colluvium	6.1	3.248	0.02		1	4	-3		6.0				NAF
E46	E46D3026-4	20.0	24.0	4.0	Waste Rock	Lacustrine	6.2	2.646	0.02		1	5	-4		8.0				NAF
E46	E46D3026-5	25.0	27.0	2.0	Waste Rock	Colluvium	6.2	2.709	0.03		1	4	-3		4.5				NAF
E46	E46D3026-6	28.0	32.0	4.0	Waste Rock	Saprolite	6.5	1.678	0.02		1	4	-4		7.2				NAF
E46	E46D3026-7	33.0	53.0	20.0	Waste Rock	Saprolite	6.1	6.216	0.03		1	5	-4		5.6				NAF
E46	E46D3026-8	53.0	68.0	15.0	Low-Grade Ore	Saprolite	6.4	3.778	0.02		1	7	-6		11.1				NAF
E46	E46D3026-9	71.0	83.0	12.0	Waste Rock	Saprock	6.7	2.569	0.02		1	5	-4		8.3				NAF
E46	E46D3026-10	105.0	109.0	4.0	Waste Rock	Saprock	8.5	0.380	0.22		7	100	-93		14.9				NAF
E46	E46D3026-11	114.0	117.0	3.0	Waste Rock	Diorite	8.7	0.377	0.09		3	64	-61		23.2				NAF
E46	E46D3026-12	118.0	134.0	16.0	Waste Rock	Diorite	8.9	0.444	0.19		6	104	-98		17.9				NAF
E46	E46D3026-13	138.0	161.0	23.0	Waste Rock	Monzodiorite	8.5	0.355	0.09		3	70	-67		25.5				NAF
E46	E46D3026-15	166.0	175.0	9.0	Waste Rock	Diorite	8.6	0.360	0.09		3	63	-61		23.0				NAF
E46	E46D3026-16	176.0	204.0	28.0	Waste Rock	Diorite	8.5	0.396	0.17		5	79	-74		15.1				NAF
E46	E46D3026-17	204.0	208.0	4.0	Waste Rock	Fault Zone	8.6	0.376	0.06		2	76	-74		41.6				NAF
E46	E46D3026-18	208.0	235.0	27.0	Waste Rock	Diorite	8.5	0.317	0.14		4	60	-56		14.1				NAF
E46	E46D3026-19	210.0	211.0	1.0	Low-Grade Ore	Diorite	8.5	0.385	0.13		4	80	-76		20.1				NAF
E46	E46D3026-20	236.0	245.0	9.0	Waste Rock	Diorite	8.5	0.308	0.22		7	51	-44		7.6				NAF
E46	E46D3026-21	246.0	261.0	15.0	Waste Rock	Diorite	8.4	0.410	0.48	0.436	15	48	-33	-34	3.3	10.4	0	0	NAF
E46	E46D3041-1	2.0	7.0	5.0	Waste Rock	Lacustrine	8.5	0.720	<0.01		0	5	-4		15.7				NAF
E46	E46D3041-2	8.0	17.0	9.0	Waste Rock	Lacustrine	7.3	2.415	0.02		1	1	0		1.6	7.3	0	0	NAF
E46	E46D3041-3	18.0	23.0	5.0	Waste Rock	Lacustrine	6.7	2.834	0.02		1	0	0		0.8	7.2	0	0	NAF
E46	E46D3041-4	24.0	60.0	36.0	Waste Rock	Lacustrine	6.6	3.601	0.04	0.009	1	0	1	0	0.4	6.9	0	0	NAF
E46	E46D3041-5	55.0	56.0	1.0	Low-Grade Ore	Lacustrine	6.8	3.084	0.03		1	2	-1		1.7	8.7	0	0	NAF
E46	E46D3041-6	61.0	77.0	16.0	Waste Rock	Saprolite	6.3	5.926	0.02		1	1	0		0.8	7.8	0	0	NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-4: Acid forming characteristics of drill-hole samples from the E46 deposit for the CGO Open Cut Expansion Project. CONTINUED

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E46	E46D3041-7	77.0	106.0	29.0	Waste Rock	Saprock	6.5	3.569	0.02		1	0	0		0.8	8.0	0	0	NAF
E46	E46D3041-8	114.0	115.0	1.0	Low-Grade Ore	Saprock	6.7	2.112	<0.01		0	0	0		1.6				NAF
E46	E46D3041-9	119.0	134.0	15.0	Waste Rock	Volcaniclastic	8.5	0.455	0.47	0.402	14	43	-29	-31	3.0	9.1	0	0	NAF
E46	E46D3041-10	135.0	144.0	9.0	Waste Rock	Volcaniclastic	8.3	0.649	0.34		10	63	-53		6.1				NAF
E46	E46D3041-11	148.0	149.0	1.0	Low-Grade Ore	Sandstone	8.4	0.471	0.80	0.722	24	59	-34	-37	2.4	8.6	0	0	NAF
E46	E46D3041-12	149.0	160.0	11.0	Waste Rock	Volcaniclastic	8.5	0.520	0.61		19	77	-58		4.1				NAF
E46	E46D3041-13	161.0	166.0	5.0	Waste Rock	Diorite	8.4	0.428	0.12		4	101	-97		27.5				NAF
E46	E46D3041-14	168.0	211.2	43.2	Waste Rock	Diorite	8.5	0.320	<0.01		0	48	-48		158.2				NAF
E46	E46D3053-1	0.0	2.0	2.0	Waste Rock	Lacustrine	8.1	0.861	<0.01		0	7	-6		21.9				NAF
E46	E46D3053-2	3.0	7.0	4.0	Waste Rock	Lacustrine	7.9	0.682	<0.01		0	0	0		1.6				NAF
E46	E46D3053-3	8.0	23.0	15.0	Waste Rock	Lacustrine	6.9	1.936	0.01		0	0	0		1.6				NAF
E46	E46D3053-4	24.0	25.0	1.0	Waste Rock	Saprolite	6.5	2.921	0.03		1	0	0		0.5	6.9	0	0	NAF
E46	E46D3053-5	26.0	104.0	78.0	Waste Rock	Saprock	6.6	2.714	<0.01		0	3	-3		9.5				NAF
E46	E46D3053-6	56.0	57.0	1.0	Low-Grade Ore	Saprock	6.2	2.097	0.03		1	1	0		0.9	7.1	0	0	NAF
E46	E46D3053-7	105.0	106.0	1.0	Waste Rock	Dyke	7.4	1.279	<0.01		0	11	-10		34.3				NAF
E46	E46D3053-8	107.0	108.0	1.0	Low-Grade Ore	Saprock	8.1	0.941	<0.01		0	9	-9		30.4				NAF
E46	E46D3053-9	108.0	114.0	6.0	Waste Rock	Saprock	9.1	0.961	<0.01		0	33	-33		107.5				NAF
E46	E46D3053-10	115.0	129.0	14.0	Waste Rock	Diorite	8.8	0.314	0.38	0.343	12	43	-31	-32	3.7	10.4	0	0	NAF
E46	E46D3053-11	130.0	138.0	8.0	Waste Rock	Dyke	8.3	0.379	0.81	0.757	25	38	-14	-15	1.5	10.3	0	0	NAF
E46	E46D3053-12	139.0	157.0	18.0	Waste Rock	Diorite	8.2	0.302	0.39	0.321	12	40	-28	-30	3.4	10.9	0	0	NAF
E46	E46D3053-13	158.0	177.0	19.0	Waste Rock	Trachyandesite	8.1	0.513	2.12	2.440	65	59	6	16	0.9	10.1	0	0	UC(NAF)
E46	E46D3053-14	179.0	222.0	43.0	Waste Rock	Trachyandesite	8.2	0.577	1.66	1.600	51	45	6	4	0.9	9.6	0	0	UC(NAF)
E46	E46D3053-15	223.0	227.0	4.0	Waste Rock	Volcaniclastic	8.3	0.317	0.63	0.586	19	38	-19	-20	2.0	10.5	0	0	NAF
E46	E46D3053-16	228.0	248.0	20.0	Waste Rock	Trachyandesite	8.3	0.437	1.00	0.879	31	40	-9	-13	1.3	8.6	0	0	NAF
E46	E46D3053-17	250.0	280.2	30.2	Waste Rock	Volcaniclastic	8.6	0.352	0.38		12	71	-59		6.1				NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-4: Acid forming characteristics of drill-hole samples from the E46 deposit for the CGO Open Cut Expansion Project. CONTINUED

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E46	E46D3248-1	5.0	9.3	4.3	Waste Rock	Alluvium	7.8	2.259	0.03		1	5	-4		5.4	7.1	0	0	NAF
E46	E46D3248-2	9.3	29.3	20.1	Waste Rock	Alluvium	7.8	0.327	0.02		1	4	-3		6.2	8.1	0	0	NAF
E46	E46D3248-3	31.0	32.0	1.0	Ore	Saprolite	7.1	0.166	0.02		1	2	-1		2.8	7.4	0	0	NAF
E46	E46D3248-4	32.0	33.0	1.0	Low-Grade Ore	Saprolite	7.0	0.242	0.01		0	3	-2		8.8	7.6	0	0	NAF
E46	E46D3249-1	4.9	9.6	4.7	Waste Rock	Alluvium	7.8	1.599	0.03		1	6	-5		6.8	7.7	0	0	NAF
E46	E46D3249-2	10.0	20.0	10.0	Waste Rock	Alluvium	6.7	0.984	0.02		1	5	-4		8.3	7.6	0	0	NAF
E46	E46D3249-3	25.0	35.0	10.0	Waste Rock	Saprolite	6.4	1.001	0.02		1	4	-4		7.2	6.9	0	1	NAF
E46	E46D3249-17	133.0	135.0	2.0	Waste Rock	Volcaniclastic	9.2	0.158	0.09		3	85	-82		30.9	10.8	0	0	NAF
E46	E46D3250-1	5.4	14.0	8.6	Waste Rock	Alluvium	7.5	1.035	0.02		1	5	-4		8.0	8.4	0	0	NAF
E46	E46D3250-2	14.0	22.5	8.5	Waste Rock	Alluvium	7.9	0.528	<0.01		0	5	-5		17.3	8.2	0	0	NAF
E46	E46D3250-10	92.0	97.0	5.0	Waste Rock	Diorite	9.6	0.294	0.04		1	86	-85		70.6	11.2	0	0	NAF
E46	E46D3250-11	97.0	99.0	2.0	Ore	Diorite	9.7	0.320	0.02		1	94	-93		153.6	11.1	0	0	NAF
E46	E46D3250-12	102.0	110.0	8.0	Waste Rock	Diorite	9.5	0.188	0.03		1	64	-63		69.9	11.0	0	0	NAF
E46	E46D3250-13	123.0	129.0	6.0	Waste Rock	Diorite	9.3	0.137	0.06		2	94	-92		51.0	11.2	0	0	NAF
E46	E46D3250-14	129.0	130.0	1.0	Low-Grade Ore	Diorite	9.2	0.149	1.34	1.090	41	183	-142	-150	4.5	11.1	0	0	AC

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)

MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)

NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-5: Acid forming characteristics of drill-hole samples from the Galway Regal (GR) deposit for the CGO Open Cut Expansion Project.

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
GR	E46D3134-1	1.0	3.0	2.0	Waste Rock	Lacustrine	7.9	1.202	<0.01		0	9	-9		30.4				NAF
GR	E46D3134-2	3.0	5.0	2.0	Waste Rock	Lacustrine	7.3	1.247	<0.01		0	0	0		1.6				NAF
GR	E46D3134-3	6.0	18.0	12.0	Waste Rock	Lacustrine	6.0	3.557	0.03		1	1	0		0.9	7.3	0	0	NAF
GR	E46D3134-4	19.0	54.0	35.0	Waste Rock	Saprolite	5.9	5.500	<0.01		0	0	0		1.6				NAF
GR	E46D3134-5	55.0	68.0	13.0	Waste Rock	Saprock	6.2	5.500	0.01		0	4	-4		13.7				NAF
GR	E46D3134-6	69.0	76.0	7.0	Waste Rock	Volcaniclastic	8.4	0.691	0.06		2	58	-56		31.4				NAF
GR	E46D3134-7	77.0	83.0	6.0	Waste Rock	Volcaniclastic	8.4	0.467	<0.01		0	99	-99		323.9				NAF
GR	E46D3134-8	84.0	89.4	5.4	Waste Rock	Volcaniclastic	8.8	0.574	<0.01		0	57	-57		186.6				NAF
GR	E46D3173-1	23.0	25.0	2.0	Waste Rock	Alluvium	6.7	2.872	0.02		1	2	-1		2.9	6.7	0	1	NAF
GR	E46D3173-2	27.0	33.0	6.0	Waste Rock	Saprolite	6.1	5.794	0.04	0.026	1	2	0	-1	1.3	6.6	0	1	NAF
GR	E46D3173-3	43.0	52.0	9.0	Waste Rock	Saprock	6.2	3.459	0.02		1	3	-2		4.1				NAF
GR	E46D3173-4	67.0	71.0	4.0	Waste Rock	Saprock	6.5	1.679	<0.01		0	3	-3		9.5				NAF
GR	E46D3173-5	73.0	78.0	5.0	Low-Grade Ore	Saprock	6.4	2.383	0.01		0	4	-3		12.1				NAF
GR	E46D3173-6	92.0	104.0	12.0	Waste Rock	Saprock	6.5	1.704	<0.01		0	2	-1		5.2				NAF
GR	E46D3173-7	110.0	114.0	4.0	Waste Rock	Saprock	6.6	1.025	0.01		0	0	0		1.6				NAF
GR	E46D3173-8	115.0	119.0	4.0	Waste Rock	Saprock	6.6	1.213	<0.01		0	9	-9		30.4				NAF
GR	E46D3173-9	117.0	118.0	1.0	Low-Grade Ore	Saprock	7.0	1.029	<0.01		0	9	-8		28.1				NAF
GR	E46D3173-10	124.0	130.0	6.0	Waste Rock	Volcaniclastic	8.5	0.660	0.08		2	38	-36		15.7				NAF
GR	E46D3173-11	130.0	132.0	2.0	Low-Grade Ore	Volcaniclastic	8.2	0.929	0.05		2	38	-36		24.7				NAF
GR	E46D3173-12	133.0	134.0	1.0	Waste Rock	Volcaniclastic	8.6	0.679	0.44		13	63	-50		4.7				NAF
GR	E46D3173-13	134.0	142.0	8.0	Waste Rock	Volcaniclastic	8.9	0.512	0.10		3	93	-90		30.3				NAF
GR	E46D3173-14	143.0	146.0	3.0	Waste Rock	Volcaniclastic	9.0	0.515	0.21		6	27	-21		4.2				NAF
GR	E46D3173-15	147.0	149.0	2.0	Waste Rock	Dyke	9.0	0.475	0.10		3	153	-150		50.0				AC
GR	E46D3173-16	150.0	152.0	2.0	Waste Rock	Volcaniclastic	8.9	0.531	0.42		13	115	-102		8.9				AC
GR	E46D3173-17	153.0	157.0	4.0	Waste Rock	Volcaniclastic	8.9	0.427	0.25		8	34	-26		4.5				NAF
GR	E46D3173-18	158.0	164.0	6.0	Waste Rock	Volcaniclastic	8.9	0.503	0.04		1	116	-115		94.8				AC

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)

MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)

NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-5: Acid forming characteristics of drill-hole samples from the Galway Regal (GR) deposit for the CGO Open Cut Expansion Project. CONTINUED

Deposit	Drill Hole / Sample ID	Depth (m)			Material Type	Lithology	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS							NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	$NAPP_T$	$NAPP_S$	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
GR	E46D3173-19	165.0	167.0	2.0	Waste Rock	Fault Zone	8.9	0.660	1.00		31	134	-103		4.4				AC
GR	E46D3173-20	170.0	173.0	3.0	Waste Rock	Volcaniclastic	8.9	0.532	0.47		14	131	-117		9.1				AC
GR	E46D3173-21	182.0	186.0	4.0	Waste Rock	Volcaniclastic	8.9	0.553	0.36		11	163	-152		14.8				AC
GR	E46D3173-22	187.0	196.0	9.0	Waste Rock	Trachyandesite	8.8	0.534	0.58		18	141	-123		7.9				AC
GR	E46D3173-23	197.0	198.0	1.0	Waste Rock	Volcaniclastic	8.8	0.486	0.56		17	141	-124		8.2				AC
GR	E46D3173-24	199.0	221.0	22.0	Waste Rock	Volcaniclastic	8.8	0.497	0.36		11	70	-58		6.3				NAF
GR	E46D3173-25	227.0	238.0	11.0	Waste Rock	Volcaniclastic	8.8	0.468	0.36		11	96	-85		8.7				NAF
GR	E46D3173-26	238.0	240.0	2.0	Waste Rock	Volcaniclastic	8.9	0.386	0.08		2	112	-110		45.8				AC
GR	E46D3173-27	242.0	246.0	4.0	Waste Rock	Volcaniclastic	8.9	0.314	0.36	0.298	11	37	-26	-27	3.3	9.3	0	0	NAF
GR	E46D3173-28	246.0	248.0	2.0	Low-Grade Ore	Mudstone	8.6	0.508	0.83	0.722	25	88	-63	-66	3.5	9.0	0	0	NAF
GR	E46D3173-29	250.0	255.4	5.4	Waste Rock	Volcaniclastic	9.0	0.421	<0.01		0	58	-57		188.6				NAF
GR	UG-BH-05-1	5.0	15.0	10.0	Waste Rock	Alluvium	7.8	0.262	0.02		1	4	-3		6.5	8.0	0	0	NAF
GR	UG-BH-05-2	18.0	23.0	5.0	Waste Rock	Saprock	7.3	0.123	0.03		1	4	-3		3.9	7.4	0	0	NAF
GR	UG-BH-05-3	23.0	24.0	1.0	Ore	Saprock	7.2	0.070	0.01		0	3	-3		9.5	6.6	0	1	NAF
GR	UG-BH-05-4	30.0	35.0	5.0	Waste Rock	Saprock	7.2	0.106	0.02		1	4	-3		6.5	8.6	0	0	NAF
GR	UG-BH-05-5	36.0	42.0	6.0	Waste Rock	Saprock	7.4	0.089	0.02		1	4	-3		5.9	8.8	0	0	NAF
GR	UG-BH-05-6	42.0	43.2	1.2	Ore	Saprock	7.5	0.087	0.01		0	3	-3		9.8	8.8	0	0	NAF
GR	UG-BH-05-7	59.0	60.0	1.0	Low-Grade Ore	Saprock	7.7	0.125	0.19	0.021	6	6	0	-5	1.0	7.8	0	0	NAF
GR	UG-BH-05-8	75.0	77.0	2.0	Waste Rock	Trachyandesite	8.5	0.235	0.46	0.419	14	49	-35	-36	3.5	10.6	0	0	NAF
GR	UG-BH-05-9	77.0	82.0	5.0	Ore	Trachyandesite	8.8	0.144	0.75	0.703	23	65	-42	-43	2.8	10.1	0	0	NAF
GR	UG-BH-05-10	82.0	83.0	1.0	Low-Grade Ore	Trachyandesite	8.6	0.131	0.97	0.534	30	54	-24	-37	1.8	8.4	0	0	NAF
GR	UG-BH-05-11	85.0	88.0	3.0	Waste Rock	Trachyandesite	8.9	0.116	0.41	0.369	13	60	-47	-49	4.8	10.9	0	0	NAF
GR	UG-BH-05-12	95.0	98.0	3.0	Waste Rock	Trachyandesite	8.9	0.117	0.68	0.584	21	47	-26	-29	2.3	9.8	0	0	NAF
GR	UG-BH-05-13	98.0	102.0	4.0	Ore	Trachyandesite	8.3	0.189	1.37	1.190	42	62	-20	-25	1.5	6.1	0	1	NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)

MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
$NAPP_T$ = Net Acid Producing Potential for Total S (kg H_2SO_4/t)
$NAPP_S$ = Net Acid Producing Potential for Sulfide S (kg H_2SO_4/t)

NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

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PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain (expected classification)

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Table B-6: Acid forming characteristics of E46 backfill material for the CGO Open Cut Expansion Project.

Pit	Sample ID	Depth (m)			Lithology	Material Type	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS						NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	NAPP	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
GR	E46D3134/1	1.0	3.0	2.0	Lacustrine	TR	7.9	1.202	<0.01		0	9	-9	30.4				NAF
GR	E46D3134/2	3.0	5.0	2.0	Lacustrine	TR	7.3	1.247	<0.01		0	0	0	1.6				NAF
GR	E46D3134/3	6.0	18.0	12.0	Lacustrine	TR	6.0	3.557	0.03		1	1	0	0.9	7.3	0	0	NAF
GR	E46D3173/1	23.0	25.0	2.0	Alluvium	TR	6.7	2.872	0.02		1	2	-1	2.9	6.7	0	1	NAF
GR	UG-BH-05/1	5.0	15.0	10.0	Alluvium	TR	7.8	0.262	0.02		1	4	-3	6.5	8.0	0	0	NAF
GR	E46D3134/4	19.0	54.0	35.0	Saprolite	SOX	5.9	5.500	<0.01		0	0	0	1.6				NAF
GR	E46D3173/2	27.0	33.0	6.0	Saprolite	SOX	6.1	5.794	0.04	0.026	1	2	0	1.3	6.6	0	1	NAF
GR	E46D3134/5	55.0	68.0	13.0	Saprock	HOX	6.2	5.500	0.01		0	4	-4	13.7				NAF
GR	E46D3173/3	43.0	52.0	9.0	Saprock	HOX	6.2	3.459	0.02		1	3	-2	4.1				NAF
GR	E46D3173/4	67.0	71.0	4.0	Saprock	HOX	6.5	1.679	<0.01		0	3	-3	9.5				NAF
GR	E46D3173/6	92.0	104.0	12.0	Saprock	HOX	6.5	1.704	<0.01		0	2	-1	5.2				NAF
GR	E46D3173/7	110.0	114.0	4.0	Saprock	HOX	6.6	1.025	0.01		0	0	0	1.6				NAF
GR	E46D3173/8	115.0	119.0	4.0	Saprock	HOX	6.6	1.213	<0.01		0	9	-9	30.4				NAF
GR	UG-BH-05/2	18.0	23.0	5.0	Saprock	HOX	7.3	0.123	0.03		1	4	-3	3.9	7.4	0	0	NAF
GR	UG-BH-05/4	30.0	35.0	5.0	Saprock	HOX	7.2	0.106	0.02		1	4	-3	6.5	8.6	0	0	NAF
GR	UG-BH-05/5	36.0	42.0	6.0	Saprock	HOX	7.4	0.089	0.02		1	4	-3	5.9	8.8	0	0	NAF
E42	E46D3173/15	147.0	149.0	2.0	Dyke	DI	9.0	0.475	0.10		3	153	-150	50.0				AC
E42	1535DD051/8	100.0	110.0	10.0	Diorite	DI	8.6	0.366	<0.01		0	51	-51	166.3				NAF
E42	1535DD051/9	180.0	183.0	3.0	Diorite	DI	8.5	0.354	<0.01		0	53	-52	172.2				NAF
E42	E42D1632/9	121.0	138.0	17.0	Diorite	DI	8.4	0.518	0.06	0.061	2	122	-120	66.4				AC
E42	E42D1632/10	138.0	156.0	18.0	Diorite	DI	8.5	0.307	0.02		1	71	-70	116.2				NAF
E42	E42D1632/11	157.0	163.0	6.0	Dyke	DI	8.2	0.394	0.59	0.560	18	122	-104	6.8	10.9	0	0	AC
E42	E42D1632/13	166.0	179.0	13.0	Diorite	DI	8.3	0.394	0.29		9	119	-110	13.4				AC
E42	E42D1632/14	179.0	191.0	12.0	Diorite	DI	8.6	0.298	0.26		8	138	-130	17.3				AC

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)

MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
NAPP = Net Acid Producing Potential (kg H_2SO_4/t)

NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming

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Table B-6: Acid forming characteristics of E46 backfill material for the CGO Open Cut Expansion Project. CONTINUED

Pit	Sample ID	Depth (m)			Lithology	Material Type	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS						NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E42	E42D1632/15	192.0	211.0	19.0	Diorite	DI	8.4	0.358	0.04		1	105	-104	85.8				AC
E42	E42D1632/16	212.0	220.0	8.0	Diorite	DI	8.4	0.418	0.08		2	112	-110	45.8				AC
E42	E42D1632/17	222.0	242.0	20.0	Diorite	DI	8.3	0.499	0.28	0.244	9	119	-110	13.9				AC
E42	E42D1632/18	242.0	261.0	19.0	Diorite	DI	8.4	0.437	0.22	0.236	7	116	-109	17.2				AC
E42	E42D1632/19	262.0	280.0	18.0	Diorite	DI	8.3	0.393	0.30	0.306	9	134	-125	14.6				AC
E42	E42D1632/20	280.0	298.0	18.0	Diorite	DI	8.5	0.508	0.13	0.117	4	89	-85	22.3				NAF
E42	E42D1632/22	298.0	316.0	18.0	Diorite	DI	8.6	0.422	0.18	0.184	6	79	-73	14.3				NAF
E42	E42D1632/23	316.0	334.0	18.0	Diorite	DI	8.6	0.488	0.18		6	72	-67	13.1				NAF
E42	E42D1632/24	338.0	361.0	23.0	Diorite	DI	8.5	0.377	0.18	0.154	6	63	-57	11.4				NAF
E42	E42D1632/26	362.0	384.0	22.0	Diorite	DI	8.3	0.446	0.44	0.403	13	77	-63	5.7	10.9	0	0	NAF
E42	E42D1632/27	384.0	406.0	22.0	Diorite	DI	8.6	0.390	0.30		9	103	-94	11.2				NAF
E42	E42D1632/28	407.0	430.0	23.0	Diorite	DI	8.3	0.332	0.24	0.230	7	68	-61	9.3				NAF
E42	E42D1632/29	434.0	449.0	15.0	Diorite	DI	8.2	0.506	0.33		10	71	-61	7.1				NAF
E42	E42D1632/31	464.0	483.0	19.0	Diorite	DI	8.3	0.444	0.25	0.232	8	70	-63	9.2				NAF
E42	E42D1632/32	485.0	503.0	18.0	Diorite	DI	8.3	0.436	0.26		8	67	-59	8.4				NAF
E42	E42D1632/33	505.0	522.8	17.8	Diorite	DI	8.4	0.349	0.11	0.108	3	57	-54	17.0				NAF
E42	E42D1634/3	41.0	56.0	15.0	Diorite	DI	8.2	0.407	0.22		7	69	-62	10.2				NAF
E42	E42D1634/4	57.0	76.0	19.0	Diorite	DI	8.2	0.335	0.20		6	100	-94	16.3				NAF
E42	E42D1634/5	76.0	95.0	19.0	Diorite	DI	8.2	0.298	0.08		2	89	-86	36.2				NAF
E42	E42D1634/6	95.0	115.0	20.0	Diorite	DI	8.1	0.326	0.08	0.074	2	108	-106	44.1				AC
E42	E42D1634/8	125.0	129.0	4.0	Diorite	DI	8.3	0.385	0.58	0.542	18	113	-95	6.4	10.7	0	0	NAF
E42	E42D1634/9	136.0	158.0	22.0	Dyke	DI	8.3	0.381	0.25		8	101	-93	13.2				NAF
E42	E42D1634/10	159.0	176.0	17.0	Diorite	DI	8.4	0.300	0.14		4	81	-77	18.9				NAF
E42	E42D1634/11	183.0	194.0	11.0	Diorite	DI	8.4	0.383	0.33	0.343	10	92	-82	9.1				NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
NAPP = Net Acid Producing Potential (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

AC = Acid Consuming
NAF = Non-Acid Forming
PAF = Potentially Acid Forming

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Table B-6: Acid forming characteristics of E46 backfill material for the CGO Open Cut Expansion Project. CONTINUED

Pit	Sample ID	Depth (m)			Lithology	Material Type	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS						NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E42	E42D1634/13	203.0	215.0	12.0	Diorite	DI	8.4	0.371	0.35	0.302	11	74	-63	6.9				NAF
E42	E42D1634/14	218.0	224.0	6.0	Diorite	DI	8.4	0.380	0.58		18	101	-83	5.7	11.1	0	0	NAF
E42	E42D1634/16	235.0	249.0	14.0	Diorite	DI	8.5	0.365	0.12		4	71	-67	19.3				NAF
E42	E42D1634/17	251.0	262.0	11.0	Diorite	DI	8.4	0.445	0.42		13	98	-85	7.6				NAF
E42	E42D1634/18	270.0	285.0	15.0	Diorite	DI	8.4	0.489	0.32		10	100	-90	10.2				NAF
E42	E42D1634/19	289.0	298.0	9.0	Diorite	DI	8.4	0.441	0.33	0.290	10	82	-72	8.1				NAF
E42	E42D1634/20	300.0	316.0	16.0	Diorite	DI	8.3	0.420	0.33		10	88	-77	8.7				NAF
E42	E42D1634/21	321.0	335.0	14.0	Diorite	DI	8.4	0.369	0.26	0.256	8	72	-64	9.1				NAF
E42	E42D1634/22	336.0	352.0	16.0	Diorite	DI	8.5	0.355	0.30	0.322	9	62	-53	6.7				NAF
E42	E42D1634/25	364.0	376.0	12.0	Diorite	DI	8.4	0.399	0.54		17	72	-56	4.4	10.8	0	0	NAF
E42	E42D1634/26	377.0	399.0	22.0	Diorite	DI	8.4	0.417	0.51		16	75	-59	4.8	11.0	0	0	NAF
E42	E42D1634/28	407.0	412.0	5.0	Diorite	DI	8.4	0.435	0.53	0.502	16	106	-90	6.5	10.8	0	0	NAF
E42	E42D1634/30	440.0	448.0	8.0	Diorite	DI	8.4	0.488	0.60	0.546	18	108	-90	5.9	10.6	0	0	NAF
E42	E46D3134/6	69.0	76.0	7.0	Volcaniclastic	VC	8.4	0.691	0.06		2	58	-56	31.4				NAF
E42	E46D3134/7	77.0	83.0	6.0	Volcaniclastic	VC	8.4	0.467	<0.01		0	99	-99	323.9				NAF
E42	E46D3134/8	84.0	89.4	5.4	Volcaniclastic	VC	8.8	0.574	<0.01		0	57	-57	186.6				NAF
E42	E46D3173/10	124.0	130.0	6.0	Volcaniclastic	VC	8.5	0.660	0.08		2	38	-36	15.7				NAF
E42	E46D3173/12	133.0	134.0	1.0	Volcaniclastic	VC	8.6	0.679	0.44		13	63	-50	4.7				NAF
E42	E46D3173/13	134.0	142.0	8.0	Volcaniclastic	VC	8.9	0.512	0.10		3	93	-90	30.3				NAF
E42	E46D3173/14	143.0	146.0	3.0	Volcaniclastic	VC	9.0	0.515	0.21		6	27	-21	4.2				NAF
E42	E46D3173/16	150.0	152.0	2.0	Volcaniclastic	VC	8.9	0.531	0.42		13	115	-102	8.9				AC
E42	E46D3173/17	153.0	157.0	4.0	Volcaniclastic	VC	8.9	0.427	0.25		8	34	-26	4.5				NAF
E42	E46D3173/18	158.0	164.0	6.0	Volcaniclastic	VC	8.9	0.503	0.04		1	116	-115	94.8				AC
E42	E46D3173/20	170.0	173.0	3.0	Volcaniclastic	VC	8.9	0.532	0.47		14	131	-117	9.1				AC

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
NAPP = Net Acid Producing Potential (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

Geochemical Classification Key

AC = Acid Consuming
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Table B-6: Acid forming characteristics of E46 backfill material for the CGO Open Cut Expansion Project. CONTINUED

Pit	Sample ID	Depth (m)			Lithology	Material Type	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS						NAG TEST			Geochem. Class.
		from	to	int.					Total %S	Sulfide %S	MPA	ANC	NAPP	ANC/ MPA	NAGpH	$NAG_{pH4.5}$	$NAG_{pH7.0}$	
E42	E46D3173/21	182.0	186.0	4.0	Volcaniclastic	VC	8.9	0.553	0.36		11	163	-152	14.8				AC
E42	E46D3173/23	197.0	198.0	1.0	Volcaniclastic	VC	8.8	0.486	0.56		17	141	-124	8.2				AC
E42	E46D3173/24	199.0	221.0	22.0	Volcaniclastic	VC	8.8	0.497	0.36		11	70	-58	6.3				NAF
E42	E46D3173/25	227.0	238.0	11.0	Volcaniclastic	VC	8.8	0.468	0.36		11	96	-85	8.7				NAF
E42	E46D3173/26	238.0	240.0	2.0	Volcaniclastic	VC	8.9	0.386	0.08		2	112	-110	45.8				AC
E42	E46D3173/27	242.0	246.0	4.0	Volcaniclastic	VC	8.9	0.314	0.36	0.30	11	37	-26	3.3	9.3	0	0	NAF
E42	E46D3173/29	250.0	255.4	5.4	Volcaniclastic	VC	9.0	0.421	<0.01		0	58	-57	188.6				NAF
E42	1535DD051/12	228.0	238.0	10.0	Volcaniclastic	VC	8.5	0.453	0.30		9	40	-30	4.3				NAF
E42	1535DD066/5	129.0	134.0	5.0	Volcaniclastic	VC	8.6	0.603	0.14		4	76	-71	17.7				NAF
E42	1535DD066/6	141.0	159.8	18.8	Volcaniclastic	VC	8.4	0.554	0.38	0.33	12	27	-16	2.3	9.0	0	0	NAF
E42	E46D3173/22	187.0	196.0	9.0	Trachyandesite	LAVA	8.8	0.534	0.58		18	141	-123	7.9				AC
E42	E46D3173/19	165.0	167.0	2.0	Fault Zone	LAVA	8.9	0.660	1.00		31	134	-103	4.4				AC
E42	1535DD051/10	184.0	189.0	5.0	Fault Zone	LAVA	8.4	0.595	0.49		15	186	-171	12.4				AC
E42	E42D1634/7	116.0	121.0	5.0	Shear Zone	LAVA	8.3	0.523	0.79	0.748	24	186	-162	7.7	10.4	0	0	AC
E42	E42D1634/31	451.0	454.0	3.0	Shear Zone	LAVA	8.4	0.508	0.90	0.845	28	152	-124	5.5	10.1	0	0	AC

KEY
$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Elec Conductivity 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kg H_2SO_4/t)
ANC = Acid Neutralising Capacity (kg H_2SO_4/t)
NAPP = Net Acid Producing Potential (kg H_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{pH4.5}$ = Net Acid Generation capacity to pH 4.5 (kg H_2SO_4/t)
$NAG_{pH7.0}$ = Net Acid Generation capacity to pH 7.0 (kg H_2SO_4/t)

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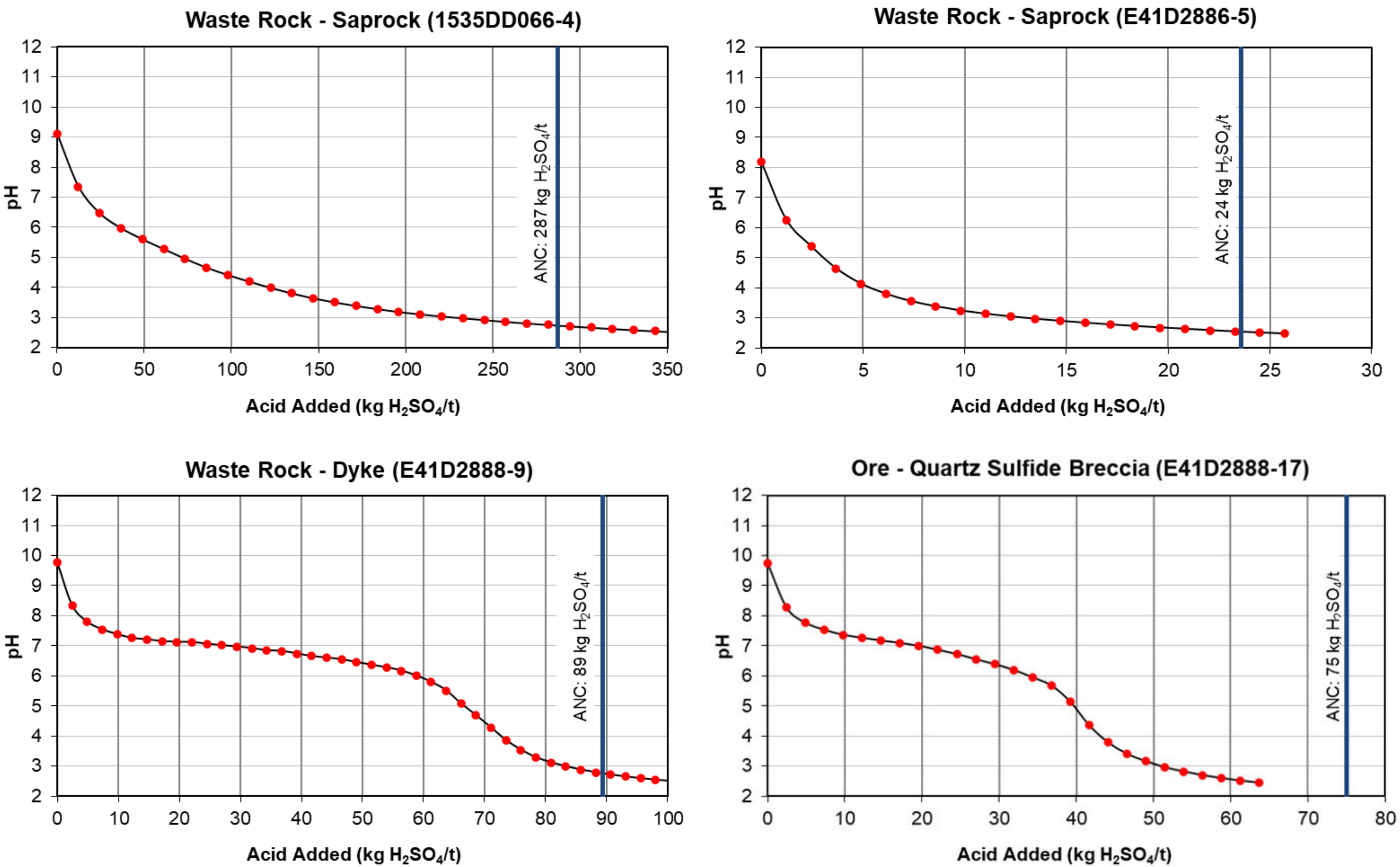


Figure B-1: Acid buffering characteristic curves for selected drill-hole samples.

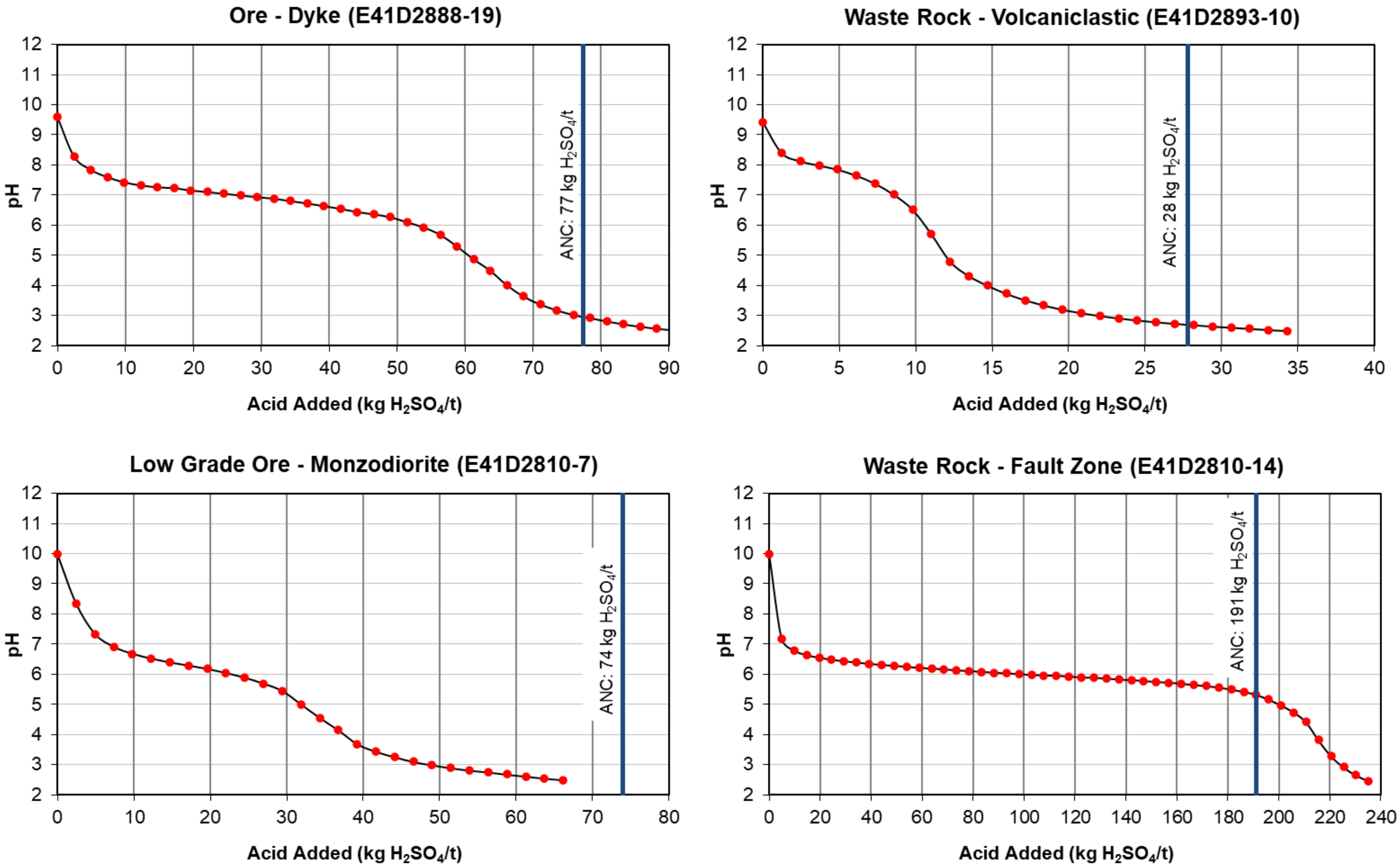


Figure B-1: Acid buffering characteristic curves for selected drill-hole samples.

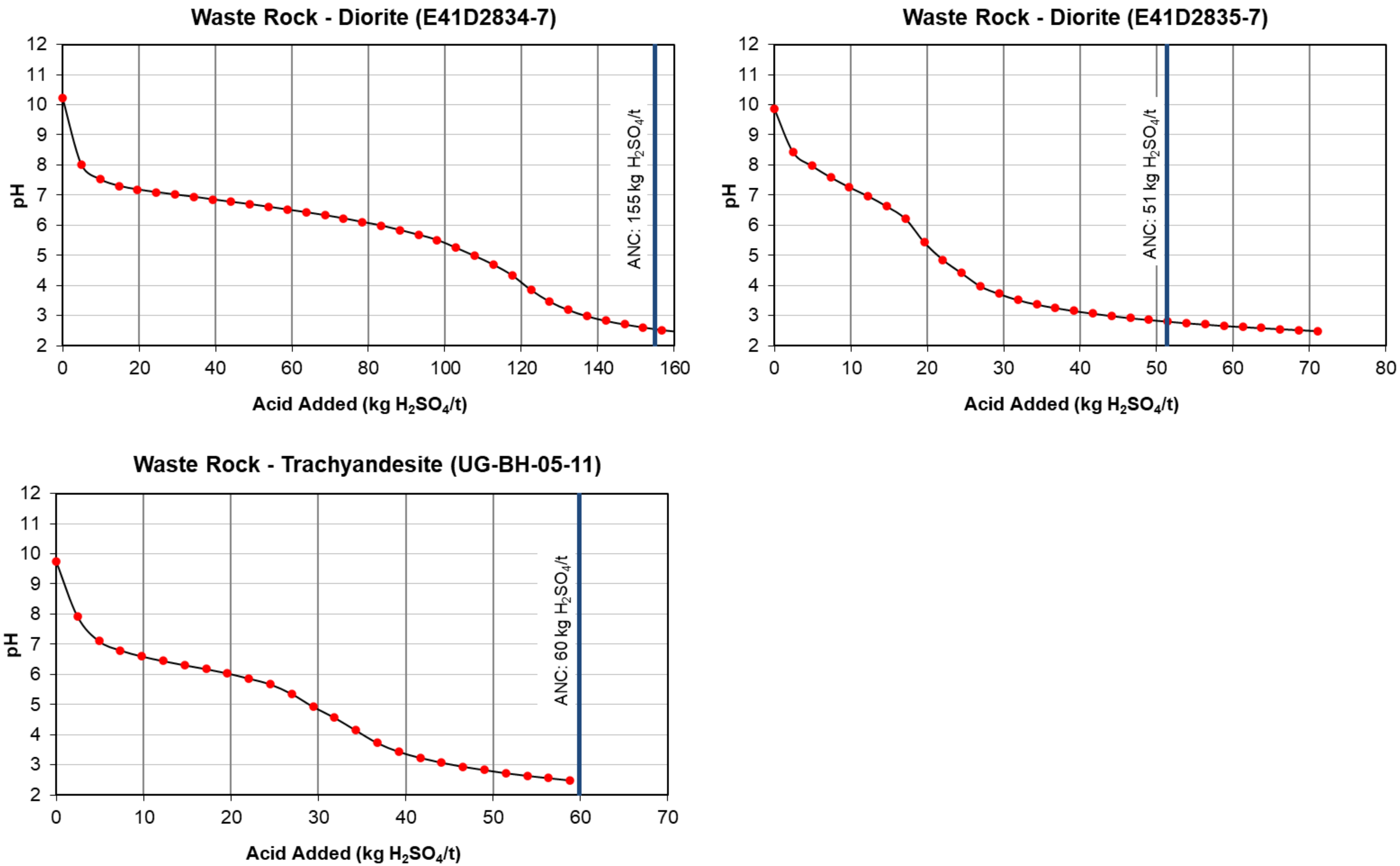


Figure B-1: Acid buffering characteristic curves for selected drill-hole samples.

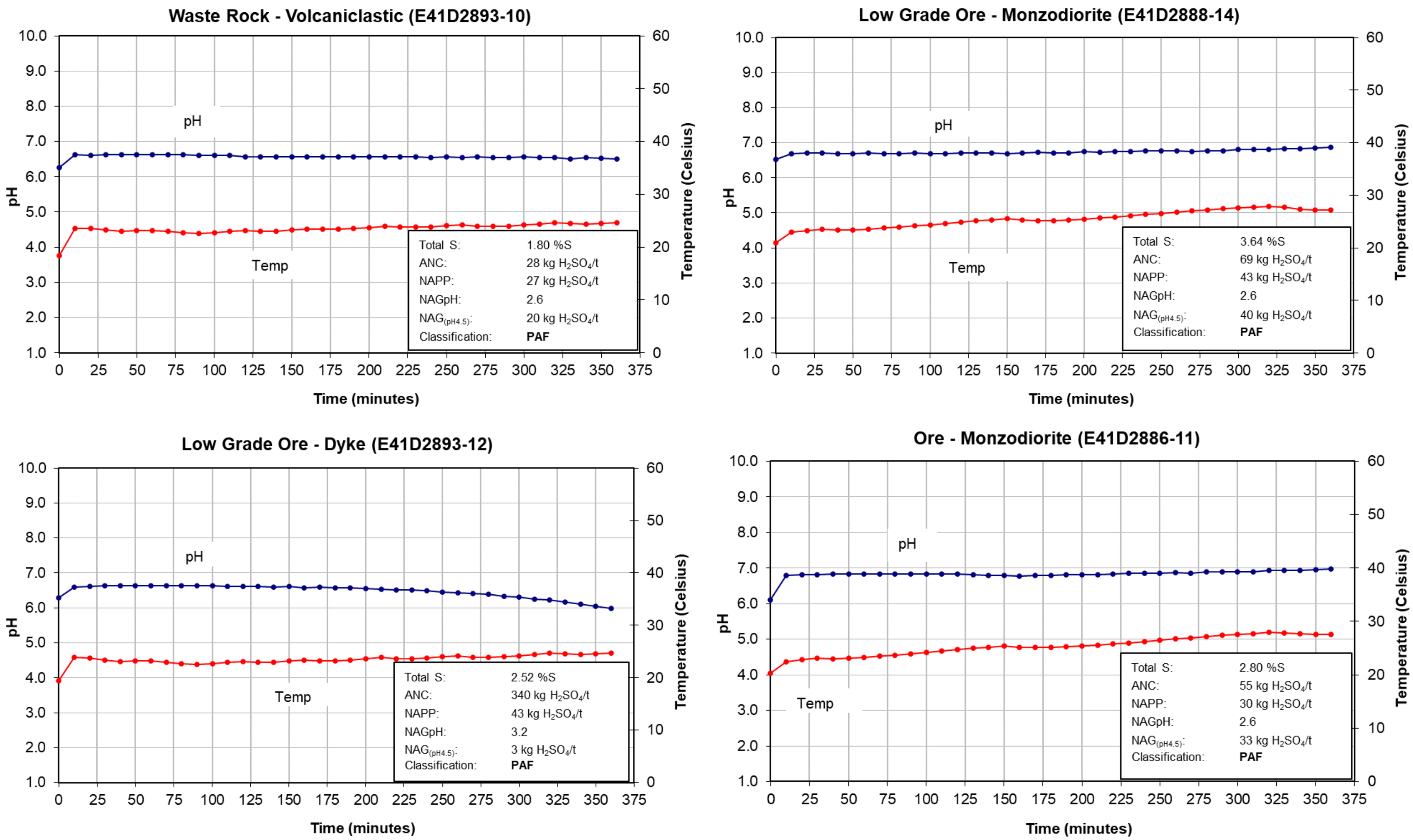
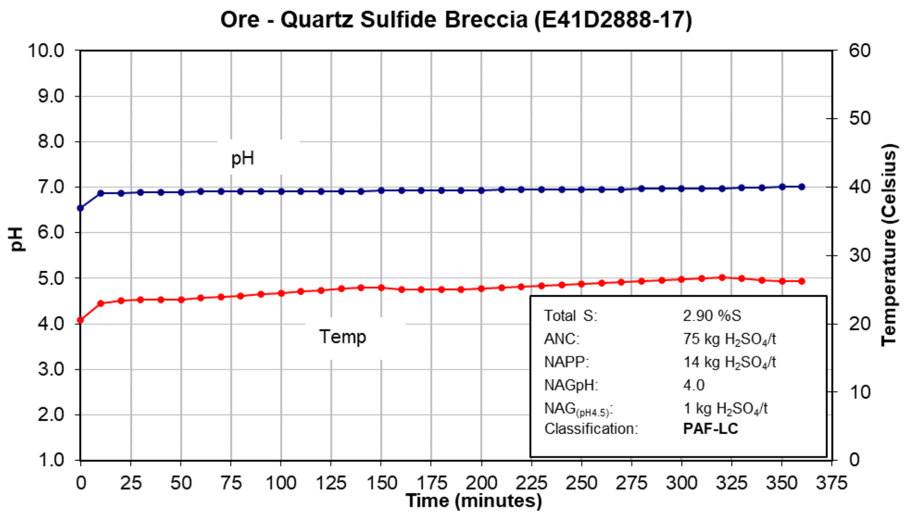


Figure B-2: Kinetic NAG test profiles for selected drill-hole samples.



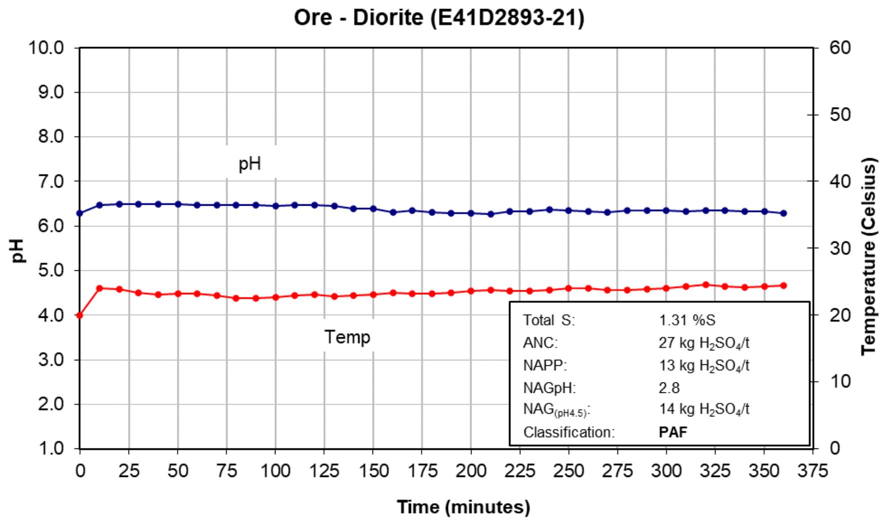


Figure B-2: Kinetic NAG test profiles for selected drill-hole samples.

Attachment C

Exchangeable Cations Analysis Results

Table C-1: Exchangeable cations, cation exchange capacity (CEC) and exchangeable sodium percent (ESP) for selected samples representing the range of materials within the Project areas.

Table C-1: Exchangeable cations, cation exchange capacity (CEC) and exchangeable sodium percent (ESP) for selected samples representing the range of materials within the Project areas.

Area	Sample ID	Lithology	$pH_{1:2}$	$EC_{1:2}$	Exchangeable Cations (meq/100g)					ESP (%)
					Ca	Mg	K	Na	CEC	
E41-E	E41D2063/5	Alluvial	5.7	10.360	2.5	6.3	0.5	14.5	23.9	60.9
GR	E41D3173/1	Alluvial	6.7	2.872	1.1	3.0	1.3	4.6	10.0	45.8
E41-E	E41D2886-1	Alluvial	5.8	0.483	1.7	4.1	0.5	1.5	8	19.3
E46	E46D3249-1	Alluvial	7.8	1.599	1.6	6.2	2.5	4.2	14.4	28.9
E46	E41D3026/5	Alluvial	6.2	2.709	1.4	3.8	0.6	5.8	11.7	49.9
E41-E	E41D2063/3	Alluvial	5.6	5.558	2.8	9.0	1.6	10.8	24.2	44.7
E41-W	E41D2178/1	Alluvial	7.9	2.552	8.0	10.7	1.8	6.7	27.1	24.7
E46	E41D3053/2	Alluvial	7.9	0.682	1.3	3.1	1.0	3.0	8.4	36.2
E41-E	E41D2893-1	Alluvial	7.4	0.421	2.7	6.4	0.5	2.4	12.1	20
E41-E	E41D2063/6	Saprolite	5.6	12.019	3.1	8.3	1.1	20.0	32.6	61.6
E46	E41D3026/6	Saprolite	6.5	1.678	0.8	2.1	3.0	3.2	9.1	35.2
E46	E41D3026/7	Saprolite	6.1	6.216	1.7	4.4	1.5	9.4	17.0	55.6
E41-E	E41D2893-2	Saprolite	6.6	1.089	1	2.8	0.3	1.3	5.4	24.6
E41-W	E41D2810-2	Saprolite	7.1	0.038	2.4	4.5	0.3	1.4	8.7	16.7
E46	E46D3248-4	Saprolite	7.0	0.242	1	2	0.6	0.4	4.1	10.3
E46	E46D3249-3	Saprolite	6.4	1.001	0.3	1.8	0.4	0.9	3.4	25.9
E41-E	E41D2063/10	Saprock	6.5	11.827	4.0	9.4	0.5	19.7	33.6	58.5
E46	E41D3026/10	Saprock	8.5	0.380	23.2	0.8	0.5	1.2	25.7	4.6
E41-E	E41D2063/11	Saprock	6.9	6.671	2.5	5.3	3.0	10.9	21.8	50.2
GR	E41D3173/3	Saprock	6.2	3.459	1.4	2.9	1.5	5.6	11.4	49.3
GR	E41D3173/8	Saprock	6.6	1.213	1.8	2.8	2.5	2.9	9.9	29.4
E41-E	E41D2219/5	Saprock	6.1	8.855	2.6	5.9	0.5	10.7	19.7	54.2
GR	E41D3173/7	Saprock	6.6	1.025	1.0	1.8	2.8	2.6	8.2	31.7
GR	E41D3134/5	Saprock	6.2	5.500	2.7	5.8	0.6	10.2	19.4	52.6
GR	E41D3173/4	Saprock	6.5	1.679	1.2	2.3	2.8	3.3	9.6	34.8
E41-E	E41D2893-3	Saprock	6.5	1.449	0.7	1.6	<0.02	0.7	3.2	22.2
E41-W	E41D2834-6	Saprock	7.1	1.376	4.9	8.6	0.2	20.2	33.9	59.6
GR	UG-BH-05-5	Saprock	7.4	0.089	<0.02	0.4	0.4	<0.02	0.9	<0.02
GR	UG-BH-05-7	Saprock	7.7	0.125	1.2	2	<0.02	2.3	5.7	39.8
E42-SI	1535DD051/4	Saprock	7.2	5.299	8.1	21.9	0.6	29.8	60.5	49.3
E42-SI	1535DD051/7	Saprock	9.2	0.704	18.7	2.8	0.3	5.4	27.2	20.0
E46	E41D3053/17	Volcaniclastic	8.6	0.352	20.8	0.8	1.2	0.6	23.4	2.8
GR	E41D3134/6	Volcaniclastic	8.4	0.691	24.3	1.8	0.7	2.8	29.6	9.5
GR	E41D3173/12	Volcaniclastic	8.6	0.679	18.6	2.1	2.4	1.3	24.4	5.3
E41-E	E41D2888-11	Volcaniclastic	9.4	0.079	0.6	<0.02	<0.02	<0.02	0.6	<0.02
E42-SI	1535DD066/5	Volcaniclastic	8.6	0.603	19.4	1.7	1.7	1.1	23.9	4.8
E41-W	E41D2178/5	Intrusives	8.6	0.607	18.8	0.6	2.1	1.0	22.6	4.7
E41-E	E41D2893-19	Intrusives	9.1	0.106	0.4	<0.02	<0.02	<0.02	0.4	<0.02
E41-W	E41D2834-9	Intrusives	8.6	0.091	4.7	0.7	<0.02	<0.02	5.4	<0.02
E41-W	E41D2178/8	Intrusives	8.1	0.490	16.5	0.8	1.3	0.8	19.4	3.9
E41-E	E41D2888-13	Intrusives	9.5	0.109	1.4	<0.02	<0.02	0.3	1.8	18
E41-W	E41D2831-12	Intrusives	8.8	0.104	0.9	<0.02	0.3	<0.02	1.2	<0.02
E41-E	E41D2063/15	Intrusives	8.4	0.500	21.7	0.8	1.1	0.9	24.5	3.6
E46	E41D3053/7	Intrusives	7.4	1.279	4.2	9.5	0.8	13.8	28.4	48.9
E41-E	E41D2888-9	Intrusives	9.4	0.080	0.8	<0.02	<0.02	<0.02	0.8	<0.02
E41-E	E41D2888-21	Extrusives	9.3	0.112	0.6	<0.02	<0.02	<0.02	0.6	<0.02
GR	E41D3173/22	Extrusives	8.8	0.534	21.4	2.4	4.1	1.3	29.2	4.5
GR	UG-BH-05-8	Extrusives	8.5	0.235	0.5	<0.02	<0.02	0.3	0.8	37.4
E41-E	E41D2063/14	Fault/Shear Zone	8.5	0.667	24.8	1.2	1.7	1.8	29.6	6.1
GR	E41D3173/19	Fault/Shear Zone	8.9	0.660	11.0	4.9	3.4	1.3	20.6	6.3
E41-W	E41D2834-11	Fault/Shear Zone	8.0	2.044	9.6	1.2	<0.02	0.9	11.7	7.5

Attachment D

Multi-Element Test Results

Table D-1: Multi-element composition of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	Detect. Limit	**Element Concentration** (mg/kg except where shown)										
		Waste Rock										
Sample ID		E46D3248-2	E41D2893-1	E41D2063 -2	E41D2063 -4	E41D3026 -5	E41D2893-2	E41D3173 -2	1535DD051 -3	UG-BH-05-4	E41D2063 -7	E41D2219 -4
Lithology		Alluvium	Transported	Transported	Transported	Transported	Saprolite	Saprolite	Saprolite	Saprock	Saprock	Saprock
Geochem. Class.		NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Ag	0.05	0.12	0.79	0.16	0.12	0.4	0.52	1.99	0.43	1.78	0.34	0.22
Al%	0.005%	4.665%	8.024%	7.72%	3.37%	4.68%	11.228%	13.61%	12.69%	9.125%	10.97%	12.53%
As	0.5	16.5	23.3	7.1	14.4	46.6	58.1	42	43.5	54.7	103.9	80.4
B	50	<	54	<	<	<	<	<	<	84	<	<
Ba	0.1	198.8	459.2	350.9	136.4	115.2	661.8	191.1	235.1	1458.4	653.0	719.9
Be	0.05	1.52	1.97	1.21	1.27	0.93	1.4	0.58	0.99	2	1.48	1.54
Ca%	0.005%	0.070%	0.096%	0.11%	0.04%	0.04%	0.069%	0.06%	0.07%	0.052%	0.09%	0.08%
Cd	0.02	0.05	0.05	0.04	0.04	0.07	0.17	0.30	0.61	0.87	0.58	0.21
Co	0.1	6.8	44.5	5.8	7.0	3.5	14.8	4.8	7.8	70.9	10.8	9.7
Cr	5	37	54	62	36	56	23	141	100	6	157	14
Cu	1	30	134	30	45	24	334	171	124	152	420	165
Fe%	0.01%	3.94%	4.85%	3.70%	3.64%	8.62%	8.76%	14.54%	9.14%	4.59%	11.83%	9.68%
Hg	0.001	0.008	<	<	<	<	0.066	<	0.08	0.019	0.06	<
K%	0.002%	0.960%	1.218%	1.12%	0.67%	0.51%	1.519%	2.04%	0.53%	3.084%	0.57%	0.95%
Mg%	0.002%	0.254%	0.429%	0.42%	0.20%	0.15%	0.313%	0.32%	0.28%	0.262%	0.23%	0.27%
Mn	1	206	513	91	121	97	593	405	554	6065	682	611
Mo	0.1	0.5	0.7	0.4	0.9	1.1	0.6	0.8	0.8	3	1.3	1.1
Na%	0.002%	0.106%	0.225%	0.39%	0.28%	0.21%	0.121%	0.34%	0.36%	0.157%	0.47%	0.33%
Ni	1	13	21	15	10	4	12	10	14	2	28	5
P	50	111	268	142	106	110	608	389	786	1285	1398	946
Pb	0.5	18.6	16.6	20.4	19.8	32.9	7.6	14.7	34.5	6.4	13.6	20.5
Sb	0.05	1.32	1.3	0.69	1.12	4.55	2.1	5.37	3.68	2.96	3.66	2.16
Se	0.01	0.07	0.22	0.13	0.09	0.23	0.2	0.67	0.41	0.02	0.44	0.11
Si%	0.1%	36.3%	32.1%	32.3%	38.9%	35.2%	25.3%	19.8%	23.6%	29.9%	22.4%	24.0%
Sn	0.1	2.5	2.6	3.2	1.9	1.7	1.3	1.1	1.8	1.5	1.1	1.2
Th	0.01	10.04	9.91	12.96	6.66	7.23	4.14	2.95	4.29	4.11	3.78	3.73
U	0.01	2.44	2.34	2.14	1.82	3.75	1.8	2.58	1.56	4.17	2.88	3.17
V	1	76	142	100	74	185	289	545	287	83	383	433
Zn	1	35	50	101	111	211	44	242	107	85	92	405

< element at or below analytical detection limit. *Page 1 of 5*

Table D-1: Multi-element composition of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	Detect. Limit	Element Concentration (mg/kg except where shown)									
		Waste Rock									
Sample ID		E41D3173 -3	1535D051 -7	E41D2886-7	E41D2178 -5	E41D2893-10	E41D3053 -15	E41D3173 -12	E41D3173 -16	E41D3173 -20	E41D2810-13
Lithology		Saprock	Saprock	Diorite	Diorite	Volcaniclastic	Volcaniclastic	Volcaniclastic	Volcaniclastic	Volcaniclastic	Monzodiorite
Geochem. Class.		NAF	NAF	NAF	NAF	PAF	NAF	NAF	NAF	NAF	NAF
Ag	0.05	0.37	0.94	0.15	0.37	0.23	2.63	1.46	0.45	0.44	0.3
Al%	0.005%	9.25%	8.58%	7.713%	6.93%	9.132%	6.44%	6.88%	7.28%	7.35%	8.517%
As	0.5	73.2	20.4	31	43.7	32.3	31.8	14.4	14.2	23.1	212.2
B	50	<	<	<	<	<	<	<	<	<	81
Ba	0.1	374.3	448.0	448.2	453.3	673.7	766.6	206.6	254.6	175.1	232
Be	0.05	1.09	0.94	0.87	1.29	1.13	1.13	0.83	0.81	0.65	1.34
Ca%	0.005%	0.06%	4.32%	5.691%	2.22%	1.957%	1.91%	3.00%	4.12%	4.93%	3.109%
Cd	0.02	0.35	2.26	0.07	0.09	0.05	0.06	2.20	0.72	0.58	0.15
Co	0.1	2.5	29.4	32.8	6.6	20.1	9.6	14.8	18.5	19.6	9.9
Cr	5	27	28	184	11	21	10	4	7	11	<
Cu	1	175	278	171	190	227	100	57	345	133	90
Fe%	0.01%	6.44%	7.67%	6.89%	3.31%	5.36%	5.02%	5.62%	6.13%	6.40%	4.31%
Hg	0.001	0.02	0.2	0.002	0.01	0.009	0.01	0.05	0.01	0.03	0.027
K%	0.002%	2.47%	2.15%	1.520%	4.33%	3.590%	3.67%	2.81%	3.07%	2.48%	3.419%
Mg%	0.002%	0.26%	1.65%	3.604%	0.71%	1.607%	1.43%	1.30%	1.91%	2.56%	0.874%
Mn	1	111	1208	1457	448	749	900	1865	2154	2587	790
Mo	0.1	1.2	1.0	0.7	4.7	0.4	1.8	0.4	0.5	0.3	3
Na%	0.002%	0.23%	3.50%	2.431%	0.85%	1.171%	0.95%	0.10%	0.08%	0.24%	1.493%
Ni	1	5	16	57	3	13	<	<	2	3	2
P	50	1322	1981	1236	734	1444	1474	1634	1624	1141	1556
Pb	0.5	165.8	7.5	5.3	8.8	2.7	5.5	12.8	8.7	97.1	15.8
Sb	0.05	3.19	3.46	1.44	2.50	1.84	1.74	2.96	2.55	3.31	5.97
Se	0.01	0.12	0.01	0.07	0.26	0.37	0.20	0.69	0.12	0.19	0.5
Si%	0.1%	30.4%	25.8%	24.0%	30.9%	27.9%	31.3%	28.8%	25.7%	23.6%	27.7%
Sn	0.1	1.1	1.2	0.8	1.2	0.9	1.2	1.0	0.8	0.7	1.6
Th	0.01	2.59	3.22	2.69	8.59	2.83	3.05	2.53	1.82	1.44	5.74
U	0.01	2.62	1.70	1.61	6.01	1.57	2.07	1.55	1.41	1.11	3.57
V	1	148	320	257	82	184	81	129	209	262	83
Zn	1	311	138	97	47	57	56	189	242	228	93

< element at at or below analytical detection limit.

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Table D-1: Multi-element composition of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	Detect. Limit	**Element Concentration** (mg/kg except where shown)									
		Waste Rock									
Sample ID		E41D2178 -7	E41D2178 -12	UG-BH-05-8	E41D2888-21	E41D3053 -13	E41D2888-9	E41D2063 -20	E41D2888-8	E41D3173 -19	E41D2063 -14
Lithology		Monzodiorite	Monzodiorite	Extrusive	Extrusive	Extrusive	Dyke	Dyke	Fault Zone	Fault Zone	Shear Zone
Geochem. Class.		NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Ag	0.05	0.43	0.29	1.15	0.29	0.45	0.08	2.5	0.06	1.31	0.48
Al%	0.005%	7.90%	8.94%	7.806%	7.112%	6.96%	8.150%	7.71%	8.238%	7.02%	7.51%
As	0.5	45.8	37.1	60.2	28.5	67.2	25.7	90.4	27.7	129.4	48.4
B	50	<	<	<	<	<	<	<	<	<	<
Ba	0.1	540.0	223.2	524.2	309.9	669.4	119.5	638.8	286.6	164.1	201.2
Be	0.05	1.29	0.78	0.65	0.81	0.9	0.93	0.63	1.03	0.81	0.93
Ca%	0.005%	1.87%	6.00%	1.679%	7.699%	2.73%	5.747%	3.15%	6.393%	4.54%	4.96%
Cd	0.02	0.44	0.08	4.37	0.07	0.18	0.03	0.08	0.04	0.35	0.10
Co	0.1	9.5	27.5	11.7	42.6	13.9	16.7	18.8	11.3	17.8	21.3
Cr	5	7	32	<	290	4	6	9	<	6	71
Cu	1	77	85	99	111	121	15	101	7	63	55
Fe%	0.01%	4.58%	6.75%	4.73%	8.17%	6.38%	5.08%	5.82%	5.51%	5.51%	5.53%
Hg	0.001	0.08	<	0.04	0.077	0.03	0.005	0.18	0.009	0.07	0.02
K%	0.002%	3.52%	1.35%	2.389%	1.274%	3.18%	1.528%	3.31%	2.501%	3.15%	1.61%
Mg%	0.002%	0.83%	2.49%	0.974%	4.292%	1.12%	2.041%	1.40%	1.872%	1.60%	1.80%
Mn	1	629	1371	1558	1827	915	904	871	868	2450	1283
Mo	0.1	3.7	1.7	4.4	0.7	2.0	0.4	2.0	0.2	2.0	1.0
Na%	0.002%	2.82%	2.57%	3.425%	1.675%	1.31%	2.121%	3.07%	0.633%	0.13%	2.60%
Ni	1	<	14	2	83	<	6	<	1	<	19
P	50	1390	858	1803	1031	1411	2325	2303	1831	1103	1445
Pb	0.5	21.1	6.9	4.1	4.3	7.6	4.2	31.1	4.2	29.5	7.4
Sb	0.05	6.55	1.43	1.21	4.24	2.47	1.51	1.66	1.97	5.75	1.80
Se	0.01	0.21	0.03	0.34	0.09	1.02	0.1	0.37	<	0.17	0.08
Si%	0.1%	30.5%	25.2%	29.0%	23.3%	31.0%	25.1%	26.0%	25.6%	25.1%	25.3%
Sn	0.1	1.8	0.9	1.4	0.6	1.1	0.8	1.0	1.2	0.7	1.1
Th	0.01	6.35	2.40	3.66	2.07	2.81	3.73	3.05	2.84	1.46	4.22
U	0.01	3.99	1.42	2.31	1.18	1.94	4.44	2.44	7.54	1.19	2.46
V	1	81	261	72	316	90	182	122	125	221	165
Zn	1	140	90	662	97	65	42	62	62	129	83

< element at or below analytical detection limit. ***Page 3 of 5***

Table D-1: Multi-element composition of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	**Detect. Limit**	**Element Concentration** (mg/kg except where shown)										
		Low Grade Ore										
Sample ID		E41D3041 -5	E46D3248-4	E41D3026 -8	E41D2888-4	E41D2063 -9	E41D3041 -8	E41D3173 -5	E41D3173 -9	E41D2835-8	E41D3026 -19	E41D3041 -11
Lithology		Transported	Saprolite	Saprolite	Saprock	Saprock	Saprock	Saprock	Saprock	Diorite	Diorite	Volcaniclastic
Geochem. Class.		NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Ag	0.05	0.84	0.28	0.95	0.88	3.51	0.62	3.05	0.35	0.88	0.56	1.41
Al%	0.005%	9.36%	9.222%	9.12%	9.381%	11.63%	8.85%	8.02%	8.30%	9.566%	9.42%	7.06%
As	0.5	35.6	83.4	41.2	50.8	63.4	43.2	51	11.9	53.6	9	41.9
B	50	<	51	<	<	<	<	<	<	<	<	<
Ba	0.1	415.3	155.7	897.9	490.2	861.8	595.2	967.8	205.4	105.8	460.7	355.4
Be	0.05	0.82	1.17	2.31	1.57	1.66	2.37	1.5	1.01	0.43	0.67	0.55
Ca%	0.005%	0.08%	0.040%	0.07%	0.140%	0.09%	0.04%	0.07%	0.48%	6.767%	4.18%	2.08%
Cd	0.02	0.21	0.89	1.86	0.63	1.40	1.92	2.04	0.89	0.14	0.10	4.30
Co	0.1	26.7	4.2	27.2	29.5	152.6	7.5	107.0	21.4	36.3	19.4	6.1
Cr	5	26	9	<	12	153	15	75	25	49	12	<
Cu	1	41	72	42	290	616	119	197	168	435	173	28
Fe%	0.01%	5.99%	5.98%	5.74%	6.08%	10.66%	4.42%	7.91%	6.45%	7.61%	6.15%	4.41%
Hg	0.001	0.07	0.006	<	0.012	0.04	0.01	0.02	0.03	0.004	<	0.08
K%	0.002%	0.45%	2.687%	2.50%	2.155%	0.54%	4.16%	2.72%	3.43%	0.729%	1.99%	1.95%
Mg%	0.002%	0.27%	0.238%	0.51%	0.920%	0.25%	0.64%	0.24%	0.78%	2.835%	1.88%	1.21%
Mn	1	1011	169	5930	965	13574	1672	4729	1489	1891	1304	1882
Mo	0.1	1.5	1	1.8	0.7	1.2	0.7	1.0	0.4	0.7	0.8	0.9
Na%	0.002%	0.35%	0.039%	0.74%	0.226%	0.41%	0.19%	0.19%	0.25%	1.558%	3.56%	3.39%
Ni	1	14	3	2	14	34	4	16	9	22	7	<
P	50	379	261	552	776	1062	495	1618	2226	924	1124	920
Pb	0.5	34.8	17.9	11.5	5.6	24.4	6.7	15.9	7.2	4.8	4.1	11.8
Sb	0.05	2.45	2.75	1.13	1.87	3.10	2.87	3.74	3.51	3.61	1.70	0.79
Se	0.01	0.20	0.1	0.05	0.12	0.19	0.03	0.14	0.09	0.27	0.10	0.02
Si%	0.1%	30.2%	29.9%	31.1%	28.8%	21.4%	32.7%	29.5%	31.1%	22.4%	25.2%	29.4%
Sn	0.1	2.0	1.4	1.5	1.2	1.2	1.4	1.0	1.0	0.6	0.6	0.9
Th	0.01	5.40	3.91	3.99	2.87	3.92	3.99	2.67	2.34	0.79	1.65	3.09
U	0.01	3.08	4.62	3.53	1.75	2.99	2.62	2.41	1.96	0.55	1.07	2.39
V	1	130	80	47	188	382	97	330	245	392	283	31
Zn	1	292	234	1079	399	111	806	659	356	119	98	750

< element at or below analytical detection limit. *Page 4 of 5*

Table D-1: Multi-element composition of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	Detect. Limit	**Element Concentration** (mg/kg except where shown)											
		Low Grade Ore						**Ore**					
Sample ID		E41D3173 -11	E41D3173 -28	E41D2888-14	UG-BH-05-	E41D2893-	E41D2834-8	E41D2886-3	E41D2893-	E41D2893-11	E41D2886-11	UG-BH-05-	E41D2888-
Lithology		Volcaniclastic	Volcaniclastic	Monzodiorite	10 Extrusive	12 Dyke	Fault Zone	Saprock	21 Diorite	Volcaniclastic	Monzodiorite	13 Extrusive	17 Breccia
Geochem. Class.		NAF	NAF	PAF	NAF	PAF	AC	NAF	PAF	NAF	PAF	NAF	PAF-LC
Ag	0.05	2.02	0.59	2.72	0.95	0.25	5.34	0.39	0.2	0.68	0.79	0.78	4.79
Al%	0.005%	7.96%	7.74%	7.344%	7.453%	8.847%	6.089%	9.271%	7.661%	8.725%	8.181%	6.942%	8.483%
As	0.5	16.7	15.9	47.6	60.4	46.3	5561.5	154.6	38.1	41.3	142.5	63	44.3
B	50	<	<	<	<	<	<	<	<	<	<	<	<
Ba	0.1	214.9	687.3	309.2	716.1	508	88.8	563.3	384.7	382.6	838.9	863.2	333.9
Be	0.05	0.95	0.81	0.69	0.76	1.12	0.59	1.52	0.75	1.01	1.15	0.76	0.59
Ca%	0.005%	2.20%	3.17%	6.104%	1.609%	1.713%	9.628%	0.104%	6.709%	2.889%	2.400%	1.995%	5.207%
Cd	0.02	2.92	0.06	0.06	6.22	0.03	7.83	1.13	0.06	0.11	0.41	3.21	0.53
Co	0.1	22.1	21.2	46.3	10.7	24.1	58.1	10.8	33.6	17.2	15.1	9.7	24.2
Cr	5	32	19	220	<	19	282	16	188	8	<	<	66
Cu	1	84	24	110	129	51	736	240	182	519	288	104	1002
Fe%	0.01%	6.74%	6.71%	7.78%	4.50%	6.35%	7.59%	6.73%	8.14%	6.49%	5.37%	4.16%	7.96%
Hg	0.001	0.69	0.02	0.479	0.08	0.007	0.231	0.012	0.025	0.005	0.026	0.025	0.162
K%	0.002%	2.80%	2.12%	1.574%	3.141%	2.830%	1.058%	3.619%	1.937%	2.460%	3.749%	3.020%	1.938%
Mg%	0.002%	1.72%	2.67%	3.974%	1.137%	1.914%	2.105%	0.737%	3.397%	2.177%	1.018%	0.971%	2.363%
Mn	1	6058	1657	1539	1699	616	2085	638	1435	850	786	1759	1285
Mo	0.1	0.6	0.3	1.6	3.3	0.8	4.6	2.2	0.7	0.4	1.7	5.8	0.6
Na%	0.002%	0.15%	0.83%	2.410%	2.491%	2.001%	0.102%	0.279%	1.484%	2.023%	2.349%	2.651%	2.239%
Ni	1	9	5	68	2	12	67	16	62	6	3	<	22
P	50	1914	1089	1226	1655	1522	342	1460	1327	1858	2080	1506	908
Pb	0.5	9.2	6	8	8.8	4	88	7.6	2.8	4.1	59.5	6.7	10
Sb	0.05	2.92	2.71	2.33	1.41	1.98	34.17	2.27	3.36	3.16	1.55	1.39	1.97
Se	0.01	0.20	0.15	3.13	0.13	0.71	1.32	0.12	0.15	0.3	0.35	0.21	0.75
Si%	0.1%	28.3%	26.6%	23.0%	29.8%	26.9%	20.4%	28.9%	23.8%	25.8%	26.8%	29.7%	23.9%
Sn	0.1	1.0	0.9	0.7	1.1	0.8	0.4	1	0.6	0.9	1.2	1.3	0.6
Th	0.01	2.18	2.30	2.09	3.38	2.68	0.7	3.21	2	2.72	4.47	3.37	1.21
U	0.01	1.70	1.41	1.34	2.49	1.2	0.77	2.17	1.2	1.42	2.63	2.36	0.72
V	1	203	175	264	65	195	359	203	291	277	132	59	213
Zn	1	527	97	89	1006	48	781	415	63	73	52	382	109

< element at at or below analytical detection limit. *Page 5 of 5*

Table D-2: Geochemical abundance indices of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	**Mean Crust. Abun.***	**Geochemical Abundance Indices (GAI)**										
		Waste Rock										
Sample ID		E46D3248-2	E41D2893-1	E41D2063 -2	E41D2063 -4	E41D3026 -5	E41D2893-2	E41D3173 -2	1535DD051 -3	UG-BH-05-4	E41D2063 -7	E41D2219 -4
Lithology		Alluvium	Transported	Transported	Transported	Transported	Saprolite	Saprolite	Saprolite	Saprock	Saprock	Saprock
Geochem. Class.		NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Ag	0.07	-	**3**	1	-	2	2	**4**	2	**4**	2	1
Al	8.2%	-	-	-	-	-	-	-	-	-	-	-
As	1.5	**3**	**3**	2	**3**	**4**	**5**	**4**	**4**	**5**	**6**	**5**
B	10	<2	2	<2	<2	<2	<2	<2	<2	2	<2	<2
Ba	500	-	-	-	-	-	-	-	-	1	-	-
Be	2.6	-	-	-	-	-	-	-	-	-	-	-
Ca	4.0%	-	-	-	-	-	-	-	-	-	-	-
Cd	0.11	-	-	-	-	-	-	1	2	2	2	-
Co	20	-	1	-	-	-	-	-	-	1	-	-
Cr	100	-	-	-	-	-	-	-	-	-	-	-
Cu	50	-	1	-	-	-	2	1	1	1	2	1
Fe	4.1%	-	-	-	-	-	1	1	1	-	1	1
Hg	0.05	-	-	-	-	-	-	-	-	-	-	-
K	2.1%	-	-	-	-	-	-	-	-	-	-	-
Mg	2.3%	-	-	-	-	-	-	-	-	-	-	-
Mn	950	-	-	-	-	-	-	-	-	2	-	-
Mo	1.5	-	-	-	-	-	-	-	-	-	-	-
Na	2.3%	-	-	-	-	-	-	-	-	-	-	-
Ni	80	-	-	-	-	-	-	-	-	-	-	-
P	1000	-	-	-	-	-	-	-	-	-	-	-
Pb	14	-	-	-	-	1	-	-	1	-	-	-
Sb	0.2	2	2	1	2	**4**	**3**	**4**	**4**	**3**	**4**	**3**
Se	0.05	-	2	1	-	2	1	**3**	2	-	**3**	1
Si	27.7%	-	-	-	-	-	-	-	-	-	-	-
Sn	2.2	-	-	-	-	-	-	-	-	-	-	-
Th	12	-	-	-	-	-	-	-	-	-	-	-
U	2.4	-	-	-	-	-	-	-	-	-	-	-
V	160	-	-	-	-	-	-	1	-	-	1	1
Zn	75	-	-	-	-	1	-	1	-	-	-	2

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

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Table D-2: Geochemical abundance indices of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	**Mean Crust. Abun.***	**Geochemical Abundance Indices (GAI)**									
		Waste Rock									
Sample ID		E41D3173 -3	1535D051 -7	E41D2886-7	E41D2178 -5	E41D2893-10	E41D3053 -15	E41D3173 -12	E41D3173 -16	E41D3173 -20	E41D2810-13
Lithology		Saprock	Saprock	Diorite	Diorite	Volcaniclastic	Volcaniclastic	Volcaniclastic	Volcaniclastic	Volcaniclastic	Monzodiorite
Geochem. Class.		NAF	NAF	NAF	NAF	PAF	NAF	NAF	NAF	NAF	NAF
Ag	0.07	2	**3**	1	2	1	**5**	**4**	2	2	2
Al	8.2%	-	-	-	-	-	-	-	-	-	-
As	1.5	**5**	**3**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**6**
B	10	<2	<2	<2	<2	<2	<2	<2	<2	<2	2
Ba	500	-	-	-	-	-	-	-	-	-	-
Be	2.6	-	-	-	-	-	-	-	-	-	-
Ca	4.0%	-	-	-	-	-	-	-	-	-	-
Cd	0.11	1	**4**	-	-	-	-	**4**	2	2	-
Co	20	-	-	-	-	-	-	-	-	-	-
Cr	100	-	-	-	-	-	-	-	-	-	-
Cu	50	1	2	1	1	2	-	-	2	1	-
Fe	4.1%	-	-	-	-	-	-	-	-	-	-
Hg	0.05	-	1	-	-	-	-	-	-	-	-
K	2.1%	-	-	-	-	-	-	-	-	-	-
Mg	2.3%	-	-	-	-	-	-	-	-	-	-
Mn	950	-	-	-	-	-	-	-	1	1	-
Mo	1.5	-	-	-	1	-	-	-	-	-	-
Na	2.3%	-	-	-	-	-	-	-	-	-	-
Ni	80	-	-	-	-	-	-	-	-	-	-
P	1000	-	-	-	-	-	-	-	-	-	-
Pb	14	**3**	-	-	-	-	-	-	-	2	-
Sb	0.2	**3**	**4**	2	**3**	**3**	**3**	**3**	**3**	**3**	**4**
Se	0.05	1	-	-	2	2	1	**3**	1	1	**3**
Si	27.7%	-	-	-	-	-	-	-	-	-	-
Sn	2.2	-	-	-	-	-	-	-	-	-	-
Th	12	-	-	-	-	-	-	-	-	-	-
U	2.4	-	-	-	1	-	-	-	-	-	-
V	160	-	-	-	-	-	-	-	-	-	-
Zn	75	1	-	-	-	-	-	1	1	1	-

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

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Table D-2: Geochemical abundance indices of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	**Mean Crust. Abun.***	**Geochemical Abundance Indices (GAI)**									
		Waste Rock									
Sample ID		E41D2178 -7	E41D2178 -12	UG-BH-05-8	E41D2888-21	E41D3053 -13	E41D2888-9	E41D2063 -20	E41D2888-8	E41D3173 -19	E41D2063 -14
Lithology		Monzodiorite	Monzodiorite	Extrusive	Extrusive	Extrusive	Dyke	Dyke	Fault Zone	Fault Zone	Shear Zone
Geochem. Class.		NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Ag	0.07	2	1	**3**	1	2	-	**5**	-	**4**	2
Al	8.2%	-	-	-	-	-	-	-	-	-	-
As	1.5	**4**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**6**	**4**
B	10	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ba	500	-	-	-	-	-	-	-	-	-	-
Be	2.6	-	-	-	-	-	-	-	-	-	-
Ca	4.0%	-	-	-	-	-	-	-	-	-	-
Cd	0.11	1	-	**5**	-	-	-	-	-	1	-
Co	20	-	-	-	1	-	-	-	-	-	-
Cr	100	-	-	-	1	-	-	-	-	-	-
Cu	50	-	-	-	1	1	-	-	-	-	-
Fe	4.1%	-	-	-	-	-	-	-	-	-	-
Hg	0.05	-	-	-	-	-	-	1	-	-	-
K	2.1%	-	-	-	-	-	-	-	-	-	-
Mg	2.3%	-	-	-	-	-	-	-	-	-	-
Mn	950	-	-	-	-	-	-	-	-	1	-
Mo	1.5	1	-	1	-	-	-	-	-	-	-
Na	2.3%	-	-	-	-	-	-	-	-	-	-
Ni	80	-	-	-	-	-	-	-	-	-	-
P	1000	-	-	-	-	-	1	1	-	-	-
Pb	14	-	-	-	-	-	-	1	-	-	-
Sb	0.2	**4**	2	2	**4**	**3**	2	2	**3**	**4**	**3**
Se	0.05	1	-	2	-	**4**	-	2	-	1	-
Si	27.7%	-	-	-	-	-	-	-	-	-	-
Sn	2.2	-	-	-	-	-	-	-	-	-	-
Th	12	-	-	-	-	-	-	-	-	-	-
U	2.4	-	-	-	-	-	-	-	1	-	-
V	160	-	-	-	-	-	-	-	-	-	-
Zn	75	-	-	**3**	-	-	-	-	-	-	-

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

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Table D-2: Geochemical abundance indices of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	**Mean Crust. Abun.***	**Geochemical Abundance Indices (GAI)**										
		Low Grade Ore										
Sample ID		E41D3041 -5	E46D3248-4	E41D3026 -8	E41D2888-4	E41D2063 -9	E41D3041 -8	E41D3173 -5	E41D3173 -9	E41D2835-8	E41D3026 -19	E41D3041 -11
Lithology		Transported	Saprolite	Saprolite	Saprock	Saprock	Saprock	Saprock	Saprock	Diorite	Diorite	Volcaniclastic
Geochem. Class.		NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Ag	0.07	**3**	1	**3**	**3**	**5**	**3**	**5**	2	**3**	2	**4**
Al	8.2%	-	-	-	-	-	-	-	-	-	-	-
As	1.5	**4**	**5**	**4**	**4**	**5**	**4**	**5**	2	**5**	2	**4**
B	10	<2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ba	500	-	-	-	-	-	-	-	-	-	-	-
Be	2.6	-	-	-	-	-	-	-	-	-	-	-
Ca	4.0%	-	-	-	-	-	-	-	-	-	-	-
Cd	0.11	-	2	**3**	2	**3**	**4**	**4**	2	-	-	**5**
Co	20	-	-	-	-	2	-	2	-	-	-	-
Cr	100	-	-	-	-	-	-	-	-	-	-	-
Cu	50	-	-	-	2	**3**	1	1	1	**3**	1	-
Fe	4.1%	-	-	-	-	1	-	-	-	-	-	-
Hg	0.05	-	-	-	-	-	-	-	-	-	-	-
K	2.1%	-	-	-	-	-	-	-	-	-	-	-
Mg	2.3%	-	-	-	-	-	-	-	-	-	-	-
Mn	950	-	-	2	-	**3**	-	2	-	-	-	-
Mo	1.5	-	-	-	-	-	-	-	-	-	-	-
Na	2.3%	-	-	-	-	-	-	-	-	-	-	-
Ni	80	-	-	-	-	-	-	-	-	-	-	-
P	1000	-	-	-	-	-	-	-	1	-	-	-
Pb	14	1	-	-	-	-	-	-	-	-	-	-
Sb	0.2	**3**	**3**	2	**3**	**3**	**3**	**4**	**4**	**4**	**3**	1
Se	0.05	1	-	-	1	1	-	1	-	2	-	-
Si	27.7%	-	-	-	-	-	-	-	-	-	-	-
Sn	2.2	-	-	-	-	-	-	-	-	-	-	-
Th	12	-	-	-	-	-	-	-	-	-	-	-
U	2.4	-	-	-	-	-	-	-	-	-	-	-
V	160	-	-	-	-	1	-	-	-	1	-	-
Zn	75	1	1	**3**	2	-	**3**	**3**	2	-	-	**3**

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

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Table D-2: Geochemical abundance indices of selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Element	Mean Crust. Abun.*	Geochemical Abundance Indices (GAI)											
		Low Grade Ore						Ore					
Sample ID		E41D3173 -11	E41D3173 -28	E41D2888-14	UG-BH-05-10	E41D2893-12	E41D2834-8	E41D2886-3	E41D2893-21	E41D2893-11	E41D2886-11	UG-BH-05-13	E41D2888-17
Lithology		Volcaniclastic	Volcaniclastic	Monzodiorite	Extrusive	Dyke	Fault Zone	Saprock	Diorite	Volcaniclastic	Monzodiorite	Extrusive	Breccia
Geochem. Class.		NAF	NAF	PAF	NAF	PAF	AC	NAF	PAF	NAF	PAF	NAF	PAF-LC
Ag	0.07	**4**	2	**5**	**3**	1	**6**	2	1	**3**	**3**	**3**	**6**
Al	8.2%	-	-	-	-	-	-	-	-	-	-	-	-
As	1.5	**3**	**3**	**4**	**5**	**4**	**6**	**6**	**4**	**4**	**6**	**5**	**4**
B	10	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ba	500	-	-	-	-	-	-	-	-	-	-	-	-
Be	2.6	-	-	-	-	-	-	-	-	-	-	-	-
Ca	4.0%	-	-	-	-	-	1	-	-	-	-	-	-
Cd	0.11	**4**	-	-	**5**	-	**6**	**3**	-	-	1	**4**	2
Co	20	-	-	1	-	-	1	-	-	-	-	-	-
Cr	100	-	-	1	-	-	1	-	-	-	-	-	-
Cu	50	-	-	1	1	-	**3**	2	1	**3**	2	-	**4**
Fe	4.1%	-	-	-	-	-	-	-	-	-	-	-	-
Hg	0.05	**3**	-	**3**	-	-	2	-	-	-	-	-	1
K	2.1%	-	-	-	-	-	-	-	-	-	-	-	-
Mg	2.3%	-	-	-	-	-	-	-	-	-	-	-	-
Mn	950	2	-	-	-	-	1	-	-	-	-	-	-
Mo	1.5	-	-	-	1	-	1	-	-	-	-	1	-
Na	2.3%	-	-	-	-	-	-	-	-	-	-	-	-
Ni	80	-	-	-	-	-	-	-	-	-	-	-	-
P	1000	-	-	-	-	-	-	-	-	-	-	-	-
Pb	14	-	-	-	-	-	2	-	-	-	2	-	-
Sb	0.2	**3**	**3**	**3**	2	**3**	**6**	**3**	**3**	**3**	2	2	**3**
Se	0.05	1	1	**5**	1	**3**	**4**	1	1	2	2	1	**3**
Si	27.7%	-	-	-	-	-	-	-	-	-	-	-	-
Sn	2.2	-	-	-	-	-	-	-	-	-	-	-	-
Th	12	-	-	-	-	-	-	-	-	-	-	-	-
U	2.4	-	-	-	-	-	-	-	-	-	-	-	-
V	160	-	-	-	-	-	1	-	-	-	-	-	-
Zn	75	2	-	-	**3**	-	**3**	2	-	-	-	2	-

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

Table D-3: Chemical composition of water extracts from selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Parameter	Detect. Limit	Chemical Composition										
		Waste Rock										
Sample ID		E46D3248-2	E41D2893-1	E41D2063 -2	E41D2063 -4	E41D3026 -5	E41D2893-2	E41D3173 -2	1535DD051 -3	UG-BH-05-4	E41D2063 -7	E41D2219 -4
Lithology		Alluvium	Transported	Transported	Transported	Transported	Saprolite	Saprolite	Saprolite	Saprock	Saprock	Saprock
Geochem. Class.		NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
pH	0.1	7.8	7.4	5.8	6.1	6.2	6.6	6.1	7.3	7.2	5.8	5.9
EC (dS/m)	0.001	0.327	0.421	5.446	6.167	2.709	1.089	5.794	6.022	0.106	11.267	8.551
Cl (mg/L)	5	77	90	575	1045	900	369	1190	1340	18	1967	1383
SO4 (mg/L)	0.3	37.3	140.4	430	257	252	153.1	188	179	21.7	251	236
Major Elements (mg/L)												
Al	0.01	2.15	0.61	0.0	0.0	0.0	0.02	<	0.0	0.05	<	<
B	0.01	0.13	0.05	0.1	0.1	0.2	0.06	0.1	0.0	0.03	0.1	0.0
Ca	0.01	1.09	2.04	30.3	34.1	28.8	20.44	41.7	39.1	0.3	83.5	68.9
Cr	0.01	<	<	<	<	<	<	<	<	<	<	<
Cu	0.01	<	<	0.03	0.04	<	<	<	<	<	0.05	<
Fe	0.01	1	0.39	0.07	3.11	0.03	0.01	<	<	0.01	0.10	<
K	0.1	11	3.7	31	29	15	10.9	29	11	12.8	20	24
Mg	0.01	1.02	2	50.2	82.3	60.2	27.34	79.5	72.9	0.25	139.7	114.1
Mn	0.001	0.018	0.006	0.10	1.79	0.84	0.004	0.05	0.06	0.002	0.38	1.31
Na	0.1	74.3	134.4	454	566	567	284.4	634	718	20.6	963	667
Ni	0.01	<	<	<	0.030	<	<	<	<	<	<	<
P	0.05	<	<	<	<	<	<	<	<	<	<	<
Si	0.05	13.48	12.22	19.79	4.74	7.61	8.26	8.97	10.03	1.15	8.19	8.98
V	0.01	<	<	<	<	<	<	<	<	<	<	<
Zn	0.01	0.02	0.02	0.06	0.15	0.15	0.02	0.02	<	0.01	0.02	7.25
Minor Elements (µg/l)												
Ag	0.01	0.04	0.09	<	0.01	<	0.06	0.06	<	0.02	0.08	0.02
As	0.1	1.8	2.9	2	3	3	2.5	3	3	1.9	5	4
Ba	0.05	7.77	5.66	17.4	35.5	33.5	56.63	37.2	46.7	4.01	42.1	39.2
Be	0.1	0.3	0.1	<	<	<	<	<	<	<	<	<
Cd	0.02	0.27	0.07	0.1	0.2	0.2	0.11	0.1	1.0	<	1.7	0.9
Co	0.1	1	0.7	6	32	2	0.4	0	0	<	81	38
Hg	0.1	<	<	<	<	<	<	<	<	<	<	<
Mo	0.05	0.17	0.05	0.1	1.2	0.3	0.39	0.3	0.4	1.13	0.1	0.4
Pb	0.5	3.2	0.8	1.2	1.9	0.7	<	0.9	0.7	<	1.6	0.8
Sb	0.01	0.31	0.05	0.0	0.1	0.0	0.36	0.0	0.1	0.17	0.0	0.0
Se	0.5	<	<	7	10	10	<	12	12	<	19	13
Sn	0.1	<	<	<	0.1	<	0.2	<	<	<	<	<
Th	0.005	1.153	0.111	0.007	0.069	<	<	<	<	0.007	0.023	<
U	0.005	0.718	0.144	0.02	0.02	0.03	0.012	<	<	0.005	<	0.01

< parameter at or below analytical detection limit. *Page 1 of 5*

Table D-3: Chemical composition of water extracts from selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Parameter	Detect. Limit	Chemical Composition									
		Waste Rock									
Sample ID		E41D3173 -3	1535D051 -7	E41D2886-7	E41D2178 -5	E41D2893-10	E41D3053 -15	E41D3173 -12	E41D3173 -16	E41D3173 -20	E41D2810-13
Lithology		Saprock	Saprock	Diorite	Diorite	Volcaniclastic	Volcaniclastic	Volcaniclastic	Volcaniclastic	Volcaniclastic	Monzodiorite
Geochem. Class.		NAF	NAF	NAF	NAF	PAF	NAF	NAF	NAF	NAF	NAF
pH	0.1	6.2	9.2	9.3	8.6	9	8.3	8.6	8.9	8.9	9.2
EC (dS/m)	0.001	3.459	0.704	0.103	0.607	0.084	0.317	0.679	0.531	0.532	0.114
Cl (mg/L)	5	1135	40	13	26	19	14	82	16	34	9
SO4 (mg/L)	0.3	204	18	5.3	161	21.9	52	78	69	64	27.1
Major Elements (mg/L)											
Al	0.01	0.0	0.9	0.17	0.2	0.25	0.2	0.4	0.7	0.3	0.15
B	0.01	0.1	0.1	0.02	0.1	0.02	0.1	0.1	0.1	0.1	0.02
Ca	0.01	48.7	1.7	3.3	7.7	8.31	7.8	8.7	6.7	8.0	8.97
Cr	0.01	<	<	<	<	<	<	<	<	<	<
Cu	0.01	<	0.01	<	<	<	<	<	<	<	<
Fe	0.01	<	1.38	0.01	0.09	0.05	0.03	0.12	0.15	0.0	0.02
K	0.1	78	1	1.8	68	1.4	56	66	99	66	3
Mg	0.01	77.2	1.3	0.74	2.0	0.79	3.5	6.3	5.4	6.1	2.23
Mn	0.001	0.05	0.05	0.004	<	0.006	0.01	0.02	0.01	<	0.013
Na	0.1	584	186	27.1	95	29.1	33	110	62	98	30.4
Ni	0.01	<	<	<	<	<	<	<	<	<	<
P	0.05	<	0.40	<	<	<	<	<	<	<	<
Si	0.05	6.69	7.54	2.37	2.27	1.67	1.19	2.3	2.21	1.76	1.28
V	0.01	<	0.16	0.01	<	<	<	<	<	<	<
Zn	0.01	0.01	<	<	<	0.01	<	<	<	<	0.01
Minor Elements (µg/l)											
Ag	0.01	0.01	<	0.01	<	0.31	<	<	<	<	<
As	0.1	3	27	13.3	3	13.9	1	2	2	1	21.9
Ba	0.05	44.1	5.3	1.41	24.3	4.03	40.8	5.2	31.7	45.2	6.82
Be	0.1	<	<	<	<	<	<	<	<	<	<
Cd	0.02	0.1	0.1	<	0.0	0.05	<	0.1	0.0	0.0	0.04
Co	0.1	0	2	<	0	0.1	<	<	<	<	<
Hg	0.1	<	<	<	<	<	<	<	<	<	<
Mo	0.05	0.2	7.5	0.57	20.8	0.98	13.7	7.3	17.7	12.1	8.28
Pb	0.5	0.7	0.8	<	0.9	<	0.9	1.1	0.8	1	<
Sb	0.01	0.1	0.8	0.42	3.2	0.74	1.7	0.7	5.6	4.6	6.89
Se	0.5	11	2	<	1	<	1	31	1	2	<
Sn	0.1	<	<	<	<	<	<	<	0.2	<	<
Th	0.005	<	0.026	<	0.048	<	0.058	0.018	0.017	<	<
U	0.005	<	0.12	0.034	0.35	0.096	0.03	0.03	0.31	0.11	2.163

< parameter at or below analytical detection limit. *Page 2 of 5*

Table D-3: Chemical composition of water extracts from selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Parameter	Detect. Limit	Chemical Composition									
		Waste Rock									
Sample ID		E41D2178 -7	E41D2178 -12	UG-BH-05-8	E41D2888-21	E41D3053 -13	E41D2888-9	E41D2063 -20	E41D2888-8	E41D3173 -19	E41D2063 -14
Lithology		Monzodiorite	Monzodiorite	Extrusive	Extrusive	Extrusive	Dyke	Dyke	Fault Zone	Fault Zone	Shear Zone
Geochem. Class.		NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
pH	0.1	8.2	8.4	8.5	9.3	8.1	9.4	8.2	9.7	8.9	8.5
EC (dS/m)	0.001	0.589	0.313	0.235	0.112	0.513	0.08	0.626	0.067	0.660	0.667
Cl (mg/L)	5	32	21	17	11	13	6	42	9	34	100
SO4 (mg/L)	0.3	164	13	72.1	17	196	6.5	337	8.3	158	102
Major Elements (mg/L)											
Al	0.01	0.1	0.3	0.08	0.19	0.1	0.38	0.3	0.47	0.2	0.3
B	0.01	0.1	0.1	0.02	0.04	0.1	0.02	0.1	0.02	0.1	0.1
Ca	0.01	18.4	7.2	10.36	7.61	22.4	4.56	42.3	1.37	12.6	9.5
Cr	0.01	<	<	<	<	<	<	<	<	<	<
Cu	0.01	<	<	<	<	<	<	<	<	<	<
Fe	0.01	<	0.04	0.02	0.05	0.02	0.01	0.01	0.04	0.02	0.25
K	0.1	65	31	3.9	1.4	80	2.2	32	1.6	97	39
Mg	0.01	10.0	7.7	3.98	0.5	7.3	0.4	17.6	0.28	7.3	3.3
Mn	0.001	0.02	<	0.046	0.01	0.02	0.004	0.02	0.002	0.02	<
Na	0.1	76	52	48.3	25.1	52	21.4	99	48.7	101	145
Ni	0.01	<	<	<	<	<	<	<	<	<	<
P	0.05	<	<	<	<	<	<	<	<	<	<
Si	0.05	1.56	1.94	1.94	2.73	1.37	1.81	1.77	2.28	1.85	2.67
V	0.01	<	<	<	0.02	<	<	<	<	<	<
Zn	0.01	0.01	<	0.01	0.01	<	<	<	<	<	<
Minor Elements (µg/l)											
Ag	0.01	<	<	0.02	0.05	<	<	0.03	<	<	<
As	0.1	2	5	3.2	22.8	1	50.6	2	40.1	6	4
Ba	0.05	39.1	1.8	12.06	1.79	21.3	2.66	23.2	2.17	8.4	4.8
Be	0.1	<	<	<	<	<	<	<	<	<	<
Cd	0.02	0.0	0.0	0.34	<	0.0	<	0.1	<	0.1	0.0
Co	0.1	<	<	0.3	0.1	<	<	0	0.2	0	0
Hg	0.1	<	<	<	<	<	<	<	<	<	<
Mo	0.05	22.5	18.6	42.41	1.54	36.5	1.09	71.5	0.85	53.8	25.6
Pb	0.5	0.7	0.8	<	<	1.9	<	0.8	<	0.8	1.0
Sb	0.01	8.5	1.2	0.49	0.94	2.2	1.95	0.6	1.85	8.4	1.6
Se	0.5	1	<	12	<	1	<	2	<	1	2
Sn	0.1	<	<	<	<	<	<	<	<	0.1	0.1
Th	0.005	0.007	<	<	<	<	<	0.008	<	0.009	0.024
U	0.005	0.73	0.02	0.08	0.139	0.07	0.272	0.22	3.302	0.31	0.16

< parameter at or below analytical detection limit. *Page 3 of 5*

Table D-3: Chemical composition of water extracts from selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Parameter	Detect. Limit	Chemical Composition										
		Low Grade Ore										
Sample ID		E41D3041 -5	E46D3248-4	E41D3026 -8	E41D2888-4	E41D2063 -9	E41D3041 -8	E41D3173 -5	E41D3173 -9	E41D2835-8	E41D3026 -19	E41D3041 -11
Lithology		Transported	Saprolite	Saprolite	Saprock	Saprock	Saprock	Saprock	Saprock	Diorite	Diorite	Volcaniclastic
Geochem. Class.		NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
pH	0.1	6.8	7	6.4	6.8	6.4	6.7	6.4	7.0	9.1	8.5	8.4
EC (dS/m)	0.001	3.084	0.242	3.778	0.914	9.510	2.112	2.383	1.029	0.1	0.385	0.471
Cl (mg/L)	5	655	51	1617	232	1626	625	740	250	10	20	19
SO4 (mg/L)	0.3	214	9.1	282	88.1	249	128	144	54	6.2	50	112
Major Elements (mg/L)												
Al	0.01	0.1	0.03	0.0	0.05	<	0.1	0.0	0.2	0.35	0.3	0.2
B	0.01	0.0	0.04	0.1	0.04	0.0	0.1	0.1	0.1	0.02	0.1	0.1
Ca	0.01	8.5	2.36	56.0	3.18	80.3	11.0	26.6	6.9	3.86	6.1	11.5
Cr	0.01	<	<	<	<	<	<	<	<	<	<	<
Cu	0.01	<	<	<	<	0.04	<	<	<	<	<	<
Fe	0.01	0.01	<	<	0.02	<	<	<	0.08	0.04	0.07	0.02
K	0.1	4	18.3	39	4	12	35	92	31	0.9	54	41
Mg	0.01	18.6	2.62	113.3	3.48	119.4	25.0	37.7	10.4	0.57	3.9	10.8
Mn	0.001	0.06	0.003	1.99	0.012	1.47	0.12	0.08	0.02	0.002	<	0.03
Na	0.1	509	28.1	869	232.3	1075	429	407	174	26.4	74	85
Ni	0.01	<	<	<	<	<	<	<	<	<	<	<
P	0.05	<	<	<	<	<	<	<	<	<	<	<
Si	0.05	4.67	1.18	7.38	3.72	7.91	6.83	6.77	5.84	1.3	1.54	2.1
V	0.01	<	<	<	<	<	<	<	<	<	0.01	<
Zn	0.01	0.03	0.01	2.32	0.02	0.02	0.02	<	<	<	<	<
Minor Elements (µg/l)												
Ag	0.01	<	0.02	0.01	0.05	0.01	<	0.03	<	0.05	<	<
As	0.1	2	2	5	3.8	4	2	2	1	18	1	1
Ba	0.05	22.9	26.91	37.8	9.26	2.3	22.7	12.7	1.5	1.06	63.6	5.3
Be	0.1	<	<	<	<	<	<	<	<	<	<	<
Cd	0.02	0.1	0.03	3.2	0.1	0.9	0.2	0.2	0.1	<	0.3	0.0
Co	0.1	3	<	17	1.5	123	10	1	1	0.1	0	<
Hg	0.1	<	<	<	<	<	<	<	<	<	<	<
Mo	0.05	0.6	0.09	0.7	2.11	0.2	2.5	0.4	4.1	1.02	22.4	16.4
Pb	0.5	1.0	<	0.6	<	1.5	0.7	0.7	0.6	<	9.2	1.0
Sb	0.01	0.1	0.22	0.1	0.69	0.0	0.4	0.2	0.8	0.95	3.8	0.8
Se	0.5	7	<	17	<	15	7	8	3	<	1	1
Sn	0.1	<	<	<	0.2	<	<	<	<	<	0.6	<
Th	0.005	<	<	<	<	0.008	<	<	0.007	<	0.010	<
U	0.005	0.01	0.006	0.02	0.017	<	0.03	0.01	0.03	0.069	0.04	0.07

< parameter at or below analytical detection limit. *Page 4 of 5*

Table D-3: Chemical composition of water extracts from selected waste rock, low-grade ore and ore samples for the CGO Open Cut Expansion Project.

Parameter	Detect. Limit	Chemical Composition											
		Low Grade Ore						Ore					
Sample ID		E41D3173 -11	E41D3173 -28	E41D2888-14	UG-BH-05-10	E41D2893-12	E41D2834-8	E41D2886-3	E41D2893-21	E41D2893-11	E41D2886-11	UG-BH-05-13	E41D2888-17
Lithology		Volcaniclastic	Volcaniclastic	Monzodiorite	Extrusive	Dyke	Fault Zone	Saprock	Diorite	Volcaniclastic	Monzodiorite	Extrusive	Breccia
Geochem. Class.		NAF	NAF	PAF	NAF	PAF	AC	NAF	PAF	NAF	PAF	NAF	PAF-LC
pH	0.1	8.2	8.6	8.7	8.6	9.3	8	6.7	9	9.3	9	8.3	8.8
EC (dS/m)	0.001	0.929	0.508	0.213	0.131	0.073	0.234	1.697	0.102	0.071	0.136	0.189	0.119
Cl (mg/L)	5	245	27	7	6	<	7	515	17	7	16	7	<
SO4 (mg/L)	0.3	45	60	87.5	42.4	14.6	72.3	114.3	28.5	8	33.1	77.3	35.9
Major Elements (mg/L)													
Al	0.01	0.2	0.3	0.11	0.06	0.24	0.03	<	0.12	0.4	0.16	0.05	0.18
B	0.01	0.0	0.1	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.02
Ca	0.01	12.9	7.0	21.11	10.91	5.97	26.62	16.2	14.66	6.32	9.67	34.14	15.98
Cr	0.01	<	<	<	<	<	<	<	<	<	<	<	<
Cu	0.01	<	<	<	<	<	<	<	<	<	<	<	<
Fe	0.01	0.10	0.1	0.03	0.02	0.02	<	<	<	0.07	0.02	<	0.02
K	0.1	44	59	1.4	3.8	0.8	2.5	27.6	0.9	0.8	2.8	3.9	1.6
Mg	0.01	5.5	4.6	1.5	2.82	0.4	3.24	21.82	0.85	0.35	1.46	4.01	0.89
Mn	0.001	0.02	<	0.007	0.117	0.006	0.011	0.04	0.007	0.005	0.014	0.251	0.02
Na	0.1	182	60	34.1	22.3	23.9	32.6	394.5	23.7	24.3	26.8	8.9	11.6
Ni	0.01	<	<	<	<	<	<	<	<	<	<	<	<
P	0.05	<	<	<	<	<	<	<	<	<	<	<	<
Si	0.05	2.77	1.8	1.35	1.13	1.21	3.78	3.82	1.82	1.56	1.21	1.29	1.17
V	0.01	<	<	<	<	<	<	<	<	<	<	<	<
Zn	0.01	<	<	0.01	0.02	<	<	0.01	0.01	0.01	<	0.02	0.01
Minor Elements (µg/l)													
Ag	0.01	<	<	0.09	0.01	0.03	<	0.17	<	0.05	0.4	<	0.23
As	0.1	1	3	7	2.9	31.8	178.6	2.3	16.1	130.3	9.7	3	3.4
Ba	0.05	2.1	45.9	6.8	10.78	1.32	5.63	9.87	1.7	2.67	25.93	34.92	2.6
Be	0.1	<	<	<	<	<	<	<	<	<	<	<	<
Cd	0.02	0.1	0.0	0.04	0.27	0.11	0.06	0.12	0.03	0.03	0.04	0.29	0.05
Co	0.1	<	<	<	0.7	<	0.2	0.5	<	0.1	<	0.8	<
Hg	0.1	<	<	<	<	<	<	<	<	<	<	<	<
Mo	0.05	4.6	14.4	0.35	15.63	0.52	19.95	3.37	0.72	0.52	8.29	35.97	0.74
Pb	0.5	0.6	1.4	<	<	<	<	<	<	<	1.6	<	<
Sb	0.01	0.5	4.7	0.5	0.72	0.54	1.65	0.42	0.63	1.42	0.4	0.97	0.37
Se	0.5	3	1	1.9	<	<	11.4	<	<	<	<	<	<
Sn	0.1	<	<	<	<	<	<	<	<	<	<	<	<
Th	0.005	0.007	0.006	<	<	<	<	<	<	<	<	<	<
U	0.005	0.03	0.03	0.411	0.173	0.058	0.268	<	0.394	0.06	0.271	0.283	0.065

< parameter at or below analytical detection limit.

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Table D-4: Multi-element composition of the E46 backfill material for the CGO Open Cut Expansion Project.

Element		Det. Limit	Element Concentration													
			GR Pit - Oxide Waste Rock			E42 Pit - Primary Waste Rock										
			Saprolite	Saprock		Volcaniclastics			Diorite					Dyke	Fault/ Shear	
			SOX	HOX		VC			DI						LAVA	
			E41D3173 /2	UG-BH-05 /4	E41D3173 /3	E41D3173 /12	E41D3173 /16	E41D3173 /20	E42D1632 /10	E42D1632 /14	E42D1632 /33	E42D1634 /25	E42D1634 /30	E42D1632 /11	E41D3173 /19	E42D1634 /31
Ag	mg/kg	0.01	1.99	1.78	0.37	1.46	0.45	0.44	0.25	0.2	0.31	0.35	0.46	0.45	1.31	0.75
Al	%	0.005%	13.61%	9.125%	9.25%	6.877%	7.282%	7.351%	8.575%	8.407%	9.435%	9.585%	9.246%	7.571%	7.021%	9.132%
As	mg/kg	0.5	42	54.7	73.2	14.4	14.2	23.1	35.8	11.0	16.7	20.1	8.9	44.0	129.4	91.4
B	mg/kg	50	<	84	<	<	<	<	80	<	<	<	<	<	<	124
Ba	mg/kg	0.1	191.1	1458.4	374.3	206.6	254.6	175.1	401.3	349.3	344.9	400.7	719.1	366.2	164.1	724.6
Be	mg/kg	0.05	0.58	2	1.09	0.83	0.81	0.65	0.84	0.91	0.81	0.81	0.75	0.94	0.81	1.29
Ca	%	0.005%	0.06%	0.052%	0.06%	3.001%	4.121%	4.935%	4.195%	5.928%	4.593%	4.204%	3.938%	4.496%	4.540%	4.759%
Cd	mg/kg	0.02	0.30	0.87	0.35	2.2	0.72	0.58	0.09	0.07	0.06	0.06	0.16	0.07	0.35	0.32
Co	mg/kg	0.1	4.8	70.9	2.5	14.8	18.5	19.6	25.0	22.5	22.1	16.7	14.7	21.5	17.8	13.6
Cr	mg/kg	2	141	6	27	4	7	11	31	25	<	9	<	12	6	7
Cu	mg/kg	1	171	152	175	57	345	133	152	92	209	114	151	296	63	166
Fe	%	0.01%	14.54%	4.59%	6.44%	5.62%	6.13%	6.40%	7.71%	6.49%	6.80%	5.61%	5.28%	7.68%	5.51%	4.46%
Hg	mg/kg	0.01	<	0.019	0.02	0.050	0.010	0.030	0.002	<	<	0.003	0.008	0.002	0.070	0.050
K	%	0.002%	2.04%	3.084%	2.47%	2.809%	3.070%	2.478%	1.616%	2.424%	1.326%	2.147%	1.951%	1.877%	3.151%	4.446%
Mg	%	0.002%	0.32%	0.262%	0.26%	1.300%	1.906%	2.562%	2.489%	1.794%	1.842%	1.666%	1.425%	2.125%	1.601%	1.377%
Mn	mg/kg	1	405	6065	111	1865	2154	2587	1322	1375	1330	1339	1249	1476	2450	1387
Mo	mg/kg	0.1	0.8	3	1.2	0.4	0.5	0.3	1.0	0.7	0.7	0.6	0.3	0.8	2.0	2.9
Na	%	0.002%	0.34%	0.157%	0.23%	0.100%	0.085%	0.243%	3.478%	1.838%	3.703%	3.583%	3.863%	1.994%	0.129%	0.249%
Ni	mg/kg	1	10	2	5	<	2	3	21	17	8	8	6	11	<	8
P	mg/kg	10	389	1285	1322	1634	1624	1141	1144	983	1760	1151	1191	1567	1103	1297
Pb	mg/kg	0.5	14.7	6.4	165.8	12.8	8.7	97.1	8.1	6.0	4.6	5.5	4.6	7.7	29.5	14.2
Sb	mg/kg	0.05	5.37	2.96	3.19	2.96	2.55	3.31	1.66	1.93	1.48	2.68	2.41	2.63	5.75	11.08
Se	mg/kg	0.01	0.67	0.02	0.12	0.69	0.12	0.19	0.08	0.07	0.11	0.11	0.15	0.22	0.17	0.15
Si	%	0.1%	19.8%	29.9%	30.4%	28.8%	25.7%	23.6%	26.7%	22.3%	24.2%	23.5%	23.6%	25.8%	25.1%	21.9%
Sn	mg/kg	0.1	1.1	1.5	1.1	1.0	0.8	0.7	0.6	0.5	0.7	0.6	0.7	1.0	0.7	0.8
Th	mg/kg	0.01	2.95	4.11	2.59	2.53	1.82	1.44	1.60	1.29	1.50	1.52	1.51	2.84	1.46	1.63
U	mg/kg	0.01	2.58	4.17	2.62	1.55	1.41	1.11	1.07	0.83	1.03	1.02	0.99	1.95	1.19	0.92
V	mg/kg	1	545	83	148	129	209	262	297	290	310	245	210	248	221	239
Zn	mg/kg	1	242	85	311	189	242	228	100	92	94	112	122	125	129	113

< element at or below analytical detection limit.

Table D-5: Geochemical abundance indices of the E46 backfill material for the CGO Open Cut Expansion Project.

Element		*Mean Crustal Abund.	Geochemical Abundance Indices													
			GR Pit - Oxide Waste Rock			**E42 Pit - Primary Waste Rock**										
			Saprolite	Saprock		Volcaniclastics			Diorite					Dyke	Fault/ Shear	
			SOX	HOX		VC			DI						LAVA	
			E41D3173 /2	UG-BH-05 /4	E41D3173 /3	E41D3173 /12	E41D3173 /16	E41D3173 /20	E42D1632 /10	E42D1632 /14	E42D1632 /33	E42D1634 /25	E42D1634 /30	E42D1632 /11	E41D3173 /19	E42D1634 /31
Ag	mg/kg	0.07	**4**	**4**	2	**4**	2	2	1	1	2	2	2	2	**4**	**3**
Al	%	8.2%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
As	mg/kg	1.5	**4**	**5**	**5**	**3**	**3**	**3**	**4**	2	**3**	**3**	2	**4**	**6**	**5**
B	mg/kg	10	<2	2	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	<2	**3**
Ba	mg/kg	500	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Be	mg/kg	2.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ca	%	4.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cd	mg/kg	0.11	1	2	1	**4**	2	2	-	-	-	-	-	-	1	1
Co	mg/kg	20	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Cr	mg/kg	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cu	mg/kg	50	1	1	1	-	2	1	1	-	1	1	1	2	-	1
Fe	%	4.1%	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Hg	mg/kg	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K	%	2.1%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mg	%	2.3%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mn	mg/kg	950	-	2	-	-	1	1	-	-	-	-	-	-	1	-
Mo	mg/kg	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Na	%	2.3%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ni	mg/kg	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P	mg/kg	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pb	mg/kg	14	-	-	**3**	-	-	2	-	-	-	-	-	-	-	-
Sb	mg/kg	0.2	**4**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**4**	**5**
Se	mg/kg	0.05	**3**	-	1	**3**	1	1	-	-	1	1	1	2	1	1
Si	%	27.7%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sn	mg/kg	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Th	mg/kg	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U	mg/kg	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V	mg/kg	160	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Zn	mg/kg	75	1	-	1	1	1	1	-	-	-	-	-	-	-	-

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

Table D-6: Chemical composition of water extracts from the E46 backfill material for the CGO Open Cut Expansion Project.

Parameter		Det. Limit	Geochemical Abundance Indices													
			GR Pit - Oxide Waste Rock			**E42 Pit - Primary Waste Rock**										
			Saprolite	Saprock		Volcaniclastics			Diorite					Dyke	Fault/ Shear	
			SOX	HOX		VC			DI						LAVA	
			E41D3173 /2	UG-BH-05 /4	E41D3173 /3	E41D3173 /12	E41D3173 /16	E41D3173 /20	E42D1632 /10	E42D1632 /14	E42D1632 /33	E42D1634 /25	E42D1634 /30	E42D1632 /11	E41D3173 /19	E42D1634 /31
pH		0.1	6.1	7.2	6.2	8.6	8.9	8.9	8.5	8.6	8.4	8.4	8.4	8.2	8.9	8.4
EC	dS/m	0.001	5.794	0.106	3.459	0.679	0.531	0.532	0.307	0.298	0.349	0.399	0.488	0.394	0.660	0.508
Cl	mg/L	10.0	1190	18	1135	82	16	34	39	23	35	31	36	32	34	35
SO_4	mg/L	0.3	188	21.7	204	77.6	68.6	64.3	10.1	25.6	47.5	108.1	178.1	53.8	157.5	98.5
Major Constituents																
Al	mg/L	0.01	<	0.05	0.0	0.35	0.66	0.27	0.15	0.2	0.3	0.2	0.3	0.13	0.18	0.19
B	mg/L	0.01	0.1	0.03	0.1	0.05	0.07	0.05	0.04	0.03	0.04	0.06	0.04	0.02	0.07	0.04
Ca	mg/L	0.01	41.7	0.3	48.7	8.72	6.72	7.97	7.98	8.74	10.52	12.14	25.76	12.61	12.57	14.66
Cr	mg/L	0.01	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cu	mg/L	0.010	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Fe	mg/L	0.01	<	0.01	<	0.12	0.15	0.0	<	0.06	<	0.03	0.27	<	0.02	0.02
K	mg/L	0.1	29	12.8	78	66.4	99.3	65.8	19.2	50.5	17.5	63.2	57	57	96.7	35.7
Mg	mg/L	0.01	79.5	0.25	77.2	6.30	5.44	6.13	3.54	1.77	5.42	3.4	9.77	3.47	7.25	7.02
Mn	mg/L	0.010	0.05	0.002	0.05	0.02	0.01	<	<	<	<	0.01	0.03	<	0.02	<
Na	mg/L	0.1	634	20.6	584	109.6	62.2	97.5	81.7	43.8	80.4	85.4	88	59.4	101.2	100.9
Ni	mg/L	0.010	<	<	<	<	<	<	<	<	<	<	<	<	<	<
P	mg/L	0.10	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Si	mg/L	0.05	8.97	1.15	6.69	2.3	2.21	1.76	2.27	2.46	1.64	2.06	1.95	2.15	1.85	1.69
V	mg/L	0.01	<	<	<	<	<	<	<	0.01	<	<	<	<	<	<
Zn	mg/L	0.01	0.02	0.01	0.01	<	<	<	<	<	<	<	<	<	<	<
Minor Constituents																
Ag	μg/L	0.01	0.06	0.02	0.01	<	<	<	<	<	<	<	0.02	<	<	<
As	μg/L	0.1	3	1.9	3	1.6	1.7	1.4	5.9	2.9	0.9	2.4	0.9	5.3	5.7	0.9
Ba	μg/L	0.05	37.2	4.01	44.1	5.16	31.67	45.18	15.32	45.83	7.62	49.7	53.61	89.17	8.43	49.21
Be	μg/L	0.1	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cd	μg/L	0.02	0.1	<	0.1	0.07	0.04	0.03	0.06	0.06	0.03	0.04	0.06	0.02	0.06	0.05
Co	μg/L	0.1	0	<	0	<	<	<	<	<	<	<	0.8	<	0.1	<
Hg	μg/L	0.1	<	<	<	<	<	<	0.1	<	<	<	<	0.1	<	0.2
Mo	μg/L	0.05	0.3	1.13	0.2	7.34	17.73	12.07	4.73	3.49	3.8	12.83	8.73	47.25	53.82	10.9
Pb	μg/L	0.5	0.9	<	0.7	1.1	0.8	1	1.3	<	<	<	<	<	0.8	<
Sb	μg/L	0.01	0.0	0.17	0.1	0.74	5.61	4.58	1.48	2.69	0.93	4.11	1.68	2.25	8.44	1.45
Se	μg/L	0.5	12	<	11	31.4	1.2	2.3	<	<	0.5	0.9	1.1	1.2	0.9	0.9
Sn	μg/L	0.1	<	<	<	<	0.2	<	<	<	<	<	<	<	0.1	<
Th	μg/L	0.005	<	0.007	<	0.018	0.017	<	<	<	<	<	0.006	<	0.009	<
U	μg/L	0.005	<	0.005	<	0.028	0.306	0.114	0.038	0.062	0.03	0.18	0.12	0.14	0.307	0.057

< parameter at or below analytical detection limit.

Table D-7: Multi-element composition of all previous primary waste rock drill-hole samples, Cowal Gold Operations.

Element		**Det. Limit**	EIS (1995) Geochemistry Assessment						Barrick (2004) Geochemistry Review											
			Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Lava	Lava	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Diorite	Diorite	Diorite	Lava	Lava
			comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.	comp.
Ag	mg/kg	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Al	%	0.005%	8.0%	7.2%	7.4%	7.4%	5.4%	7.4%	7.5%	7.7%	7.3%	7.4%	7.9%	7.3%	8.5%	8.6%	7.8%	7.8%	7.6%	6.7%
As	mg/kg	0.5	22	30	70	16	300	64	59	15	86	17	79	100	43	35	40	30	20	59
B	mg/kg	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ba	mg/kg	0.1	460	560	470	370	520	600	317	592	495	342	395	211	82	373	288	367	591	641
Be	mg/kg	0.05	2.6	2.1	2.2	2.5	1.5	1.8	0.8	0.9	0.9	0.7	0.6	0.6	0.7	0.7	0.6	0.8	1.9	0.8
Ca	%	0.005%	2.70%	3.6%	2.4%	1.9%	3.6%	2.5%	3.6%	3.4%	2.7%	2.9%	2.2%	6.9%	2.7%	3.9%	4.1%	4.6%	1.9%	2.6%
Cd	mg/kg	0.02	0.6	0.6	5.8	1.2	15.5	5.0	1.9	0.3	1.5	0.1	0.4	1.0	13.0	1.7	0.3	0.5	2.6	0.5
Co	mg/kg	0.1	18	19	10	9	16	13	17	16	11	18	18	29	22	23	20	25	11	12
Cr	mg/kg	2	26	32	20	14	26	28	6	14	6	9	14	43	12	28	8	61	3	3
Cu	mg/kg	1	60	39	64	16	235	170	125	24	54	43	46	65	103	147	159	153	122	95
Fe	%	0.01%	6.0%	5.6%	5.4%	4.1%	6.0%	5.6%	5.3%	5.1%	4.6%	6.3%	6.0%	6.9%	6.9%	6.4%	6.2%	6.1%	4.8%	4.7%
Hg	mg/kg	0.01	0.01	0.02	0.04	0.01	0.17	0.03	0.31	<0.01	0.02	<0.01	<0.01	<0.01	0.07	0.02	0.01	0.01	0.01	<0.01
K	%	0.002%	3.6%	2.7%	3.8%	3.3%	2.3%	4.8%	3.0%	3.3%	3.8%	0.9%	2.0%	2.0%	0.7%	1.9%	2.2%	2.9%	3.8%	3.2%
Mg	%	0.002%	1.75%	1.6%	1.3%	0.96%	1.0%	1.2%	1.4%	1.1%	0.95%	2.3%	1.6%	1.5%	2.2%	2.0%	1.7%	2.1%	0.92%	0.82%
Mn	mg/kg	1	1650	1900	1800	1450	1600	1500	1897	1875	1565	1948	1394	1960	1700	1340	1467	1341	1486	1471
Mo	mg/kg	0.1	1.5	2.0	2.0	1.5	4.0	3.0	0.5	0.3	0.5	0.3	0.3	1.2	0.8	0.6	0.5	0.9	2.0	1.8
Na	%	0.002%	1.02%	0.11%	1.1%	0.08%	1.4%	1.0%	0.38%	0.21%	0.19%	3.0%	3.2%	1.8%	4.4%	3.1%	2.3%	1.3%	0.77%	2.7%
Ni	mg/kg	1	3	3	4	2	7	5	8	8	6	7	8	18	8	16	8	33	4	4
P	mg/kg	10	1100	1040	880	900	1160	1600	867	1013	910	1779	1620	813	1650	1378	1606	1054	1859	1719
Pb	mg/kg	0.5	26	52	70	16	225	18	266	8	63	8	10	504	13	5	8	107	10	10
Sb	mg/kg	0.05	0.3	0.2	0.2	0.3	1.2	0.2	3.4	2.2	5.1	2.2	1.8	1.9	2.0	2.5	3.1	2.2	2.8	1.5
Se	mg/kg	0.01	0.04	0.04	0.09	0.05	0.44	0.18	3.6	0.14	0.09	0.02	0.06	0.69	0.16	0.06	0.17	0.10	0.07	0.13
Si	%	0.1%	28%	28%	26%	29%	27%	28%	25%	28%	30%	27%	28%	21%	23%	26%	26%	25%	28%	30%
Sn	mg/kg	0.1	2	2	2	2	2	2	0.7	1.4	1.3	0.9	1.0	0.7	1.3	0.8	0.9	0.8	1.6	1.4
Th	mg/kg	0.01	-	-	-	-	-	-	119	161	215	375	369	368	285	566	300	535	200	316
U	mg/kg	0.01	-	-	-	-	-	-	1.2	2.4	3.2	2.1	2.4	0.8	2.3	2.0	2.2	1.9	4.1	3.6
V	mg/kg	1	-	-	-	-	-	-	1.0	1.7	2.2	1.5	1.5	0.8	2.8	1.3	1.3	1.1	3.1	2.4
Zn	mg/kg	1	175	235	740	170	1850	540	323	124	290	174	202	243	1394	233	162	187	438	193

< element at or below analytical detection limit.

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Table D-7: Multi-element composition of all previous primary waste rock drill-hole samples, Cowal Gold Operations.

Element		Det. Limit	E42 Modification (2008) Geochemistry Assessment														
			Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic
			E42D1027 /12	E42D1029 /13	E42D1029 /14	E42D1029 /15	E42D1136 /16	E42D1312 /17	E42D1312 /18	E42D1054 /25	E42D1062 /9	E42D1062 /10	E42D1062 /11	E42D1062 /24	E42D1074 /28	E42D1346 /29	E42D1346 /30
Ag	mg/kg	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Al	%	0.005%	3.370%	2.660%	2.350%	2.800%	1.940%	1.460%	2.810%	2.890%	2.530%	2.350%	3.570%	1.820%	2.860%	2.060%	4.060%
As	mg/kg	0.5	11	60	108	192	31	48	12	56	8	67	10	<	110	37	5
B	mg/kg	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ba	mg/kg	0.1	120	150	100	200	150	740	220	60	90	70	140	60	80	40	220
Be	mg/kg	0.05	<	<	<	1	<	<	<	<	<	<	<	<	<	<	<
Ca	%	0.005%	3.580%	2.280%	4.350%	1.080%	1.880%	2.220%	5.270%	3.360%	3.300%	6.330%	2.920%	5.110%	2.340%	1.150%	3.010%
Cd	mg/kg	0.02	<	<	5	2	1	<	<	<	<	<	<	<	1	<	<
Co	mg/kg	0.1	11	8	8	14	6	6	6	20	17	18	18	18	18	18	25
Cr	mg/kg	2	26	<	14	12	23	<	8	32	<	8	<	<	8	7	7
Cu	mg/kg	1	35	6	51	213	10	13	8	161	101	250	86	84	82	138	648
Fe	%	0.01%	4.450%	4.750%	4.070%	5.030%	4.360%	4.000%	3.490%	6.040%	4.740%	2.590%	5.170%	4.330%	6.130%	5.230%	6.010%
Hg	mg/kg	0.01	<	<	0.1	<	<	<	<	<	<	<	<	<	<	0.1	<
K	%	0.002%	1.130%	1.080%	0.756%	1.280%	0.536%	0.803%	0.770%	0.147%	0.256%	1.020%	0.483%	0.265%	0.221%	0.212%	0.667%
Mg	%	0.002%	1.200%	1.020%	0.671%	0.656%	0.925%	0.910%	0.961%	2.200%	1.700%	0.391%	1.890%	1.030%	2.230%	1.080%	1.730%
Mn	mg/kg	1	1900	2260	2280	1950	2360	2110	1780	2330	1250	1500	1550	1520	1980	692	1090
Mo	mg/kg	0.1	<	<	<	<	<	4	<	<	<	2	<	<	2	<	<
Na	%	0.002%	0.123%	0.372%	0.135%	0.060%	0.307%	0.031%	0.042%	0.370%	0.120%	0.116%	0.623%	0.039%	0.261%	0.654%	0.096%
Ni	mg/kg	1	7	<	<	7	3	<	<	12	3	5	4	3	4	8	8
P	mg/kg	10	1020	960	610	1230	870	750	810	790	700	1550	690	660	1550	1120	1410
Pb	mg/kg	0.5	<	15	664	155	66	95	5	<	58	72	13	<	56	6	<
Sb	mg/kg	0.05	<	<	<	0.1	<	0.1	<	<	<	<	<	<	<	<	0.1
Se	mg/kg	0.01	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Si	%	0.1%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sn	mg/kg	0.1	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Th	mg/kg	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U	mg/kg	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V	mg/kg	1	60	25	15	43	20	12	14	179	70	73	113	41	117	132	117
Zn	mg/kg	1	118	130	1020	482	325	246	112	204	126	67	114	70	402	82	136

< element at or below analytical detection limit.

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Table D-7: Multi-element composition of all previous primary waste rock drill-hole samples, Cowal Gold Operations.

Element		Det. Limit	E42 Modification (2008) Geochemistry Assessment									Extension Modification (2013) Geochemistry Assessment					
			Diorite	Diorite	Diorite	Diorite	Diorite	Lava	Lava	Lava	Dyke	Diorite	Diorite	Diorite	Diorite	Diorite	Dyke	Fault/ Shear
			E42D1015 /1	E42D1017 /2	E42D1007 /3	E42D1067 /4	E42D1328 /5	E42D1136 /6	E42D1074 /7	E42D1027 /8	E42D1328 /22	E42D1632 /10	E42D1632 /14	E42D1632 /33	E42D1634 /25	E42D1634 /30	E42D1632 /11	E42D1634 /31
Ag	mg/kg	0.05	-	-	-	-	-	-	-	-	-	0.25	0.2	0.31	0.35	0.46	0.45	0.75
Al	%	0.005%	2.740%	3.180%	2.680%	1.610%	1.050%	0.439%	2.570%	2.330%	1.590%	8.575%	8.407%	9.435%	9.585%	9.246%	7.571%	9.132%
As	mg/kg	0.5	44	<	6	20	36	15	108	35	<	35.8	11.0	16.7	20.1	8.9	44.0	91.4
B	mg/kg	50	-	-	-	-	-	-	-	-	-	80	<	<	<	<	<	124
Ba	mg/kg	0.1	90	90	40	50	60	210	80	70	250	401.3	349.3	344.9	400.7	719.1	366.2	724.6
Be	mg/kg	0.05	<	<	<	<	<	<	<	<	<	0.84	0.91	0.81	0.81	0.75	0.94	1.29
Ca	%	0.005%	2.670%	2.650%	3.440%	4.950%	2.130%	2.330%	2.130%	2.360%	3.850%	4.195%	5.928%	4.593%	4.204%	3.938%	4.496%	4.759%
Cd	mg/kg	0.02	<	<	<	<	<	<	<	1	<	0.09	0.07	0.06	0.06	0.16	0.07	0.32
Co	mg/kg	0.1	17	20	21	33	12	8	13	13	12	25.0	22.5	22.1	16.7	14.7	21.5	13.6
Cr	mg/kg	2	5	21	10	7	<	13	<	15	6	31	25	<	9	<	12	7
Cu	mg/kg	1	227	163	356	92	32	120	139	160	40	152	92	209	114	151	296	166
Fe	%	0.01%	3.880%	5.070%	4.940%	6.090%	5.270%	4.450%	5.970%	5.180%	3.510%	7.71%	6.49%	6.80%	5.61%	5.28%	7.68%	4.46%
Hg	mg/kg	0.01	<	<	<	<	<	<	<	<	<	0.002	<	<	0.003	0.008	0.002	0.050
K	%	0.002%	0.446%	0.235%	0.288%	0.629%	0.401%	0.256%	0.423%	0.508%	0.230%	1.616%	2.424%	1.326%	2.147%	1.951%	1.877%	4.446%
Mg	%	0.002%	1.520%	2.330%	1.860%	2.050%	0.741%	0.442%	1.260%	1.020%	1.060%	2.489%	1.794%	1.842%	1.666%	1.425%	2.125%	1.377%
Mn	mg/kg	1	899	1390	1570	2120	1850	1540	2180	1980	1160	1322	1375	1330	1339	1249	1476	1387
Mo	mg/kg	0.1	<	<	<	<	<	<	<	<	<	1.0	0.7	0.7	0.6	0.3	0.8	2.9
Na	%	0.002%	0.476%	0.242%	0.208%	0.067%	0.127%	0.083%	0.216%	0.157%	0.110%	3.478%	1.838%	3.703%	3.583%	3.863%	1.994%	0.249%
Ni	mg/kg	1	7	14	10	12	2	<	<	<	3	21	17	8	8	6	11	8
P	mg/kg	10	970	1010	1050	820	1350	930	1440	1420	1120	1144	983	1760	1151	1191	1567	1297
Pb	mg/kg	0.5	<	<	<	6	14	<	26	14	5	8.1	6.0	4.6	5.5	4.6	7.7	14.2
Sb	mg/kg	0.05	0.3	<	<	<	<	<	<	<	<	1.66	1.93	1.48	2.68	2.41	2.63	11.08
Se	mg/kg	0.01	<	<	<	<	<	<	<	<	<	0.08	0.07	0.11	0.11	0.15	0.22	0.15
Si	%	0.1%	-	-	-	-	-	-	-	-	-	26.7%	22.3%	24.2%	23.5%	23.6%	25.8%	21.9%
Sn	mg/kg	0.1	<	<	<	<	<	<	<	<	<	0.6	0.5	0.7	0.6	0.7	1.0	0.8
Th	mg/kg	0.01	-	-	-	-	-	-	-	-	-	1.60	1.29	1.50	1.52	1.51	2.84	1.63
U	mg/kg	0.01	-	-	-	-	-	-	-	-	-	1.07	0.83	1.03	1.02	0.99	1.95	0.92
V	mg/kg	1	129	162	143	76	19	<	64	52	54	297	290	310	245	210	248	239
Zn	mg/kg	1	71	134	120	109	139	163	253	375	77	100	92	94	112	122	125	113

< element at or below analytical detection limit.

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Table D-8: Chemical composition of water extracts from all previous primary waste rock drill-hole samples, Cowal Gold Operations.

Parameter		Det. Limit	E42 Modification (2008) Geochemistry Assessment					Extension Modification (2013) Geochemistry Assessment						
			Volc/ clastic	Volc/ clastic	Diorite	Lava	Dyke	Diorite	Diorite	Diorite	Diorite	Diorite	Dyke	Fault/ Shear
			E42D1062 /10	E42D1074 /28	E42D1017 /2	E42D1074 /7	E42D1328 /22	E42D1632 /10	E42D1632 /14	E42D1632 /33	E42D1634 /25	E42D1634 /30	E42D1632 /11	E42D1634 /31
pH		0.1	8.7	9.0	9.3	8.9	9.3	8.5	8.6	8.4	8.4	8.4	8.2	8.4
EC	dS/m	0.001	0.485	0.274	0.337	0.320	0.307	0.307	0.298	0.349	0.399	0.488	0.394	0.508
Alkalinity	mg/L	0.5	186.0	19.4	75.5	86.0	30.7	na	na	na	na	na	na	na
Cl	mg/L	5	15	20	30	10	10	39	23	35	31	36	32	35
SO_4	mg/L	5	80	30	15	40	30	10.1	25.6	47.5	108.1	178.1	53.8	98.5
Major Constituents														
Al	mg/L	0.01	0.1	0.28	0.46	0.26	0.05	0.15	0.2	0.3	0.2	0.3	0.13	0.19
B	mg/L		na	na	na	na	na	0.04	0.03	0.04	0.06	0.04	0.02	0.04
Ca	mg/L	5	10	10	10	10	5	7.98	8.74	10.52	12.14	25.76	12.61	14.66
Cr	mg/L	0.001	<	<	0.001	0.001	<	<	<	<	<	<	<	<
Cu	mg/L	0.001	0.002	<	<	0.001	0.001	<	<	<	<	<	<	<
Fe	mg/L	0.5	<	<	<	<	<	<	0.06	<	0.03	0.27	<	0.02
K	mg/L	5	55	10	20	25	30	19.2	50.5	17.5	63.2	57	57	35.7
Mg	mg/L	5	<	<	<	<	<	3.54	1.77	5.42	3.4	9.77	3.47	7.02
Mn	mg/L	0.001	0.013	0.006	0.001	0.023	0.002	<	<	<	0.01	0.03	<	<
Na	mg/L	5	40	40	40	25	50	81.7	43.8	80.4	85.4	88	59.4	100.9
Ni	mg/L	0.001	<	<	<	<	<	<	<	<	<	<	<	<
P	mg/L	5	<	<	<	<	<	<	<	<	<	<	<	<
Si	mg/L		na	na	na	na	na	2.27	2.46	1.64	2.06	1.95	2.15	1.69
V	mg/L	0.01	<	<	0.02	<	0.02	<	0.01	<	<	<	<	<
Zn	mg/L	0.005	<	<	<	<	<	<	<	<	<	<	<	<
Minor Constituents														
Ag	µg/L	1	<	<	<	<	<	<	<	<	<	0.02	<	<
As	µg/L	1	10	3	6	2	7	5.9	2.9	0.9	2.4	0.9	5.3	0.9
Ba	µg/L	1	25	26	20	59	8	15.32	45.83	7.62	49.7	53.61	89.17	49.21
Be	µg/L	1	<	<	<	<	<	<	<	<	<	<	<	<
Cd	µg/L	0.1	<	<	<	0.4	<	0.06	0.06	0.03	0.04	0.06	0.02	0.05
Co	µg/L	1	<	<	<	<	<	<	<	<	<	0.8	<	<
Hg	µg/L	0.1	<	<	<	<	<	0.1	<	<	<	<	0.1	0.2
Mo	µg/L	1	288	34	3	25	5	4.73	3.49	3.8	12.83	8.73	47.25	10.9
Pb	µg/L	1	<	<	<	<	<	1.3	<	<	<	<	<	<
Sb	µg/L	1	8	2	4	1	2	1.48	2.69	0.93	4.11	1.68	2.25	1.45
Se	µg/L	10	<	<	<	<	<	<	<	0.5	0.9	1.1	1.2	0.9
Sn	µg/L	10	<	<	<	<	<	<	<	<	<	<	<	<
Th	µg/L		na	na	na	na	na	<	<	<	<	0.006	<	<
U	µg/L		na	na	na	na	na	0.038	0.062	0.03	0.18	0.12	0.14	0.057

< parameter at or below analytical detection limit.

Table D-9: Multi-element composition of the E42 H-Cutback primary waste rock drill-hole interval samples, Cowal Gold Operations.

Element		Det. Limit	E42 H-Cutback (PFS & 2013) Geochemistry Assessment										
			Volc/ clastic	Volc/ clastic	Volc/ clastic	Diorite	Diorite	Diorite	Diorite	Diorite	Dyke	Fault/ Shear	Fault/ Shear
			E41D3173 /12	E41D3173 /16	E41D3173 /20	E42D1632 /10	E42D1632 /14	E42D1632 /33	E42D1634 /25	E42D1634 /30	E42D1632 /11	E41D3173 /19	E42D1634 /31
Ag	mg/kg	0.01	1.46	0.45	0.44	0.25	0.2	0.31	0.35	0.46	0.45	1.31	0.75
Al	%	0.005%	6.877%	7.282%	7.351%	8.575%	8.407%	9.435%	9.585%	9.246%	7.571%	7.021%	9.132%
As	mg/kg	0.5	14.4	14.2	23.1	35.8	11.0	16.7	20.1	8.9	44.0	129.4	91.4
B	mg/kg	50	<	<	<	80	<	<	<	<	<	<	124
Ba	mg/kg	0.1	206.6	254.6	175.1	401.3	349.3	344.9	400.7	719.1	366.2	164.1	724.6
Be	mg/kg	0.05	0.83	0.81	0.65	0.84	0.91	0.81	0.81	0.75	0.94	0.81	1.29
Ca	%	0.005%	3.001%	4.121%	4.935%	4.195%	5.928%	4.593%	4.204%	3.938%	4.496%	4.540%	4.759%
Cd	mg/kg	0.02	2.2	0.72	0.58	0.09	0.07	0.06	0.06	0.16	0.07	0.35	0.32
Co	mg/kg	0.1	14.8	18.5	19.6	25.0	22.5	22.1	16.7	14.7	21.5	17.8	13.6
Cr	mg/kg	2	4	7	11	31	25	<	9	<	12	6	7
Cu	mg/kg	1	57	345	133	152	92	209	114	151	296	63	166
Fe	%	0.01%	5.62%	6.13%	6.40%	7.71%	6.49%	6.80%	5.61%	5.28%	7.68%	5.51%	4.46%
Hg	mg/kg	0.01	0.050	0.010	0.030	0.002	<	<	0.003	0.008	0.002	0.070	0.050
K	%	0.002%	2.809%	3.070%	2.478%	1.616%	2.424%	1.326%	2.147%	1.951%	1.877%	3.151%	4.446%
Mg	%	0.002%	1.300%	1.906%	2.562%	2.489%	1.794%	1.842%	1.666%	1.425%	2.125%	1.601%	1.377%
Mn	mg/kg	1	1865	2154	2587	1322	1375	1330	1339	1249	1476	2450	1387
Mo	mg/kg	0.1	0.4	0.5	0.3	1.0	0.7	0.7	0.6	0.3	0.8	2.0	2.9
Na	%	0.002%	0.100%	0.085%	0.243%	3.478%	1.838%	3.703%	3.583%	3.863%	1.994%	0.129%	0.249%
Ni	mg/kg	1	<	2	3	21	17	8	8	6	11	<	8
P	mg/kg	10	1634	1624	1141	1144	983	1760	1151	1191	1567	1103	1297
Pb	mg/kg	0.5	12.8	8.7	97.1	8.1	6.0	4.6	5.5	4.6	7.7	29.5	14.2
Sb	mg/kg	0.05	2.96	2.55	3.31	1.66	1.93	1.48	2.68	2.41	2.63	5.75	11.08
Se	mg/kg	0.01	0.69	0.12	0.19	0.08	0.07	0.11	0.11	0.15	0.22	0.17	0.15
Si	%	0.1%	28.8%	25.7%	23.6%	26.7%	22.3%	24.2%	23.5%	23.6%	25.8%	25.1%	21.9%
Sn	mg/kg	0.1	1.0	0.8	0.7	0.6	0.5	0.7	0.6	0.7	1.0	0.7	0.8
Th	mg/kg	0.01	2.53	1.82	1.44	1.60	1.29	1.50	1.52	1.51	2.84	1.46	1.63
U	mg/kg	0.01	1.55	1.41	1.11	1.07	0.83	1.03	1.02	0.99	1.95	1.19	0.92
V	mg/kg	1	129	209	262	297	290	310	245	210	248	221	239
Zn	mg/kg	1	189	242	228	100	92	94	112	122	125	129	113

< element at or below analytical detection limit.

Table D-10: Chemical composition of water extracts from the E42 H-Cutback primary waste rock drill-hole interval samples, Cowal Gold Operations.

Parameter		**Detection Limit**	E42 H-Cutback (PFS & 2013) Geochemistry Assessment										
			Volc/ clastic	Volc/ clastic	Volc/ clastic	Diorite	Diorite	Diorite	Diorite	Diorite	Dyke	Fault/ Shear	Fault/ Shear
			E41D3173 /12	E41D3173 /16	E41D3173 /20	E42D1632 /10	E42D1632 /14	E42D1632 /33	E42D1634 /25	E42D1634 /30	E42D1632 /11	E41D3173 /19	E42D1634 /31
pH		0.1	8.6	8.9	8.9	8.5	8.6	8.4	8.4	8.4	8.2	8.9	8.4
EC	dS/m	0.001	0.679	0.531	0.532	0.307	0.298	0.349	0.399	0.488	0.394	0.660	0.508
Cl	mg/L	10.0	82	16	34	39	23	35	31	36	32	34	35
SO_4	mg/L	0.3	77.6	68.6	64.3	10.1	25.6	47.5	108.1	178.1	53.8	157.5	98.5
Major Constituents													
Al	mg/L	0.01	0.35	0.66	0.27	0.15	0.2	0.3	0.2	0.3	0.13	0.18	0.19
B	mg/L	0.01	0.05	0.07	0.05	0.04	0.03	0.04	0.06	0.04	0.02	0.07	0.04
Ca	mg/L	0.01	8.72	6.72	7.97	7.98	8.74	10.52	12.14	25.76	12.61	12.57	14.66
Cr	mg/L	0.01	<	<	<	<	<	<	<	<	<	<	<
Cu	mg/L	0.010	<	<	<	<	<	<	<	<	<	<	<
Fe	mg/L	0.01	0.12	0.15	0.0	<	0.06	<	0.03	0.27	<	0.02	0.02
K	mg/L	0.1	66.4	99.3	65.8	19.2	50.5	17.5	63.2	57	57	96.7	35.7
Mg	mg/L	0.01	6.30	5.44	6.13	3.54	1.77	5.42	3.4	9.77	3.47	7.25	7.02
Mn	mg/L	0.010	0.02	0.01	<	<	<	<	0.01	0.03	<	0.02	<
Na	mg/L	0.1	109.6	62.2	97.5	81.7	43.8	80.4	85.4	88	59.4	101.2	100.9
Ni	mg/L	0.010	<	<	<	<	<	<	<	<	<	<	<
P	mg/L	0.10	<	<	<	<	<	<	<	<	<	<	<
Si	mg/L	0.05	2.3	2.21	1.76	2.27	2.46	1.64	2.06	1.95	2.15	1.85	1.69
V	mg/L	0.01	<	<	<	<	0.01	<	<	<	<	<	<
Zn	mg/L	0.01	<	<	<	<	<	<	<	<	<	<	<
Minor Constituents													
Ag	µg/L	0.01	<	<	<	<	<	<	<	0.02	<	<	<
As	µg/L	0.1	1.6	1.7	1.4	5.9	2.9	0.9	2.4	0.9	5.3	5.7	0.9
Ba	µg/L	0.05	5.16	31.67	45.18	15.32	45.83	7.62	49.7	53.61	89.17	8.43	49.21
Be	µg/L	0.1	<	<	<	<	<	<	<	<	<	<	<
Cd	µg/L	0.02	0.07	0.04	0.03	0.06	0.06	0.03	0.04	0.06	0.02	0.06	0.05
Co	µg/L	0.1	<	<	<	<	<	<	<	0.8	<	0.1	<
Hg	µg/L	0.1	<	<	<	0.1	<	<	<	<	0.1	<	0.2
Mo	µg/L	0.05	7.34	17.73	12.07	4.73	3.49	3.8	12.83	8.73	47.25	53.82	10.9
Pb	µg/L	0.5	1.1	0.8	1	1.3	<	<	<	<	<	0.8	<
Sb	µg/L	0.01	0.74	5.61	4.58	1.48	2.69	0.93	4.11	1.68	2.25	8.44	1.45
Se	µg/L	0.5	31.4	1.2	2.3	<	<	0.5	0.9	1.1	1.2	0.9	0.9
Sn	µg/L	0.1	<	0.2	<	<	<	<	<	<	<	0.1	<
Th	µg/L	0.005	0.018	0.017	<	<	<	<	<	0.006	<	0.009	<
U	µg/L	0.005	0.028	0.306	0.114	0.038	0.062	0.03	0.18	0.12	0.14	0.307	0.057

< parameter at or below analytical detection limit.

Table D-11: Multi-element composition of underground development waste rock drill-hole interval samples, Cowal Gold Operations.

Element		Det. Limit	Underground Development (2020) Geochemistry Assessment										
			Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Diorite	Extrusive	Dyke	Fault/ Shear	Diorite	Lava	Dyke
			1535D353 /10	1535D353 /13	1535D353 /16	1535D353 /6	1535D353 /17	1535D353 /14	1535D353 /2	1535D353 /11	1535D354 /6	1535D331 /13	1535D331 /9
Ag	mg/kg	0.05	0.05	0.54	0.28	0.25	0.19	0.23	0.17	0.22	0.25	0.58	0.24
Al	%	0.005%	8.07%	8.49%	8.16%	7.65%	8.66%	8.21%	7.64%	8.88%	8.37%	7.11%	10.42%
As	mg/kg	0.5	11.1	22.0	10.1	15.2	69.3	18.5	17.3	89.8	5.7	16.8	24.7
B	mg/kg	50	<	<	<	<	<	<	<	<	<	<	<
Ba	mg/kg	0.1	175.7	304.3	537.7	584.5	281.9	345.0	685.8	219.4	385.1	791.3	216.9
Be	mg/kg	0.05	1.15	1.00	1.05	1.07	0.84	0.82	1.13	0.56	0.73	1.14	1.10
Ca	%	0.005%	3.43%	2.55%	2.72%	3.17%	5.65%	3.04%	5.35%	6.81%	4.59%	1.76%	2.92%
Cd	mg/kg	0.02	0.20	0.12	0.04	0.04	0.12	0.07	0.07	0.17	0.12	0.06	0.21
Co	mg/kg	0.1	9.6	23.1	14.6	23.0	31.6	20.4	26.2	36.1	29.2	10.2	32.6
Cr	mg/kg	5	35	23	39	163	36	26	170	58	109	61	21
Cu	mg/kg	1	31	106	63	66	254	101	154	158	150	28	174
Fe	%	0.01%	3.88%	5.98%	5.28%	5.49%	7.19%	6.13%	5.23%	6.99%	6.35%	4.39%	7.64%
Hg	mg/kg	0.001	0.011	0.012	0.026	0.017	0.011	0.011	0.013	0.018	0.005	0.002	0.009
K	%	0.002%	3.93%	0.87%	2.12%	1.59%	1.02%	1.38%	1.05%	1.14%	0.89%	3.83%	3.77%
Mg	%	0.002%	1.50%	2.74%	1.78%	3.52%	2.48%	1.75%	2.79%	3.01%	3.29%	1.35%	2.21%
Mn	mg/kg	1	1019	1667	1223	1281	1458	1679	1530	1481	1594	1272	1837
Mo	mg/kg	0.1	0.2	0.6	1.1	0.6	1.0	1.4	1.3	0.6	0.5	1.0	0.8
Na	%	0.002%	0.12%	3.67%	1.95%	1.92%	2.29%	3.39%	2.46%	2.02%	2.91%	0.46%	0.67%
Ni	mg/kg	1	5	6	7	45	15	5	46	19	32	2	12
P	mg/kg	50	1192	1526	1415	1404	1132	1602	1451	798	1016	1550	869
Pb	mg/kg	0.5	3.5	5.8	3.8	6.3	5.6	5.1	5.5	3.9	4.1	4.6	5.9
Sb	mg/kg	0.05	3.20	2.99	2.34	2.01	2.70	1.98	2.06	1.83	1.43	2.70	4.31
Se	mg/kg	0.01	0.05	0.16	0.11	0.06	0.07	0.11	0.07	0.11	0.08	0.20	0.16
Si	%	0.001	0.28	0.25	0.28	0.27	0.23	0.27	0.24	0.21	0.23	0.29	0.21
Sn	mg/kg	0.1	1.1	0.9	1.0	1.2	1.0	0.8	1.0	0.6	0.7	1.3	0.6
Th	mg/kg	0.01	2.91	2.42	2.68	5.41	2.21	2.02	4.42	1.01	1.52	3.60	0.98
U	mg/kg	0.01	1.82	1.59	1.84	4.45	1.45	1.38	3.34	0.65	0.84	2.57	0.65
V	mg/kg	1	99	207	146	210	265	199	204	272	259	82	205
Zn	mg/kg	1	69	154	79	119	98	93	88	92	132	65	118

< element at or below analytical detection limit.

Table D-12: Chemical composition of water extracts from underground development waste rock drill-hole interval samples, Cowal Gold Operations.

Parameter		Det. Limit	Underground Development (2020) Geochemistry Assessment										
			Volc/ clastic	Volc/ clastic	Volc/ clastic	Volc/ clastic	Diorite	Extrusive	Dyke	Fault/ Shear	Diorite	Lava	Dyke
			1535D353 /10	1535D353 /13	1535D353 /16	1535D353 /6	1535D353 /17	1535D353 /14	1535D353 /2	1535D353 /11	1535D354 /6	1535D331 /13	1535D331 /9
pH		0.1	8.0	7.7	7.7	7.6	7.8	7.6	7.8	7.8	8.1	8.2	8.6
EC	dS/m	0.001	0.169	0.167	0.125	0.136	0.163	0.166	0.142	0.172	0.155	0.158	0.272
Cl	mg/l	2.0	5	16	9	8	29	10	9	23	18	6	9
SO_4	mg/l	0.3	21.2	26.6	12.5	7.4	11.3	35	17.3	14.2	10.8	21.2	41.3
Major Constituents													
Al	mg/l	0.01	0.14	0.18	0.17	0.16	0.17	0.17	0.22	0.21	0.17	0.12	0.27
B	mg/l	0.01	0.03	0.01	<	0.02	0.02	0.02	0.02	0.02	<	0.03	0.07
Ca	mg/l	0.01	9.86	14.26	10.96	9.89	11.96	14.58	8.98	10.52	12.53	5.48	2.91
Cr	mg/l	0.01	<	<	<	<	<	<	<	<	<	<	<
Cu	mg/l	0.01	<	<	<	<	<	<	<	<	<	<	<
Fe	mg/l	0.01	<	<	0.01	0.01	0.02	<	<	0.02	<	0.01	0.02
K	mg/l	0.1	4.7	1.6	2.4	1.5	0.8	4.9	1.8	1.2	1.9	5.3	3.9
Mg	mg/l	0.01	1.74	1.32	1.25	1.31	0.57	1.4	1.02	1.06	1.5	1.41	0.56
Mn	mg/l	0.01	0.02	0.02	0.02	<	<	0.03	<	<	0.01	0.03	<
Na	mg/l	0.1	47.5	41.2	34.6	39.5	43.4	37	39.5	44.4	33.4	41.2	86.2
Ni	mg/l	0.01	<	<	<	<	<	<	<	<	<	<	<
P	mg/l	0.1	<	<	<	<	<	<	<	<	<	<	<
Si	mg/l	0.05	1.91	2.36	1.57	2.26	2.79	2.55	2.02	2.82	1.76	1.42	1.81
V	mg/l	0.01	<	<	<	<	<	<	<	<	<	<	0.02
Zn	mg/l	0.01	<	0.01	<	<	<	<	<	<	0.01	<	<
Minor Constituents													
Ag	ug/l	0.01	<	<	<	<	<	<	<	<	<	<	<
As	ug/l	0.1	2.1	4.8	5.4	25	37.2	4.3	31.8	70.8	2.6	3.6	4.4
Ba	ug/l	0.05	29.29	42.66	107.62	42.17	3.26	105.28	98.9	3.42	63.32	47.2	8.86
Be	ug/l	0.1	<	<	<	<	<	<	<	<	<	<	<
Cd	ug/l	0.50	<	<	<	<	<	<	<	<	<	<	<
Co	ug/l	0.1	<	<	<	<	<	<	<	<	<	0.2	<
Hg	ug/l	0.1	<	<	<	<	<	<	<	<	<	<	<
Mo	ug/l	0.05	3.35	2.95	6.24	19.63	3.23	12.48	18.12	2.02	1.6	11.88	10.51
Pb	ug/l	2.0	<	<	<	<	<	<	<	<	<	<	<
Sb	ug/l	0.01	3.06	1.79	3.04	1.63	0.51	2.25	1.61	0.66	0.88	2.16	2.91
Se	ug/l	0.5	<	<	<	<	0.6	<	<	<	<	<	<
Sn	ug/l	0.1	<	<	<	<	<	<	<	<	<	<	<
Th	ug/l	0.005	<	<	<	<	<	<	<	<	<	<	<
U	ug/l	0.005	0.237	0.108	0.078	0.064	0.167	0.16	0.051	0.146	0.02	0.274	0.169

< parameter at or below analytical detection limit.

Table D-13: Multi-element composition of daily composite Scats samples, Cowal Gold Operations.

Element		Detect. Limit	Scats (2019) Geochemistry Assessment		
			18-May-23	06-Jun-23	11-Jun-23
			COWP/1	COWP/10	COWP/15
Ag	mg/kg	0.05	5.7	0.7	1.2
Al	%	0.005%	9.100%	8.456%	8.58%
As	mg/kg	0.5	23.0	24.7	32.7
B	mg/kg	50	<	<	<
Ba	mg/kg	0.1	382.1	369.4	357.7
Be	mg/kg	0.05	0.90	0.87	0.87
Ca	%	0.005%	3.824%	3.463%	3.532%
Cd	mg/kg	0.02	2.97	0.81	1.09
Co	mg/kg	0.1	16.7	16.1	16.5
Cr	mg/kg	5	8	10	17
Cu	mg/kg	1	218	171	179
Fe	%	0.01%	5.48%	5.42%	5.66%
Hg	mg/kg	0.01	0.220	0.020	0.040
K	%	0.002%	2.218%	2.093%	2.165%
Mg	%	0.002%	1.550%	1.580%	1.651%
Mn	mg/kg	1	1244	1284	1330
Mo	mg/kg	0.1	0.7	0.7	0.9
Na	%	0.002%	3.374%	3.269%	3.067%
Ni	mg/kg	1	9	9	8
P	mg/kg	50	1371	1342	1316
Pb	mg/kg	0.5	16.3	10.7	13.0
Sb	mg/kg	0.05	2.38	2.08	2.28
Se	mg/kg	0.01	0.16	0.15	0.16
Si	%	0.1%	0.25	0.25	0.26
Sn	mg/kg	0.1	0.7	0.9	1.2
Th	mg/kg	0.01	1.83	1.84	2.05
U	mg/kg	0.01	1.13	1.19	1.33
V	mg/kg	1	212	190	194
Zn	mg/kg	1	440	209	259

< element at or below analytical detection limit.

Table D-14: Chemical composition of water extracts from daily composite Scats samples, Cowal Gold Operations.

Parameter		Detect. Limit	Scats (2019) Geochemistry Assessment		
			18-May-23	06-Jun-23	11-Jun-23
			COWP/1	COWP/10	COWP/15
pH		0.1	8.5	8.7	8.7
EC	dS/m	0.001	0.183	0.186	0.151
Cl	mg/l	2.0	22	20	14
SO_4	mg/l	0.3	20.4	30.6	19.4
Major Constituents					
Al	mg/l	0.01	0.40	0.31	0.44
B	mg/l	0.01	0.03	0.03	0.02
Ca	mg/l	0.01	6.13	6.14	5.74
Cr	mg/l	0.01	<	<	<
Cu	mg/l	0.01	<	<	<
Fe	mg/l	0.01	0.03	<	0.01
K	mg/l	0.1	7.6	9.8	9.6
Mg	mg/l	0.01	0.68	0.72	0.79
Mn	mg/l	0.01	<	<	<
Na	mg/l	0.1	32.3	33.8	24.1
Ni	mg/l	0.01	<	0.01	<
P	mg/l	0.1	<	<	<
Si	mg/l	0.05	1.41	1.41	1.27
V	mg/l	0.01	<	<	<
Zn	mg/l	0.01	0.01	<	0.01
Minor Constituents					
Ag	ug/l	0.01	0.16	0.18	0.17
As	ug/l	0.1	5.8	7.3	7.5
Ba	ug/l	0.05	41.97	38.00	31.34
Be	ug/l	0.1	<	<	<
Cd	ug/l	0.50	<	<	<
Co	ug/l	0.1	0.3	0.2	<
Hg	ug/l	0.1	<	<	<
Mo	ug/l	0.05	3.43	4.20	4.80
Pb	ug/l	2.0	<	<	<
Sb	ug/l	0.01	1.41	1.49	1.60
Se	ug/l	0.5	<	<	<
Sn	ug/l	0.1	<	0.1	<
Th	ug/l	0.005	<	<	<
U	ug/l	0.005	0.018	0.013	0.017

< parameter at or below analytical detection limit.

Appendix E.2

LPB Construction Rock Management Strategy

EMM
creating opportunities

Cowal Gold Operations Open Pit Continuation Project

Lake Protection Bund Construction Rock Management Strategy

Prepared for Evolution Mining (Cowal Operations)

May 2023

Cowal Gold Operations Open Pit Continuation Project

Lake Protection Bund Construction Rock Management Strategy

Evolution Mining (Cowal) Pty Limited

May 2023

Version	Date	Prepared by	Approved by	Comments
1	23/05/2023	James Tuff	Rob Morris	1st draft
2	26/05/2023	James Tuff	Rob Morris	Final

Approved by

Rob Morris
Associate Director
26/05/2023

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1 Introduction

1.1 Overview

Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of Cowal Gold Operations (CGO), an existing open pit and underground gold mine approximately 38 kilometres (km) north-east of West Wyalong, in the central west region of New South Wales (NSW).

CGO is located on the traditional lands of the Wiradjuri People and is immediately adjacent to the western foreshore of Lake Cowal, which is an ephemeral waterbody.

CGO was first approved in 1999, and open pit mining operations commenced in 2005. Underground mining operations were approved in 2021 and development works to enable underground mining are underway. Evolution is now seeking approval for further open pit mining operations at CGO through the Open Pit Continuation Project (hereafter the Project).

The Project primarily seeks to continue the open pit operations by approximately 10 years to 2036 and extend the total mine life by approximately two years to 2042.

1.2 Lake Protection Bund expansion

The Project will include an extension of open pit mining into Lake Cowal north and south of the existing pit. The Project therefore includes an expansion of the existing lake isolation system to provide continued separation between Lake Cowal and CGO. This will involve the construction of an expanded LPB.

The extended LPB will be approximately 6.3 km long. The proposed LPB comprises two components that form an arc around the expanded Project area, abutting the western lake shoreline. The components consist of an initially constructed Temporary Isolation Bund and ultimately the LPB itself. The concept is similar to the approved lake isolation system but is more extensive.

The existing lake isolation system was constructed without any adverse impacts on Lake Cowal (refer Section 7.2 and the Surface Water Assessment contained in Appendix G of the EIS) and has been effective for approximately 19 years which includes periods when the lake level has been elevated.

Evolution's preference is to construct the extended LPB in a dry environment. However due to ongoing climate uncertainty and its effect on the schedule for the Project, it is possible that Lake Cowal may still be inundated at the time of construction of the LPB. The Project schedule centres on the need to have the extended LPB in place prior to the completion of currently approved open pit mining operations in E42 (expected in 2026) to allow open pit mining to continue and thereby retain the existing open pit workforce.

To mitigate the potential impact on the existing operational open pit workforce from a delayed LPB construction, Evolution has developed LPB construction strategy which will enable the LPB to be constructed in wet, partially inundated or dry conditions.

The proposed construction methodology will vary depending on whether the LPB is constructed in saturated or dry conditions. Construction material used to construct the initial Temporary Isolation Bund will also differ depending on the construction conditions. The choice of construction material will depend on the construction type (wet or dry), the height of the bund, and the required stability and permeability of the bund. The Temporary isolation bund in a wet construction will be a rock bund. In the case of a dry construction the Temporary isolation bund will be constructed with clay.

1.3 Purpose of this strategy

This rock management strategy addresses the scenario of construction while Lake Cowal is inundated (i.e a “wet construction” scenario).

Primary waste rock, which consists of unweathered, mined volcanic waste rock from the open pit, is proposed for use in construction of the LPB extension. The geochemical characterisation studies undertaken since the CGO first began operating, report that this primary waste rock is predominately non-acid forming (NAF), slightly alkaline, non-saline and non-sodic (Evolution Mining, 2022).

Recent geochemical investigations, have revealed the limited presence (i.e. < 5%) of potentially acid forming (PAF) primary waste rock (GEM, Cowal Gold Operations Open Cut Expansion Project Environmental Geochemistry Assessment, 2023). These investigations also indicate that a limited number of primary waste rock samples may have the potential to leach metals/metalloids, in particular arsenic (As), molybdenum (Mo) and selenium (Se), and may impact Lake Cowal’s environmental values.

The purpose of this strategy was to investigate the potential for primary rock leaching of metals/metalloids to impact the receiving environment during construction of the LPB, by undertaking an assessment of the rock leaching characteristics, and to develop an initial method to manage potential impacts. This report summarises the primary rock acid-base and leaching geochemistry in the context of the wider Lake Cowal water environment (Section 3), and provides a proposed outline of rock management during the construction of the LPB. The recommendations of this strategy will inform the Construction Environmental Management Plan which will be prepared for the construction phase of the Project (Section 4).

2 LPB Construction Methodology

The proposed construction methodology will vary depending on whether the LPB is constructed in saturated or dry conditions. Construction material used to construct the initial Temporary Isolation Bund will also differ depending on the construction conditions as outlined in Table 2.1.

The materials used for bund construction will include soil, rock, and clay. The choice of material depends on the construction type (wet or dry), the height of the bund, and the required stability and permeability of the bund. The Temporary isolation bund in a wet construction will be a rock bund, where A1 will use larger rock of a maximum size of 1 m and A2 will use finer rock of a maximum size of 50 mm (refer Figure 2.1). In the case of a dry construction the Temporary isolation bund will be constructed with clay.

Table 2.1 Temporary Isolation Bund construction material

Construction condition	Key	Description	Material
Dry construction	A1	Temporary Isolation Bund	Clay material used for entire Temporary Isolation Bund
	A2	Temporary Isolation Bund	Clay material used for entire Temporary Isolation Bund
Semi-dry construction	A1	Rock temporary Isolation Bund – coarse material <1000mmm	Well graded hard rock, low voids, low fines content. Non-PAF (potentially acid forming) material.
	A2	Clay temporary Isolation Bund	Clay material to be placed in central zone of Temporary Isolation Bund embankment.
Wet construction	A1	Rock groyne – coarse material <1000mmm	Well graded hard rock, low voids, low fines content. Non-PAF (potentially acid forming) material.
	A2	Rock groyne – fine material <100mmm	50mm minus crushed stone or similar, placed into central zone of Temporary Isolation Bund embankment.

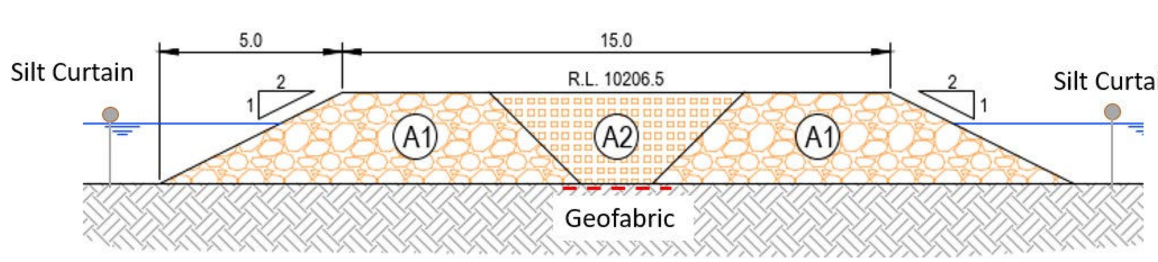
The Temporary Isolation Bund will be constructed initially to restrict, to a practical minimum, inflow from the lake to the LPB construction area. The Temporary Isolation Bund will be constructed using inert waste rock material end placed in Lake Cowal to form a bund with a maximum crest level of 206.5 m AHD, with batter slopes not exceeding 1(vertical [V]): 2(horizontal [H]).

Smaller diameter material will be selectively placed within the central portion of the bund and sheet piling used to limit seepage through the bund and foundation. Sheet piles will be recovered progressively as the main LPB is constructed integrating with the temporary isolation bund.

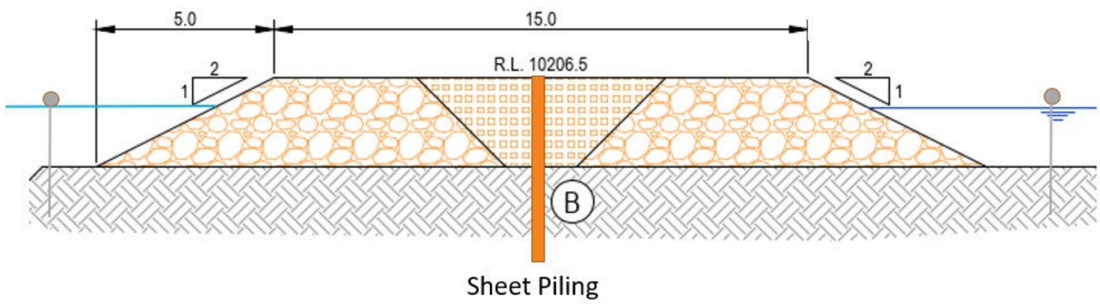
Construction of the Temporary Isolation Bund will continue progressively in 100-200 m lengths until the full length of the initial bund is completed.

Prior to construction, a continuous silt curtain will be erected around the outer and inner perimeters of the Temporary Isolation Bund, in order to trap fine sediment and control the migration of suspended material into the lake from construction activities. Any water captured behind the Temporary Isolation Bund (i.e. on the open pit side) will undergo water quality testing, to confirm suitability for release or treatment (if required), prior to pumped release back into Lake Cowal.

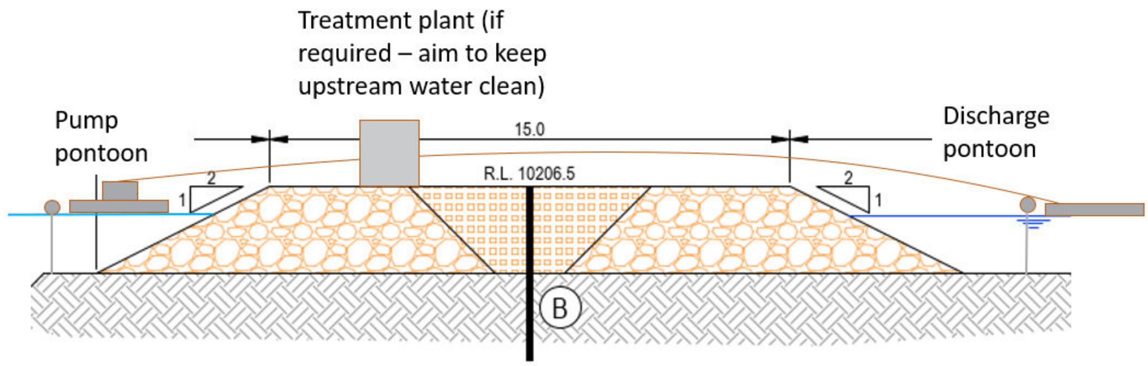
The conceptual temporary isolation bund construction methodology is depicted in Figure 2.1.



1) Groyne construction: sub-groyne (A1) and middle groyne (A2)



2) Sheet pile installation (B)



3) Dewatering

Figure 2.1 Conceptual temporary isolation bund construction cross section

i LPB construction

The LPB would comprise a main low permeability embankment constructed on the mine side of the temporary isolation bund as well as an additional bund over the temporary isolation bund integrating the two bunds to a total design height of 209.64 m and designed to withstand an 1% AEP flood event in Lake Cowal. The final LPB will be constructed using a combination of inert waste rock material and/or engineered fill material obtained from borrow areas (including the contained water storages) within the Project disturbance area. A conceptual cross-section of the final LPB is shown in Figure 2.2.

The permanent LPB embankment will be constructed by end tipping waste rock won from the mine site. Once this wall is level with the sheet piles, they will be progressively recovered to allow reuse in the southern stage of the Temporary isolation bund.

Clay protection with road base/waste rock will be placed on top of the LPB permanent wall to a depth of 600 mm to enable construction of a haul road. Rip rap won from site or imported will be placed on the lake side of the LPB with a slope of 2H:1V. The overall width required for the permanent LPB and haul road is 71 m.

A 24 m wide haul road will be constructed on the LPB. The haul road is not required for the functionality of the LPB and may be constructed any time after the construction of the permanent wall. A cross fall will direct drainage from the road to the mine side of the LPB.

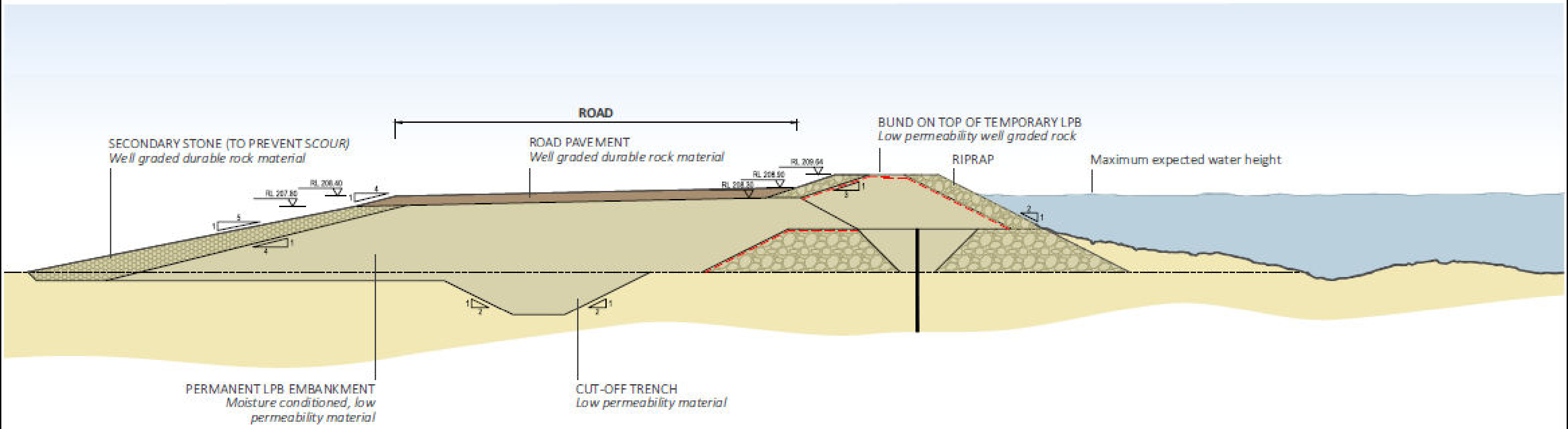


Figure 2.2 Final LPB design cross section integrating temporary isolation bund and final LPB

3 Summary of primary waste rock geochemistry

The geochemical characteristics of the primary waste rock at CGO have been detailed in a number of previous studies (e.g., (EGi, Cowal Gold Project Environmental Geochemical Assessment of Process Tailings, Mine Rock and Surface Zone Materials, 1995); (EGi, Cowal Gold Project Environmental Assessment of Simulated Tailings, 1996); (EGi, Cowal Gold Project Environmental Geochemistry Assessment of Proposed Mining Activities for Cowal Gold Project, 1997); (EGi, Cowal Gold Project Final Void Water Chemistry, 1998); (GEM, Cowal Gold Mine E42 Modification, Tailings and Waste Rock Geochemical Assessment, 2008); (GEM, Cowal Gold Mine Auhmentation Project, Environmental Geochemistry Assessment of Waste Rock and Tailings, 2011); (GEM, Cowal Gold Mine Extension Project Pre-Feasibility, Environmental Geochemistry Assessment of Waste Rock, Low Grade Ore and Tailings, 2011); (GEM, Cowal Gold Mine Extension Modification, Environmental Geochemistry Assessment of Waste Rock and Tailings, 2013); (GEM, Cowal Gold Operations Mine Life Modification, Environmental Geochemistry Assessment of Waste Rock and Tailings, 2016); (GEM, Cowal Gold Operations Underground Development, Environmental Geochemistry Assessment, 2020); (Evolution Mining, 2022); (GEM, Cowal Gold Operations Open Cut Expansion Project Environmental Geochemistry Assessment, 2023)). The following sections summarise the primary waste rock geochemistry and leachate behaviour.

3.1 Acid base accounting

Figure 3.1 shows a standard geochemical acid-base classification plot (following (GEM, Cowal Gold Operations Open Cut Expansion Project Environmental Geochemistry Assessment, 2023)) of the primary waste rock samples (105 samples from the 2023 report), with samples from previous geochemical investigations, low grade ore (LGO), and ore samples (151 samples where data were available) shown for comparison. As noted in previous studies, the majority of the primary waste rock is NAF, with negative net acid production potential (NAPP) and alkaline net acid generation (NAG) pH values.

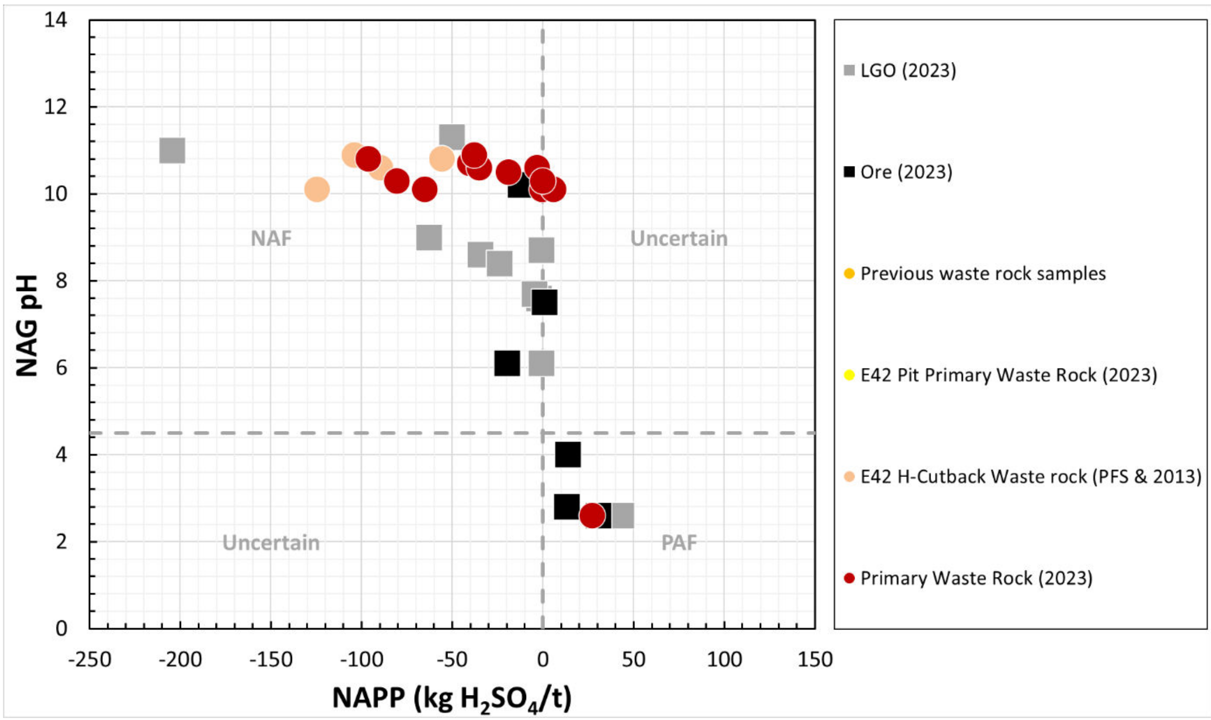


Figure 3.1 NAPP versus NAG pH for primary waste rock and other selected samples

Notes for Figure 3.1: NAPP values are calculated as the difference between the maximum potential acidity (MPA) of a sample (based on its sulfur concentration) and its intrinsic acid neutralising capacity (ANC). Positive NAPP values indicate the potential for a sample to generate net acidity. NAG testing involves oxidising a sample with hydrogen peroxide and observing the result of any acid generating or acid buffering reactions that may occur. The NAG pH is measured at the end of the test: values above a pH of 4.5 indicate that the any acidity generated has been buffered by the intrinsic ANC of the sample.

3.2 Leachate chemistry

The previous geochemical studies indicate that, although the majority of the primary waste rock is expected to be NAF, there exists the potential to leach certain metals/metalloids following exposure of the waste rock to ambient conditions. Leachate testing with deionised water (at a 1:2 solid:water ratio) showed that arsenic, molybdenum and selenium had the potential to be mobilised.

The following figures examine the leaching behaviour of the primary waste rock samples in greater detail. In each figure, primary waste rock leachate concentrations are compared to the wider range of material on site (e.g., LGO, ore, scats etc). Also shown in each figure is the range in water quality observed for each parameter in Lake Cowal from over ~ 20 years of monitoring. Lake Cowal data are shown in the ranges outlined in the surface water Environmental Impact Statement (ATC Williams, 2023), with the locus of each of these ranges bounded in a blue box. Water quality objectives, included in the ATC Williams study, are also shown as loci; values for ANZECC freshwater species 95% and 80% protection and stock water protection are shown where data are available. The figures show which leachate compositions lie inside and outside of the natural and guideline ranges. Water quality parameters are shown against pH due to the often-good correlation between pH values and metal/metalloid solubility.

Care should be taken when comparing laboratory-derived leachate data with field-observed data; however, the leachate results show the potential mobilisation of readily soluble metals and metalloids and may be considered to represent a ‘worst case’ or first flush of material as the waste rock is placed and exposed to natural environmental conditions.

Figure 3.2 shows the readily leachable salinity, represented by electrical conductivity (EC), of the primary waste rock and other material on site. Aside from one LGO sample, all leachate salinities are within the range observed in Lake Cowal, which itself exceeds the ANZECC guideline value. Although varying salinity in the lake is likely to be seasonal or climate-driven, all waste rock leachate samples shown in Figure 3.2 plot close to the average composition expected, which indicates that placement of the primary waste rock in the LPB is unlikely to adversely impact the salinity of Lake Cowal water quality in the long-term.

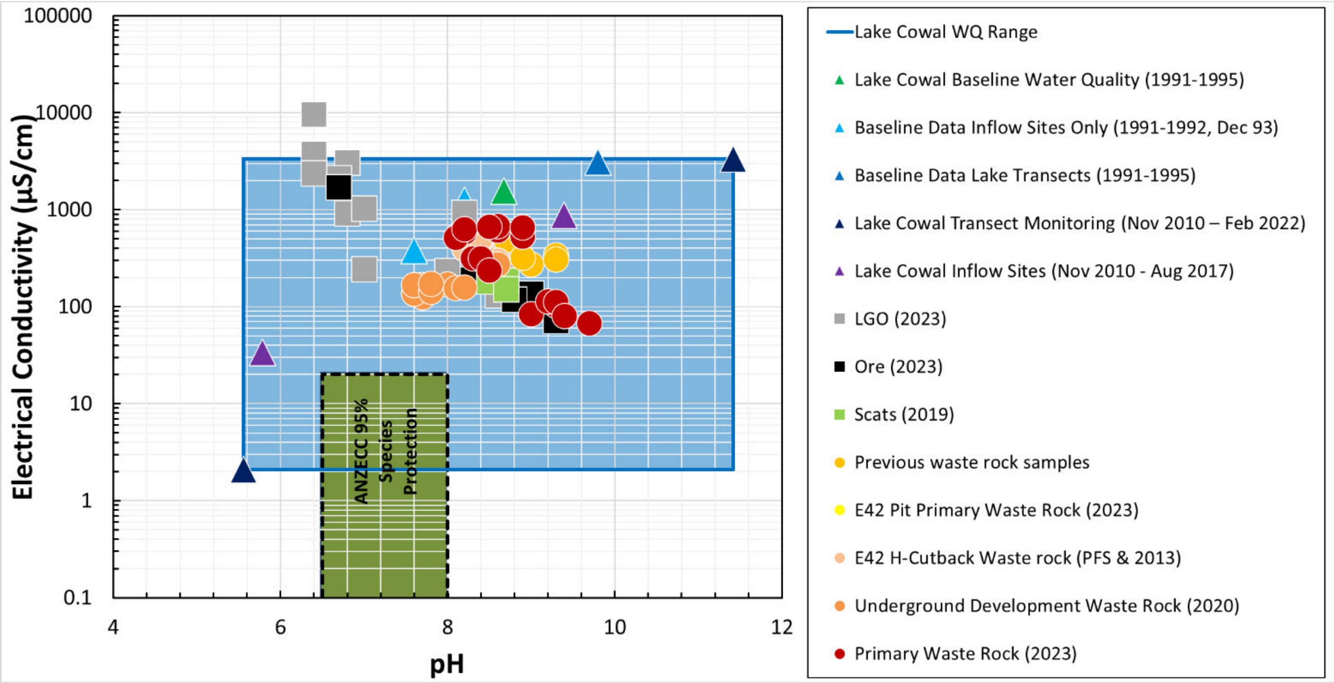


Figure 3.2 Values of pH and EC in primary waste rock leachate compared to the range in Lake Cowal water quality and water quality objectives

These diagrams (Figure 3.2 and subsequent figures) show the values of electrical conductivity, arsenic, molybdenum and selenium against the pH of leachates collected via laboratory leach testing of the different rock and ore samples (shown as circle and square symbols), from the various geochemical investigations related to the Project. These compositions are compared to the range of reported water quality values for electrical conductivity, arsenic, molybdenum and selenium (plotted against pH) collected from Lake Cowal during the monitoring campaigns outlined by ATC Williams (ATC Williams 2023) and represented by the triangle symbols, with a blue box drawn to show the expected range in Lake water quality based on these monitoring data. For each diagram, where the rock and ore leachate compositions plot within the blue box, this indicates that the leachate water quality is expected to be similar to Lake Cowal water quality and leaching from these samples is anticipated to cause limited to no impact on the lake water quality. Also shown as boxes are guideline values (these are shown against the ANZECC pH guideline values of 6.5 to 8), which have been included to indicate how both the lake compositions and the rock and ore leachate compositions compare to default guideline values: in most cases the rock and ore leachate compositions plot outside the guideline pH values but remain within guideline values for arsenic, molybdenum and selenium. Rock and ore leachate electrical conductivities generally exceed the guideline value but remain with the range observed in Lake Cowal.

Figure 3.3, Figure 3.4 and Figure 3.5 show that some arsenic, molybdenum and selenium leachate concentrations lie outside of the Lake Cowal water quality range for a number of site materials, including those from the primary waste rock samples.

Arsenic leachate concentrations correlate reasonably well with pH and increase as the water quality becomes more alkaline (Figure 3.3). Most primary waste rock leachate arsenic concentrations remain within the Lake Cowal water quality range and are below ANZECC 80% species protection and stock water protection concentrations (albeit outside the ANZECC guidelines for pH), with two samples outside of the natural range.

In contrast, most primary waste rock molybdenum concentrations lie outside both the upper and lower ranges of Lake Cowal quality (Figure 3.4); however, all samples are within the stock protection water quality objective (albeit again at higher pH values).

Almost all primary waste rock selenium leachate concentrations fall within the range of Lake Cowal water quality and are below the ANZECC 95% species protection objective (Figure 3.5), with only one primary waste leachate sample exceeding both. Most selenium concentrations are reported at or below limits of reporting (LORs).

A similar comparison exercise was undertaken for primary waste rock leachate concentrations of cadmium, copper, iron, lead, manganese, mercury, zinc and nickel; however, all leachate concentrations were found to lie within the Lake Cowal water quality range and water quality objectives for each parameter, with many leachate parameter concentrations reported at or below LORs (refer to the Geochemistry assessment, Appendix E.1 of the EIS).

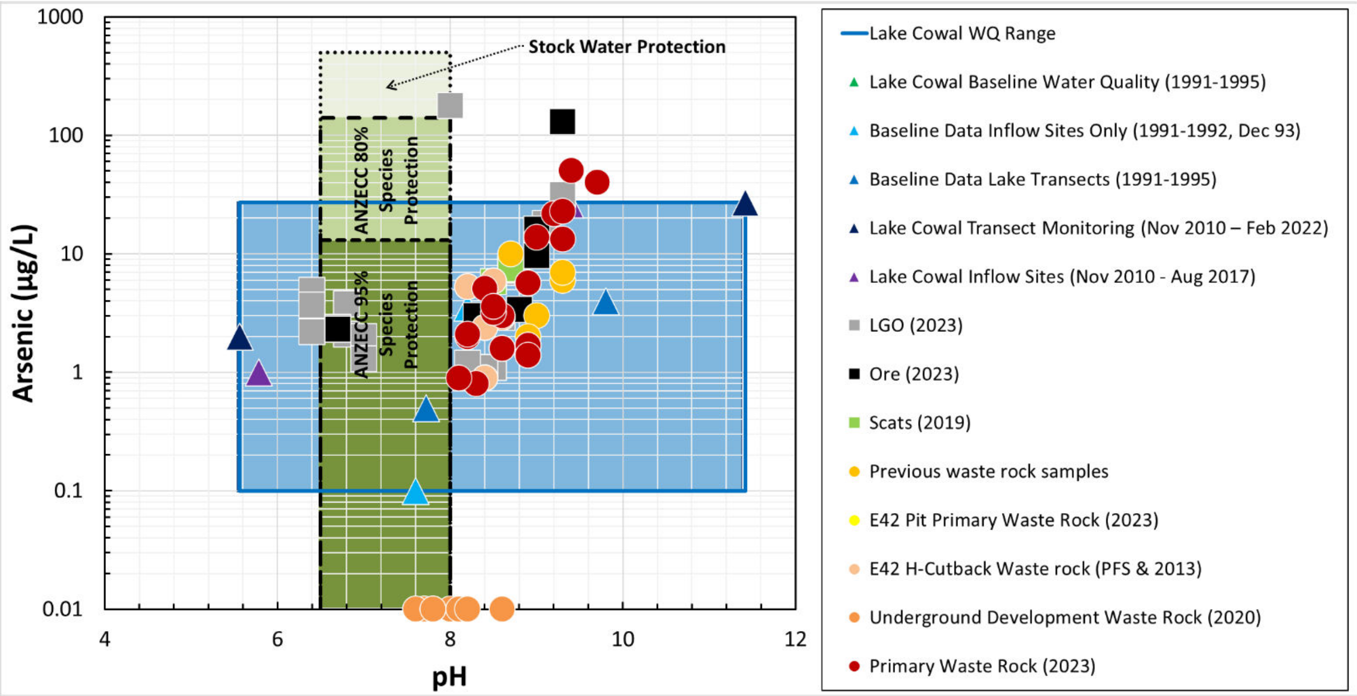


Figure 3.3 **Values of pH and As in primary waste rock leachate compared to the range in Lake Cowal water quality and water quality objectives**

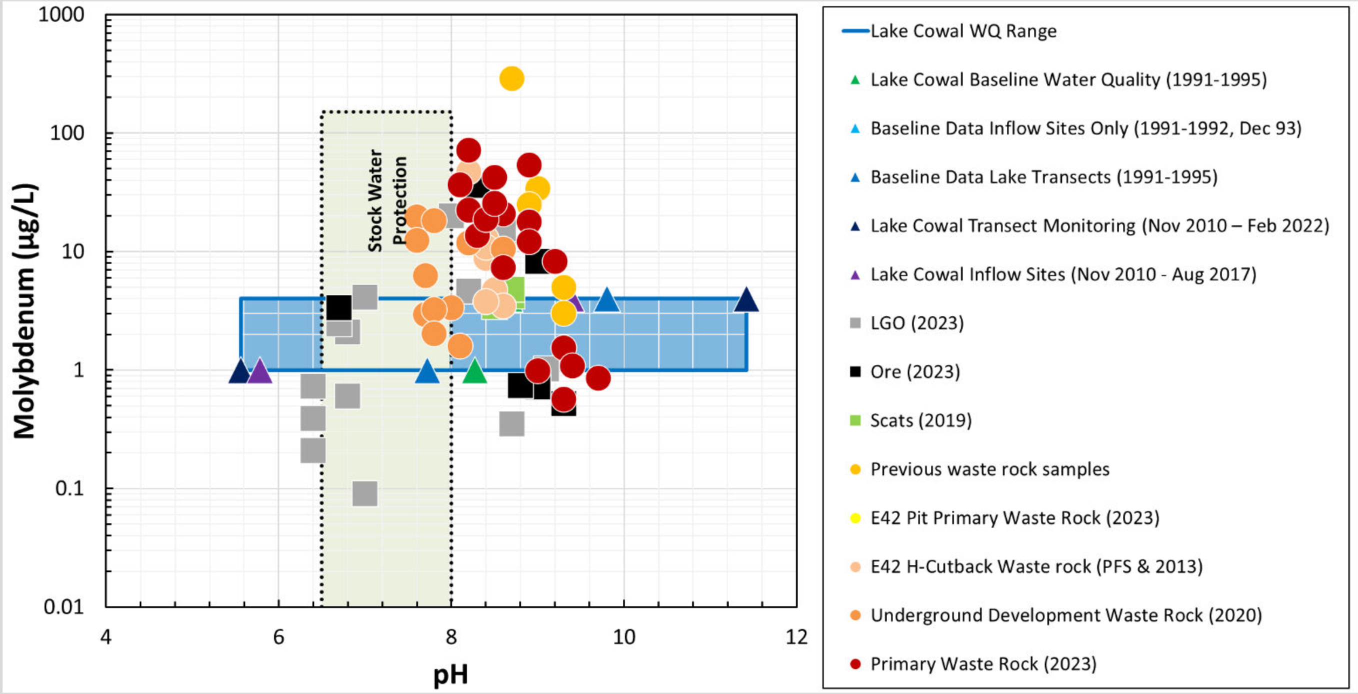


Figure 3.4 Values of pH and Mo in primary waste rock leachate compared to the range in Lake Cowal water quality and water quality objectives

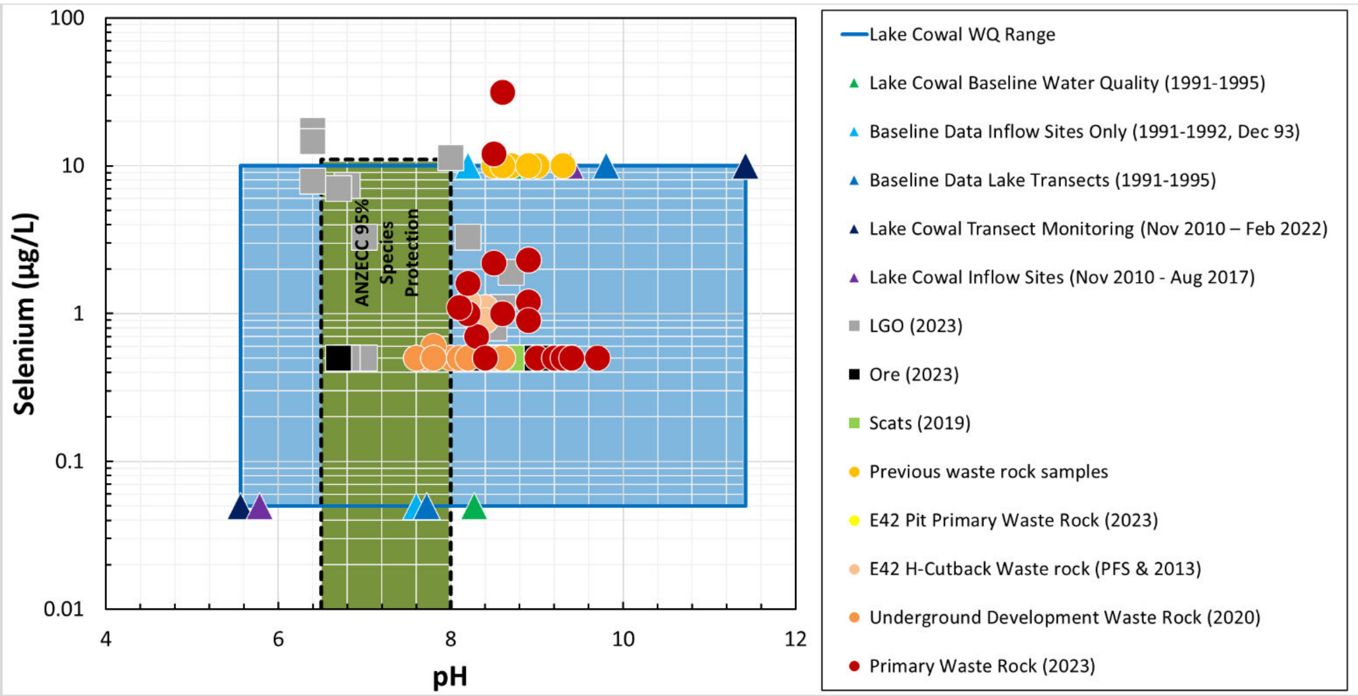


Figure 3.5 Values of pH and Se in primary waste rock leachate compared to the range in Lake Cowal water quality and water quality objectives

4 Waste rock management

Section 3 findings show the impact of placement of primary waste rock in the LPB extension is likely to have a limited impact on the receiving environment. Applying geochemical cut-off criteria may be employed as part of the existing site waste rock management plan to further limit potential impacts. Section 4.1 outlines the derivation of the geochemical criteria recommended for use in waste rock management. Section 4.2 shows how these criteria can be incorporated into the active waste management plan (Evolution Mining, 2022).

4.1 Geochemical cut-offs

Acid and metalliferous drainage is limited on site; however, active management of PAF waste rock and waste rock with the potential to generate saline or neutral drainage, may be employed to further reduce the potential for impacts on the receiving environment.

4.1.1 Acid base criteria

Active waste rock management requires rapid decisions on appropriate handling based on the waste rock characteristics as the material is mined. To aid rapid determination of sample geochemical characteristics during mining, it is convenient to send samples to laboratory for assay; however, there is frequently a lag time between sampling and obtaining final results, especially for the more time-consuming aspects of acid-base accounting, which are used to assess NAF versus PAF waste rock.

To allow rapid analysis of samples on site, the acid-base characteristics of the samples are estimated using acid-base proxies (i.e., elements that may be analysed as part of the rapid assay process but are geochemically linked to acid-base properties). Since oxidation of sulfur (as sulfide) is the primary driver of acid generation in waste rock, and sulfur can be included in rapid assays, it is commonly used as the proxy for acidity. Total sulfur is analysed, which represents a conservative estimate of the acid generating potential of the sample, since in many cases not all sulfur contributes to acid generation.

The acid buffering proxy is commonly calcium and/or carbon, which may also be determined by assay (calcium was used in this study). The primary waste rock is chiefly composed of unweathered volcanic material and as such, may contain limited occurrences of calcium as calcium carbonate ($CaCO_3$), which is a highly effective acid buffering agent. Although ANC may be provided by chemical weathering and reaction of silicate minerals (e.g., feldspars, pyroxenes), these are slow reactions and the release of readily available ANC may be limited. Laboratory testing to determine ANC comprises relatively aggressive acidification of samples and may overestimate the presence of readily available and rapidly reactive ANC, with the result that samples may be classified as NAF but in practice have limited acid buffering capacity. Using calcium assay concentrations as proxies for acid buffering therefore overestimates the presence of available ANC and must be adjusted to account for this.

The recent waste rock geochemical characterisation study (GEM, Cowal Gold Operations Open Cut Expansion Project Environmental Geochemistry Assessment, 2023) showed the results of acid buffering characteristic curve (ABCC) determinations on the primary waste rock samples. ABCCs provide an indication of readily available ANC. This study showed that approximately 50% of the ANC in the primary waste rock samples determined by laboratory analysis (the total ANC) was available to buffer acidity. Using the ABCC results, calcium may be used as a proxy for ANC (as $CaCO_3$) provided its availability is reduced by 50%.

Figure 4.1 shows calcium concentrations versus ANC for the primary waste rock samples separated by lithology. Adjusting the calcium content of the samples by the 50% determined by the ABCC tests provides close to a one to one ratio of calcium concentration and ANC. Thus, the corrected calcium concentrations can account for the available ANC.

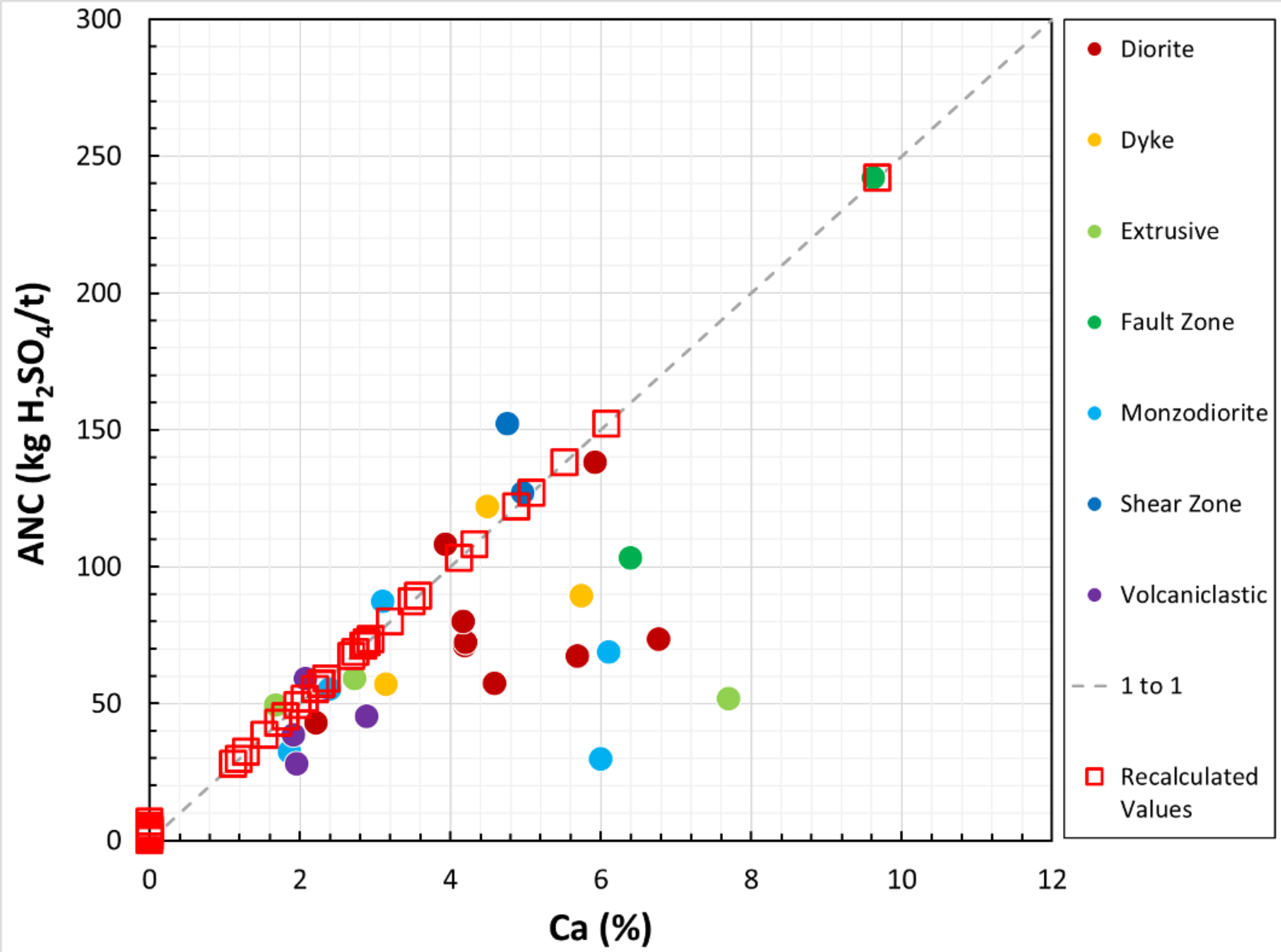


Figure 4.1 **Calcium concentration versus ANC in the primary waste rock samples. Also shown are calcium contents adjusted according to the results of the ABCC tests (GEM, Cowal Gold Operations Open Cut Expansion Project Environmental Geochemistry Assessment, 2023)**

The above method effectively calculates a proxy for NAPP, as MPA (determined by sulfur analysis) minus ANC (determined by calcium analysis, which is then corrected) and is consistent with the acid-base characterisations outlined in previous studies (e.g., (GEM, Cowal Gold Operations Open Cut Expansion Project Environmental Geochemistry Assessment, 2023)). For analysing waste rock during stockpiling LPB construction rock, the following criteria may then be applied:

- waste rock samples that contain > 0.5% sulfur (as determined by assay); may be considered to be PAF and should be managed appropriately (see Section 4.2).

All other samples may be considered as NAF and are appropriate for construction for the LPB.

4.1.2 Leachate

To provide similar geochemical cut-off criteria for the metals and metalloids of concern, the leachate chemistry of each sample was compared to its solid sample chemistry (i.e., comparing the readily leachable parameters with their corresponding source term compositions). As Figure 4.2, Figure 4.3 and Figure 4.4 show, however, there is no simple relationship between the solid source term content and leachate concentration.

As noted in section 3.2, arsenic leachate concentrations correlate with pH, whereas molybdenum concentrations are highest at mildly alkaline pH and selenium concentrations do not correlate with pH. Examination of the behaviour of these parameters with other reactive drivers, such as sulfur content, shows only limited correlation.

Given the variability in the concentrations, the following criteria are proposed:

- Arsenic leachate concentrations are generally close to or below both the Lake Cowal range in water quality and the water quality guidelines, with only two of the primary waste rock samples reporting values above the natural range (Figure 4.2). It is therefore proposed that no criterion is set for arsenic.

- A molybdenum solid sample assay cut-off of < 2mg/kg as acceptable may be employed, although all primary waste rock sample leachates are below stock water guidelines, so this may be considered as optional (Figure 4.3).

- Almost all selenium leachate concentrations are within the Lake Cowal range and below guideline values; however, to provide an additional limit on potential impacts, the optional criterion of a solid sample cut-off of < 0.3 mg/kg may be considered as an option (Figure 4.4).

It should be noted that the above criteria are conservative and based on readily leachable concentrations, which would be expected to reduce and dilute in Lake Cowal over time (ATC Williams, 2023).

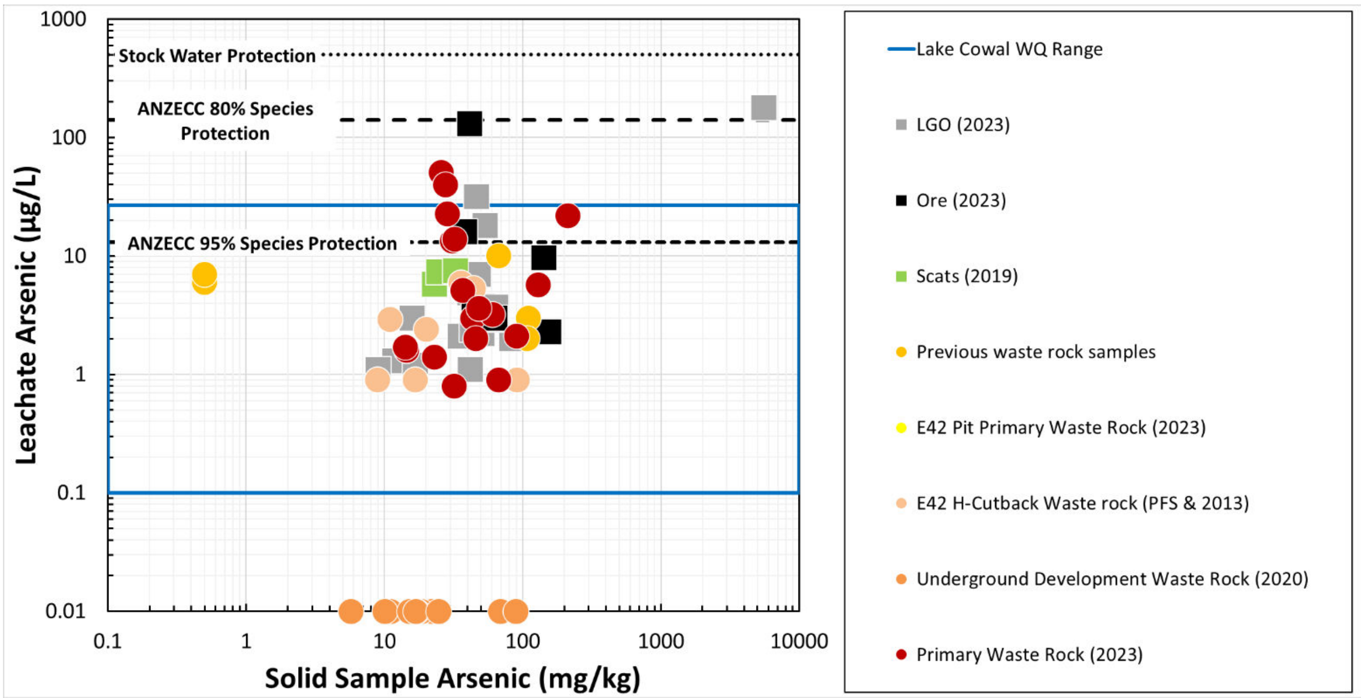


Figure 4.2 Solid versus leachate As concentrations in waste rock samples. Also shown is the range in Lake Cowal water quality and guideline values, where available

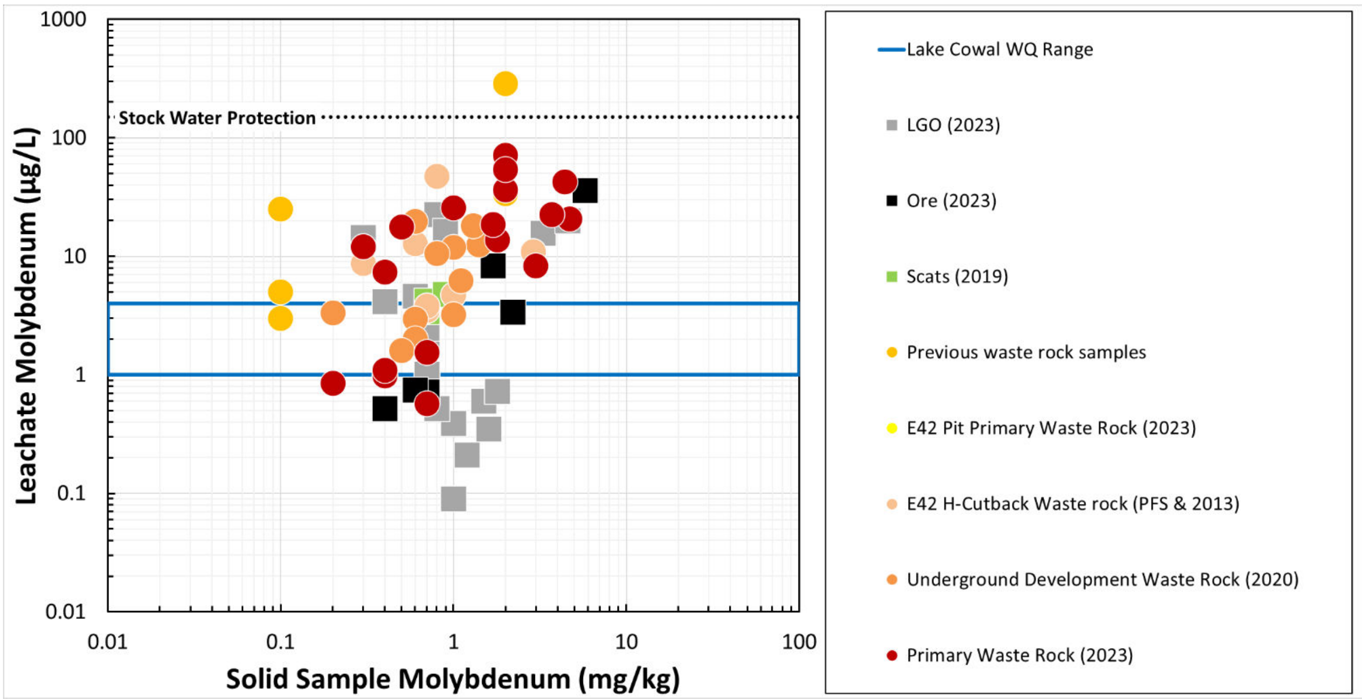


Figure 4.3 Solid versus leachate Mo concentrations in waste rock samples. Also shown is the range in Lake Cowal water quality and guideline values, where available

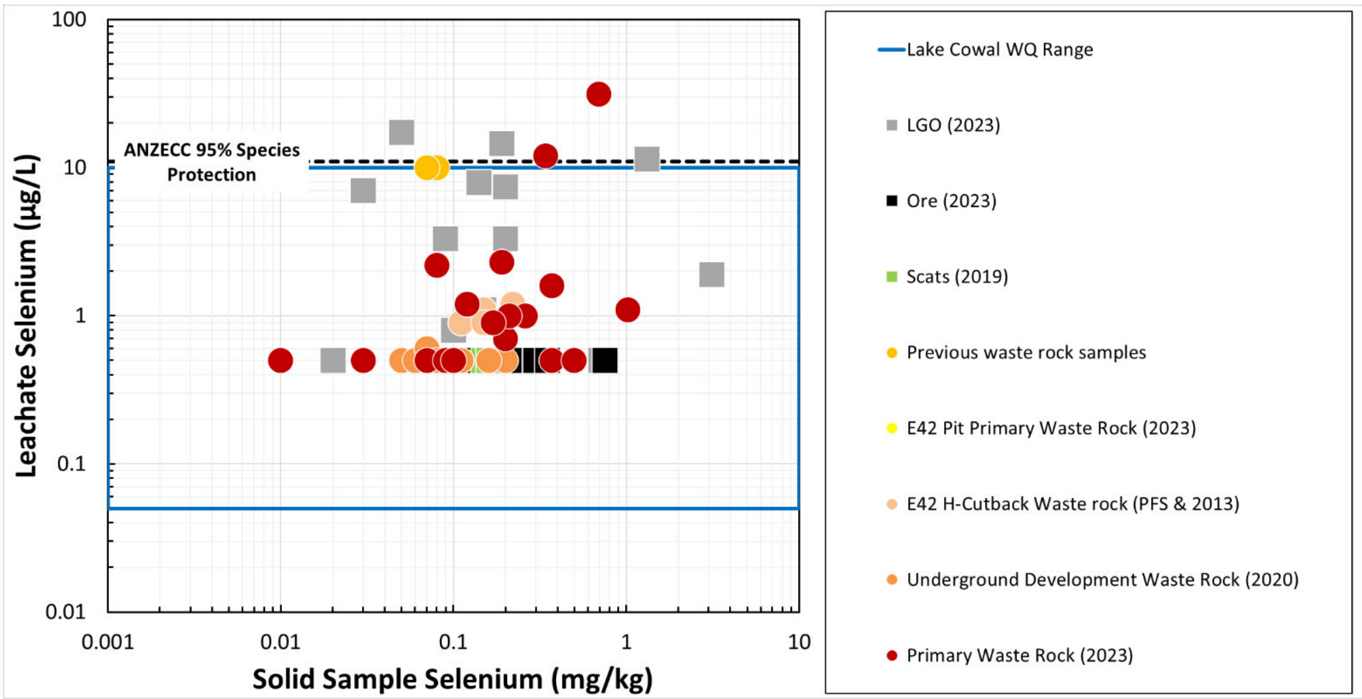


Figure 4.4 Solid versus leachate Se concentrations in waste rock samples. Also shown is the range in Lake Cowal water quality and guideline values, where available

4.2 Summary and proposed waste rock management method

4.2.1 Geochemical criteria and management

The proposed geochemical criteria for primary waste rock management during extension of the LPB are:

- waste rock samples that contain > 0.5% sulfur may be considered to be PAF and should be managed appropriately.

All other samples may be considered as NAF and are appropriate for construction.

The above criteria are consistent with the current Rehabilitation Management Plan (RMP) (Evolution Mining, 2022) which actively screens for reactive sulfide (samples > 0.5% sulfur). This will be incorporated into a Project specific Construction Environmental Management Plan. Sampling and verification program

To inform the waste rock handling, as part of a Construction Environment Management Plan, a sampling program is recommended and is outlined below.

i Sample justification and selection method

While no consensus exists as to the minimum number of samples that should be investigated to adequately constrain the acid and metalliferous drainage (AMD) risk of a particular rock type, a number of State guidelines draw on industry experience to provide overall sampling recommendations. The approach recommended by most State regulators, including the NSW EPA, is to collect ~8 samples for waste rock tonnages <100,000 t and ~80 samples for waste rock tonnages <10 Mt (Kentwell, Garvie, & Chapman, 2012). Construction of the LPB is estimated to require ~ 520,000 m^3 of waste rock. Assuming a waste rock density of 2 tonnes/m^3, approximately 1M tonnes of waste rock will be used. Following the above approach, up to 80 waste rock samples should be collected throughout the LPB construction phase and submitted for analysis. It is recommended that samples of waste rock selected for use in the LPB construction phase are submitted in batches for testing to allow for rapid result turnaround and reducing potential downtimes (e.g., four batches of 20 samples, or eight batches of 10 samples). If the waste rock earmarked for LPB construction is stockpiled, this geochemical testing may be undertaken ahead of major work to reduce the possibility of delays. All samples should be submitted for at least Stage 1 testing (see below): current cost estimates are ~ $200 per Stage 1 test per sample, or approximately $16,000 for the 80 sample testing program.

In addition, it is important that the sample set is representative of the main material types of concern. Standard practice for assigning sample numbers is to use the volumes or tonnages of the primary material types anticipated to be encountered and to weight sample numbers accordingly.

Finally, different degrees of weathering will affect the reactivity of rock and sampling provides an adequate representation of different material behaviour.

Based on the characterisation studies performed as part of the Project, the primary waste rock types are to be used in LPB construction and consist of:

- Diorite
- Dyke
- Extrusive
- Fault zone
- Monzodiorite
- Shear zone

- Volcaniclastic

ii Sample collection and testing

Sampling should provide adequate quantities of material for the testing required. A staged approach to laboratory testing is recommended, with the results of the previous stage used to determine which samples – if any – may require further testing in the subsequent stage. Experience from various mine sites has shown that this approach avoids unnecessary testing and reduces costs. Details of the testing required at each stage are provided below. The stages are summarised as follows (note that these are indicative and not all stages may be required depending on the results as the testing program proceeds):

- Stage 1:
  - All selected samples are to undergo Stage 1 testing, which provides an initial indication of the acid-base characteristics and the potential for metal leaching of the samples of concern.
  - Sample mass required: ~1 kg.
- Stage 2 (optional/dependent on Stage 1 testing):
  - Sample numbers depend on the results of the Stage 1 testing. Stage 2 testing involves obtaining a greater level of detail on AMD characteristics for the samples identified in Stage 1 as being of potential concern. Criteria for assigning Stage 2 tests are outlined below.
  - Sample mass required: Stage 2 tests make use of the ~1 kg sample collected for Stage 1.

Sample collection should consist of the following general guidelines:

- Collect as much of the sample as possible.
- Note the sample location (take GPS coordinates if possible).
- Place the sample into a labelled zip-lock sample bag.
- Photograph the bagged sample. Photograph the sample site if time permits.
- Add the sample details to the laboratory Chain of Custody (CoC) sheet, with Stage 1 testing details and as marked for retention (non-disposal). **NOTE:** Ensure that all CoCs are clearly marked to instruct the laboratory to retain the remaining samples following each stage of testing (ie instruct to store samples). This is to prevent disposal prior to completion of the later testing stages.
- Place into an appropriate container (e.g., laboratory esky).
- Arrange transfer to laboratory.

iii Sample preparation

Given the nature of the waste rock samples, no specific sample preparation is required on site.

iv Laboratory analysis

The recommended staged geochemical testing approach is outlined below.

Stage 1

The initial round of testing is recommended to follow the outline below. This is to allow verification of the cut-off criteria described in Section 4.2.1. Subsequent sampling may then revert to only the whole sample concentration analysis (assay analysis), which will provide a more rapid turn-around of results. Periodic testing of the full suite of Stage 1 tests is recommended to provide added verification of the assay data. To provide an initial indication of the geochemical characteristics and potential for AMD, SD and NMD, the following analyses are recommended for Stage 1:

- pH (saturated paste).
- Electrical conductivity (saturated paste).
- Total sulphur concentration as "S".
- Maximum potential acidity (MPA) in kgH_2SO_4/t.
- Acid neutralising capacity (ANC) in kgH_2SO_4/t and alternatively expressed as % $CaCO_3$.
- Net acid producing potential (NAPP).
- Whole-sample concentrations, including metals and metalloids. This should include S, Ca, As, Mo, Se, Ni, Cu, Au, Co, Cr, Zn, Hg, Mn, Pb, Fe, Cd and may use the existing Project assay protocols. **Note:** this testing is to continue for each sampling campaign.

Note: this list is to be included in instructions to the laboratory. It is recommended that the test methods are confirmed with the laboratory prior to sampling. The laboratory will provide analysis codes for use on the CoC.

Stage 2

Stage 1 results will be critically evaluated and discussed with Evolution prior to any work being carried out for Stage 2 testing. As for Stage 1, Stage 2 testing should be conducted in the first sampling campaign but may then be used only for verification purposes in following campaigns. The results of the Stage 1 geochemical testing will be used to select samples for more detailed geochemical characterisation. The recommended Stage 2 analyses and criteria for selection are as follows (Note: tests and test codes should be confirmed with the laboratory prior to commissioning Stage 2 testing):

- **Sulphur speciation** (i.e., total sulphate concentration, readily-soluble sulphur, acid-soluble sulphur) to provide an indication of the potential and actual behaviour of sulphur in the samples and their potential contributions to acidity. Samples with a total sulphur content >0.05 % may be selected for total sulphate analysis; additionally, samples with paste pH values <5.5 may be selected to determine readily-soluble, adsorbed and gypsum sulphate components (following KCl leach), acid-soluble, adsorbed, gypsum and jarositic sulphate components (following HCl leach) and titratable actual acidity ('soluble and readily exchangeable acidity'; (Ahern, McElnea, & Sullivan, 2004)).

- **De-ionised leach testing**. Trace-element concentrations (metals and metalloids) determined in Stage 1 will be assessed with reference to the Geochemical Abundance Index (GAI). The GAI compares the concentration of an analyte in a sample with a reference value; global median soil concentrations will be used following the standard convention (see the GARD Guide; (INAP, 2020)). The GAI is calculated as follows:

$$GAI = \log_2 \left[\frac{Conc_{Sample}}{1.5(Conc_{Median\ Soil})} \right]$$

- GAI values are reported as integers and range between 0 (the sample analyte concentration is similar to or less than the reference concentration) to 6 (the sample analyte concentration is enriched to ~100 times the reference content). Samples reporting enriched trace element contents relative to the geochemical abundance index will be subjected to leach testing to determine the potential for mobilisation of readily-leachable metals/metalloids.

- **Net Acid Generation (NAG) testing**. This is used to provide an indication of the net acid generated in each sample following oxidation of sulphide minerals with hydrogen peroxide and reactions between the acidity generated and the sample buffering capacity. Two NAG test types will be performed based on the sample types and Stage 1 results:

  - Single addition NAG test. Samples with sulphur contents between 0.05% and 1% will be selected to determine the net acid generation from moderate sulphur samples following one round of peroxide addition.

  - Sequential NAG testing. Single addition NAG tests may not fully oxidise all sulphur in samples with moderately high (>1%) sulphur contents (AMIRA, 2002). Sequential NAG testing involves conducting a series of NAG tests until either the peroxide no longer reacts, or a NAG pH above 4.5 is recorded. Samples with sulphur contents >1% will be screened to determine whether sequential NAG testing is necessary before performing additional sequences of peroxide addition. Samples initially chosen for single addition NAG testing will also be assessed by the laboratory to determine whether additional sequences are required.

- **Acid buffering characteristic curves (ABCCs)**. ABCC tests involve slowly titrating a sample with acid and continuously recording the resultant pH to provide an indication of the ANC available for acid neutralisation. While the Stage 1 ANC measurements will provide an indication of the total potential acid buffering capacity of a sample, this total ANC is not necessarily available for buffering (eg it may be hosted in slow to react minerals in lithologies such as dolerite or silicates). The shape of the ABCC provides useful information on what types of mineral species may act to buffer addition of acid. The test is especially useful for assessing whether a sulphidic sample with some buffering capacity (eg potentially including samples classified as Uncertain – UC – following the Price convention) has enough readily available carbonate to essentially be NAF. Samples with sulphur contents >0.3 % and NPR >1 will be selected for ABCC testing.

- **Mineralogy by X-ray diffraction (XRD)**. This provides an indication of which buffering and acid generating minerals are present in samples. XRD provides a measure of pyrite content, carbonate content, clay mineral content, etc. and is performed to complement/confirm the ABCC testing. A range of samples will be selected to investigate the different sample types found on site.

v Reporting

Results from the sample program(s) should be reviewed and compared to existing data. Knowledge updates should be included in ongoing management updates.

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