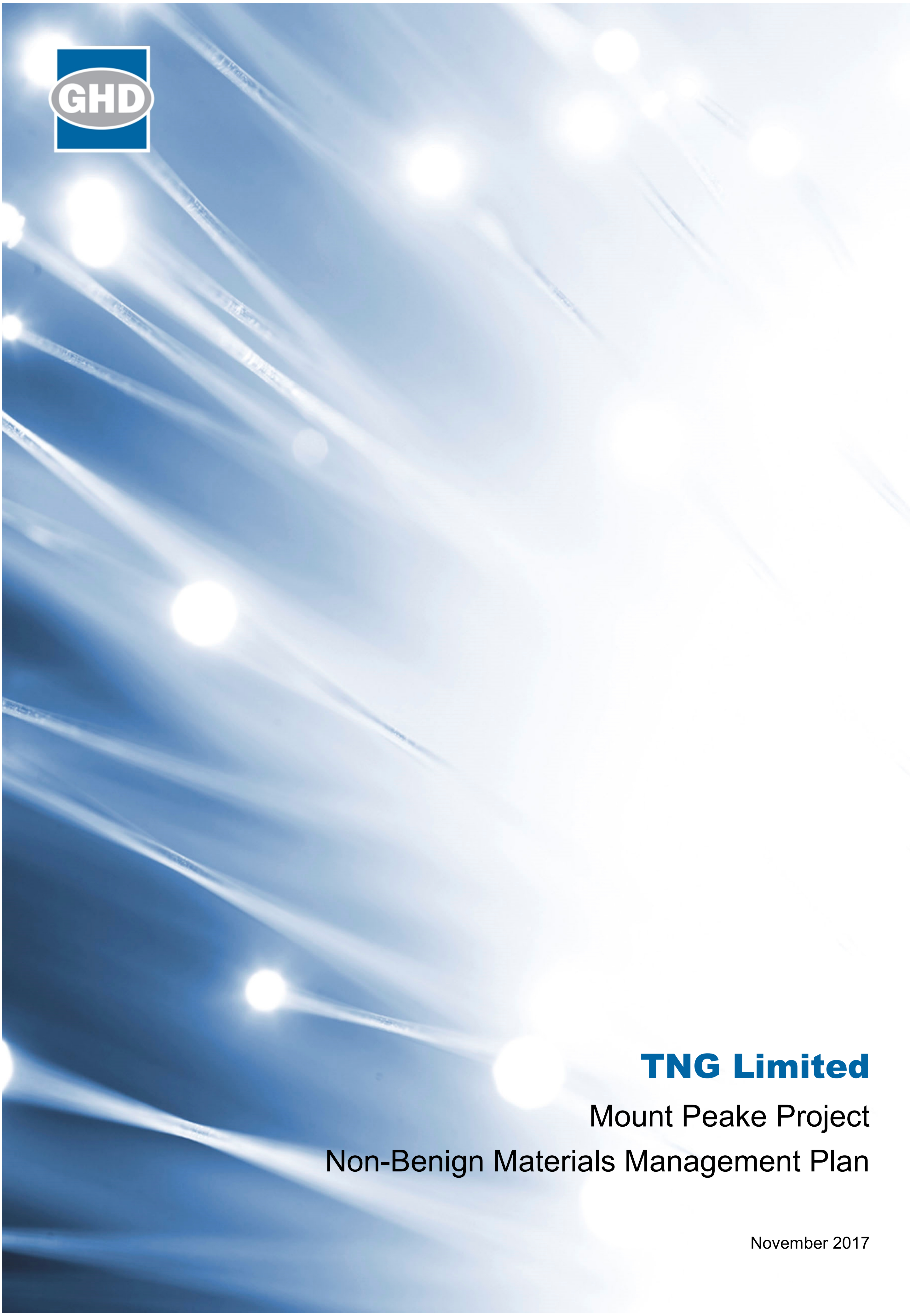

TNG Limited

Mount Peake Project

Non-Benign Materials Management Plan

November 2017

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1. Introduction

1.1 Background

GHD was engaged to complete a Non-Benign Materials Management Plan (NBMMP) for the proposed TNG Limited (TNG) Mount Peake Project (the Project).

A NBMMP was requested by the Northern Territory Environment Protection Authority (NTEPA) following TNG's submission of an Acid and Metalliferous Drainage (AMD) assessment: '*Mount Peake - Acid and Metalliferous Drainage Assessment – Assessment of laboratory results'* (GHD, 2016).

The AMD report (GHD, 2016) presented laboratory data (static and kinetic testing) on a sufficient number, depth and distribution of lithologies to determine the potential AMD risk posed by the project. In general, it was concluded that the overall risk of AMD for the Project is low with a lack of significant sulfide material within the ore and waste.

1.2 Purpose of this report

This report has been compiled in response to review comments received from the NTEPA.

This report presents a plan to address management of adverse materials that may be encountered during the operation of the Project.

1.3 Scope and limitations

This report has been prepared by GHD for TNG and may only be used and relied on by TNG for the purpose agreed between GHD and TNG as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than TNG arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report based on information provided by TNG and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report that were caused by errors or omissions in that information.

2. Sodic leachate in waste rock

2.1 Volume of sodic material present

The AMD assessment (GHD, 2016) identified that the waste rock has a low risk of salinity but a moderate to high risk of soil erosion or sodicity in the highly weathered material, if this waste is left exposed.

The total volume of waste rock is calculated to be 57.3 million tonnes (Mt) (see Table 2-1). Of this waste, the majority (57%) is formed of gabbro waste, followed by alluvial waste (32%), granite waste (10%) and a very minor component of fault-derived waste (1%). Given that less than a quarter of samples had a high ranges of Exchangeable Sodium Percentage (ESPs), the total volume of potential sodic material would possibly reflect this percentage. This equates to approximately 14 Mt of the waste material being potentially sodic. However, it should be noted that the sodicity laboratory assessment was completed on a select sub-set of samples (see GHD, 2016). These were selected from Stage 1 laboratory samples that had the highest sulfur and elevated metals results. As such, the total volume of waste that may be potentially sodic could be significantly less than this and should be further assessed during sampling of wastes/construction materials as mining progresses (see section 2.3).

2.2 Locations where sodic material may occur

The material tested has a wide range of potential for dispersion from very low to very high. Sixteen of the 88 samples (18%) had Exchangeable Sodium Percentage (ESPs) above 12% placing them in the *high* to *very high* range (EPA, 1995). Of these samples, one was granite (15 m depth), seven were ore (at depths between 11 m and 41 m), and eight were gabbro (at depths between 20 m and 45 m).

The data indicate no identifiable pattern in the distribution of the high ESP values in terms of waste material, although it is noted no samples were from the alluvial material (which would generally be excavated first and used as cover material). The samples are generally higher in the profile, and are expected to be within the weathered material. Further testing during excavation is recommended to delineate locations and materials that may be sodic.

2.3 Identification and monitoring of sodic material

The testing indicates that waste material has the potential to be sodic and cause soil dispersion if left exposed. This is generally more likely to be encountered in fault zones or areas of weathering.

Testing of material to be re-used on site (i.e. for construction purposes or batter zones) should be completed to determine its potential to be a dispersive soil. This could be through use of field tests such as the Emerson crumb test (Emerson, 2002), and/or confirmation and validation through laboratory assessment. Management options for dispersive soils are presented in Section 4.3.

2.4 Excavated material timeframes

Material to be excavated comprises between 2 m and 16 m of overburden (waste) overlying the main ore body. Mining will commence with a “starter pit” accessing high-grade and low strip ratio ore.

The waste rock generated during pre-production mining would be mainly used to construct pads for infrastructure, a run of mine (ROM) pad, and product stockpiles. It is estimated that this volume would be up to 5 Mt. This initial waste volume, taken from the upper weathered zones of waste rock is expected to have higher sodic leachate capacity, therefore appropriate controls (see Section 2.5) may be required for this stage of works.

Waste rock generated by mining in subsequent years will be trucked to the Integrated Waste landform (IWL) that will progressively develop to the west of the pit.

The Project will mine at a rate of up to 9.4 Mtpa. The life of the project is expected to be 17 years. Table 2-1 and Figure 2-1 present predicted waste and ore volumes expected to be generated during each year of mining.

Table 2-1 Waste and ore volumes for each year of mining

Year	Ore (Mt)	Waste (Mt)	Total (Mt)	Strip ratio
1	2.5	6.9	9.4	2.8
2	8.6	0.8	9.4	0.1
3	2.3	6.7	9.0	3.0
4	2.8	6.0	8.8	2.2
5	5.8	2.9	8.7	0.5
6	5.2	3.5	8.7	0.7
7	3.5	5.2	8.7	1.5
8	4.7	4.0	8.7	0.8
9	6.3	2.4	8.7	0.4
10	4.9	4.3	9.2	0.9
11	5.7	3.5	9.2	0.6
12	8.1	1.1	9.2	0.1
13	9.0	0.2	9.2	0.02
14	1.2	8.0	9.2	6.8
15	6.7	1.7	8.5	0.3
16	3.6	0.03	3.6	0.01
17	0.8	0.02	0.8	0.02
Totals	**81.5**	**57.3**	**138.8**	**0.7**

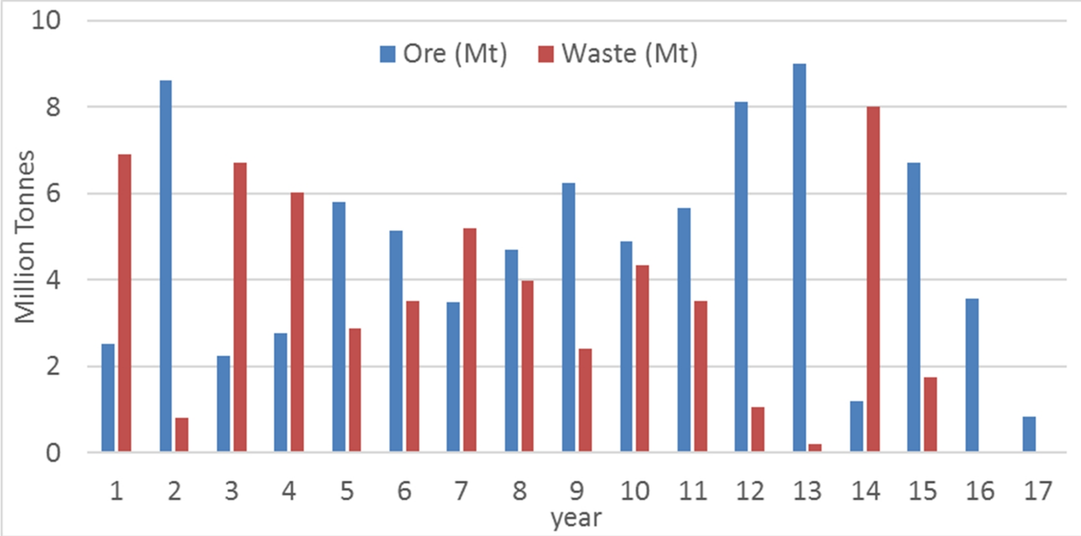

Figure 2-1 Waste and ore volumes for each year of mining

2.5 Potential implication of sodic material

A soil may be considered sodic when sodium concentrations begin to affect soil structure (generally recognised in Australia when ESP >6 %; strongly sodic soils have ESPs of >15 (Isbell 1996). When sodic soils become wet (as sodium is a monovalent cation as compared with the bivalent cations magnesium and calcium), the bonds weaken and the soils can become dispersive or slake. Therefore, a high level of exchangeable sodium is not desirable in soils for mine rehabilitation, as it can lead to dispersion, tunnel erosion and surface crusting with individual clay particles going into suspension potentially leading to decreased surface water quality (Charman and Murphy, 2000).

Secondary consequences include surface hard-setting as soil structure breaks down, with decreased infiltration leading to difficulties in establishing vegetation and, therefore, ongoing erosion from bare surfaces. Management options for material that are identified as dispersive are presented in Section 4.3.

3. Identification of AMD and PAF

3.1 Identification of PAF material

The overall resource (waste and ore) has been assessed as having a low risk of acid generation (GHD, 2016).

The Net Acid Producing Potential (NAPP) and Net Acid Generation (NAG) classification assessment did not determine any samples within the Potentially Acid Forming (PAF) range (positive NAPP or pHNAG <4.5). Approximately 99.5% of samples had a Total Sulfur-based Maximum Potential Acidity (MPA) of less than 1 kg/t H_2SO_4, and none had an NPR of less than 2 confirming they were all non-acid-forming (NAF). All material groups (ore and waste types) have a median NPR of 3 or greater suggesting overall sufficient buffering capacity. The lowest NPR is seen in the granite and fault zone.

Although the total metal analyses indicate some samples contained arsenic, selenium and vanadium elevated above background values, average results were not significantly elevated. Leachate analytical results presented in GHD (2016) indicate that the waste rock is within acceptable limits for unlined storage.

The data indicates that PAF material is unlikely to be encountered or identified during mining. As no specific waste stream shows PAF potential, all material may be considered as NAF for the purposes of storage. The material does not require specific management as PAF. Further testing of the materials during mining will provide additional information and detection of any PAF material (Section 3.4).

3.2 Identification of highly alkaline material

All the rock types had strongly positive median and mean NPR values, indicating that all waste types and ore are classified as Non Acid Forming (NAF) with a high neutralising capacity and a very low potential acidity.

Carbonate veins have been encountered in various locations, generally near-surface within the oxidised magnetite olivine gabbro. Open space filling carbonate crystals are present along deformation zones in fresh rock, and can be identified from elevated Ca values. The carbonate alteration/veining is related to weathering and probably related to thin zones of calcrete found along drainages.

There is also a small amount of pedogenic carbonate present in the lower weathered zone in the gabbro that sits on the orebody.

The ASLP leach pH ranged from 6.6 to 10.1 with a median of 9.4 and 90% of samples having a pH between 8.6 and 9.8. This indicates leachate may fall in the High to Very High (EPA, 1995) range. Preliminary barrel leach test results, however, are all between 7.31 and 8.8, which sits in the High range. In contrast, the Kinetic NAG (KNAG) test pH ranged from 4.87 to 7.32 with indicates there may be some buffering by oxidising minerals. The material does not require management as being highly alkaline but will be monitored and managed to deal with the potentially slightly alkaline leachate and runoff.

3.3 Monitoring to identify AMD and PAF

A key component of managing adverse materials will come from the ongoing testing that will be required during the operation of the mine. No further drilling works are scheduled within the area of the pit (i.e. no infill drilling to gain additional AMD/adverse material samples).

3.3.1 Preproduction (and ongoing)

Barrel leach tests have been established to provide an early indication of the potential generation of AMD. The tests aim at sampling leachate (both natural and from simulated rainfall) on a range of samples representing ore and various individual waste types and waste type combinations.

To date these samples have demonstrated relatively neutral pH, with the median pH over two rounds of sampling (8 samples) being 8.1, in line with the laboratory data presented in GHD (2016).

Sampling of leachates will continue to be completed on the barrels, with assessment of key parameters. Review of the results will allow an early indication on the potential for AMD, and where AMD is indicated, appropriate management controls can be implemented.

3.3.2 During production

Additional geochemical data collection will be carried out as part of the production phase of the project. No specific program has yet been developed however, ongoing testing will be conducted in associated with grade control to confirm absence or presence of adverse material.

It is recommended that during production, analysis will be completed through use of XRF analysis run in an on-site laboratory or by hand-held XRF with the appropriate calibrated range of analytes, level of reporting and resolution.

As a minimum, an initial assessment of sulfur, calcium, magnesium and arsenic will be completed and analysed as part of the standard AMD suite during grade control sampling. Additional metals (Al, Pb, Zn, Cu, Cr, Cd) will also be included. Sampling should be completed on all materials, inclusive of all waste streams. The data should be assessed against key assessment criteria to allow the early identification and mapping of any PAF. If the sampling identifies material as PAF, the following should be implemented:

- Re-test sample to confirm results
- Determine location of sample
- Assess nearby samples
- Estimate material volume
- Review data against block model and existing data (i.e. does result conflict/support existing testing data)
- Develop contingency plans and disposal protocol (see Section 4).

Runoff and leachate generated on site will be regularly monitored.

4. Adverse materials management

4.1 Introduction

Overall, the waste rock has a low risk of salinity but a moderate to high risk of soil erosion or sodicity in the highly weathered material if exposed. Most of the materials also had a poor capacity to hold nutrients although this is expected with non-soil materials. This will be managed by sediment and erosion control during deposition and capping with topsoil on completion, and control of leachate to minimise contact with sensitive soils. Alternatively, capping soils can be ameliorated by adding agricultural lime or gypsum, depending on soil pH, in accordance with standard agricultural practice.

4.2 Locations with high risk of PAF (based on test data)

As previously described, no specific waste stream or specific location within the pit is expected to have a high risk of PAF. Combined NAG and NAPP data demonstrate that all material tested can be classed as NAF or ACM.

Preliminary XRF data GHD (2015a) was used to identify that all material, both waste (tailings, gabbro, fault zone, granite, alluvials) and ore are classed as NAF or ACM. Some grouping based on lithology and waste was identified, with the alluvial material tending to have the highest NAG, and waste gabbro tending to have the lowest NAG. The highest NAPP values (whilst still negative) are found in the granite waste. However, the groupings only generally agree with the laboratory data obtained during later testing, where the highest average NAPP values were identified in granite (-37) and the lowest values were identified in tailings (-113).

4.3 Management strategies for sodic material

Where further testing during mine operations identifies potential sodic material, the potential for soil dispersion will be managed by sediment and erosion control during deposition. Proposed controls include:

- Capping waste rock with non-dispersive soils on closure
- Diverting runoff to holding ponds via armoured drainage channels
- If contact with sensitive soils is likely, by amending impacted soils or leachate by adding agricultural lime or gypsum to raise soil calcium concentrations and hence reduce sodicity.

Alternatively, capping soils can be ameliorated with agricultural lime or gypsum to reduce sodicity, depending on soil pH, in accordance with standard agricultural practice.

The proposed site design should aim to minimise the disturbed area footprint and long-term changes to the landscape.

The majority of potentially sodic soils will be deposited in the IWL. Due to the largely impervious nature of the waste (and unsaturated alluvial cover), minimal seepage is expected to drain from the waste rock.

The IWL will be surrounded with an engineered drainage channel, with dedicated monitoring points to gauge runoff volumes and assess water quality (Section 6)

4.4 Containment plan

A key component of waste rock management for the Project is the storage of waste rock within a designated IWL that will be designed and engineered to allow appropriate storage and segregation of waste should any potentially acid, alkaline, saline or metalliferous leachate generating waste be encountered during excavation. This is consistent with industry best practice as detailed in INAP (2009).

In the event that low volumes of isolated PAF material are identified during production, the presence of high acid consuming material supports a co-mingling approach of waste deposition within the IWL.

5. Surface water management

The process of placement and covering of materials in the IWL will be continuous to facilitate immediate and permanent capping aimed at prevention of the interaction of potential adverse materials with the atmosphere, particularly with rainfall.

Drainage, runoff and seepage controls for the IWL would form part of the Detailed Design stage (not part of this Plan). This is likely to include a perimeter drain to capture all runoff from the IWL and direct to on-site retention basins.

Drainage control will include monitoring at key locations (Section 6) to allow the assessment of water quality and potential impacts emanating from the IWL. Similar drainage control and monitoring would be required for stockpile storage areas.

Runoff and seepage controls are to be included in the design in accordance with the Water Management Plan, therefore any runoff or seepage will be monitored on a regular basis and elevated concentrations detected and managed appropriately.

6. Proposed monitoring plan

6.1 Surface water and Groundwater monitoring

Proposed surface and groundwater monitoring for the project are described in the Project's Water Management Plan (GHD 2015); therefore, only a summary of requirements is presented herein. Please refer to that document for monitoring details. Furthermore, the EIS includes commitments and monitoring requirements for the Project. This would include those required under this Plan.

6.1.1 Surface water

Due to the nature of the proposed operation, surface water impacts appear likely to be confined to those areas within and immediately downstream of the mine operations and corridors. As a reflection of the ephemeral nature of the creeks within the Project area, proposed monitoring locations will be from key areas where opportunistic sampling can be undertaken during flow events.

In addition, sediment sampling may be undertaken following flow events as a proxy for water quality given the infrequent nature of flow events within the region. The accumulation of elements in the sediment will provide an indicator of sediment quality, as well as an indicator of surface water quality and any contaminant progression within the vicinity of the Project site, and at upstream and downstream locations.

Proposed surface water sampling locations relevant to this plan will include the following:

- Within the immediate drainage/surface water capture of the IWL
- Within the immediate drainage/surface water capture of the ore stockpiles
- Within drainage basins down-stream of IWL and ore stockpiles
- Murray Creek – upstream of the Project area
- Murray Creek - downstream of the project area.

6.1.2 Groundwater

A groundwater monitoring network will be established around the operational mining area to determine baseline groundwater conditions and to detect any potential seepage and changes in groundwater quality and groundwater levels.

Monitoring would be targeted to areas affected by pit dewatering, but operational areas would also be included. These would include multiple monitoring bores (depths and locations) to represent the following areas:

- IWL
- Ore stockpiles
- Water storage areas.

6.2 Assessment criteria

The following sections present the preliminary assessment criteria for groundwater and surface water.

The proposed sampling suites and adopted criteria will need to be modified once baseline conditions (pre mining) are determined. The preliminary assessment criteria are presented in Table 6-1. The baseline conditions will allow site-specific assessment criteria to be developed including trigger and action levels for key parameters. Trigger levels will be set based on annual mean background concentrations, with the baseline data collected for at least a year to detect any natural seasonal variations.

Table 6-1 Groundwater and surface water assessment criteria

Parameter	Guideline value	Reference / comment
Physicochemical characteristics		
pH	6.0 – 8.0	Reference only – assess baseline
Electrical Conductivity	5000 µS/cm	Reference only – assess baseline
Total Suspended Solids	4000 mg/L	ANZECC 2000 Stock watering
Turbidity	TBC	Reference only – assess baseline
Major ions		
Calcium	1000 mg/L	ANZECC 2000 Stock Watering
Magnesium	TBC	Reference only – assess baseline
Sodium	180 mg/L	ADWG 2011 Aesthetic
Potassium	TBC	Reference only – assess baseline
Chloride	250 mg/L	ADWG 2011 Aesthetic
Sulphur	333 mg/L	ANZECC 2000 Stock Watering (as Sulphate S)
Carbonate	TBC	Reference only – assess baseline
Silica	80 mg/L	ADWG 2011 Aesthetic
Nutrients		
Nitrogen	5 mg/L	ANZECC 2000 Irrigation -Long-term trigger Value
Phosphorus	0.05 mg/L	ANZECC 2000 Irrigation -Long-term trigger Value
Metals		
Aluminium	5 mg/L	ANZECC 2000 Stock Watering
Arsenic	0.5 mg/L	ANZECC 2000 Stock Watering
Boron	0.5 mg/L	ANZECC 2000 Stock Watering
Cadmium	0.01 mg/L	ANZECC 2000 Stock Watering
Copper	0.5 mg/L	ANZECC 2000 Stock Watering
Mercury	0.002 mg/L	ANZECC 2000 Stock Watering
Lead	0.1 mg/L	ANZECC 2000 Stock Watering

Parameter	Guideline value	Reference / comment
Nickel	1.0 mg/L	ANZECC 2000 Stock Watering
Selenium	0.02 mg/L	ANZECC 2000 Stock Watering
Zinc	20 mg/L	ANZECC 2000 Stock Watering
Hydrocarbons		
Total Recoverable Hydrocarbons	TBC	Reference only – assess baseline
BTEX	TBC	Reference only – assess baseline

6.3 Monitoring schedule

A monitoring schedule for the pre-mining, during operation and post mining is presented in Table 6-2.

Table 6-2 Monitoring schedule

Monitoring parameters	Frequency	Comment
Pre-mining – baseline (for a period of up to two years)		
Groundwater levels	Quarterly	For all existing bores and select pastoral bores/wells
Groundwater field water quality parameters	Quarterly	For all existing bores and select pastoral bores/wells
Groundwater laboratory water quality parameters	Bi-annually	For all existing bores and select pastoral bores/wells
Surface water flow / levels	Opportunistically during flow events	At nominated locations if flow event occurs
Surface water quality field parameters	Opportunistically during flow events	At nominated locations if flow event occurs
Surface water and sediment laboratory water quality parameters	Opportunistically during flow events	At nominated locations if flow event occurs
During operation		
Groundwater abstraction volume	Continuous and monthly summaries	For all active abstraction bores
Groundwater levels	Monthly	For all existing bores and select pastoral bores/wells
Groundwater field water quality parameters	Monthly	For all existing bores and select pastoral bores/wells

Monitoring parameters	Frequency	Comment
Groundwater laboratory water quality parameters	Quarterly	All active bores and select monitoring wells
Surface water quality field parameters	Opportunistically during flow events	At nominated locations if flow event occurs
Surface water and sediment laboratory water quality parameters	Opportunistically during flow events	At nominated locations if flow event occurs
Post mining (period to be determined)		
Groundwater levels	Quarterly	For all existing bores and select pastoral bores/wells
Groundwater field water quality parameters	Quarterly	For all existing bores and select pastoral bores/wells
Groundwater laboratory water quality parameters	Bi-annually	For all existing bores and select pastoral bores/wells
Surface water flow / levels	Opportunistically during flow events	At nominated locations if flow event occurs
Surface water quality field parameters	Opportunistically during flow events	At nominated locations if flow event occurs
Surface water and sediment laboratory water quality parameters	Opportunistically during flow events	At nominated locations if flow event occurs

7. Incident response

7.1 Key indicators

Changing alkalinity is generally a good early indicator of deteriorating conditions in leachate from a IWL containing PAF or alkaline material, and can therefore be tracked as an 'early warning' mechanism.

Metal concentrations and changing pH values generally lag behind changing alkalinity therefore corrective actions can be implemented early should alkalinity fall outside the baseline range.

Other trends that highlight the onset of AMD include increasing sulfate, increasing sulfate to alkalinity ratios and sulfate to chloride ratios, decreasing pH values and an increase in soluble metals as a result. An initial set of groundwater samples will be assessed for the full suite of metals by ICP-MS such that all metals elevated in the rock are covered by baseline sampling and to provide a comparison for ASLP and barrel leach results.

7.2 Reporting

Detection of any key indicators would be reported and assessed during routine periodic monitoring and reporting that would be expected for the Project (for example annual compliance and mine reporting). However, contingency actions would need to be adopted as soon as practical following detection. This would also include notification to the appropriate regulators.

It should be noted that Under Section 29 of the Mining Management Act the Operator must report an environmental incident or serious environmental incidents as soon as practicable (also required under the Waste Management and Pollution Control Act).

The trigger for reporting an incident is any incident which causes, or is threatening or may threaten to cause pollution resulting in material environmental harm or serious harm. The NTEPA should be notified within 24 hours of the incident and following details reported:

- Incident causing or threatening to cause pollution
- Location occurred and area impacted
- Date and time
- How the pollution has occurred, is occurring or may occur
- Attempts made to prevent, reduce, control, rectify, investigation and/or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident
- Operator details.

8. Post-closure contained material management plan

Waste rock generated by mining will be stored in the IWL located to the west of the open pit. The Mine Closure Plan for the site includes overall IWL management such as ensuring that the final landform is geotechnically stable, that the surface and outer slopes of the waste rock dumps resist erosion, and that drainage from the IWL will not cause significant contamination of local surface waters or harm to local vegetation.

The process of placement and covering will be continuous to facilitate immediate and permanent capping aimed at prevention of the interaction of adverse materials with the atmosphere, particularly with rainfall. If disposal of these materials due to operational activities cannot take place immediately, materials will be provisionally encapsulated with NAF materials and then appropriately disposed of when operations permit.

On completion of mining, or progressively where the mine plan permits, PAF material could be returned to the pit for permanent encapsulation and flooding.

Runoff and seepage controls are to be included in the design in accordance with the Water Management Plan, therefore any runoff or seepage will be monitored on a regular basis and elevated concentrations detected and managed appropriately.

Further AMD monitoring should occur during the closure stage to provide critical feedback to confirm that concentrations of key AMD parameters are consistent with the existing testing.

9. Risk assessment

The following risk assessment was undertaken within the context of, and considering:

- PAF material identified during the geochemical assessment
- Metals leaching potential of the excavated material
- The mine plan and schedule
- Baseline environment and any sensitive receptors.

Given the results of the AMD laboratory assessment the primary (pre-management) risk level is currently low.

The following high level AMD risk assessment presented shows that with appropriate design and operational control measures, the residual AMD risk on site is low. This residual risk would be monitored (via the Mine Management Plan) to confirm that the design and operational control measures are effective.

Item	Risk	Impact	Primary (unmanaged) risk level			Design control measure	Operational management measure	Residual (managed) risk level			Comments
			L	C	Risk			L	C	Risk	
1	In-pit AMD material present resulting in uncontrolled AMD	• Impact on groundwater quality. • Downstream water quality impacts on ecological values from acidity, salinity or metals. • Impact on processing waters • Reputational risk.	2	3	6 Medium	• Testing to confirm chemical properties. • Contingency PAF encapsulation cells within IWLs. • Clean, dirty and contaminated water drainage systems. • Surface water management basins.	• Ongoing AMD sampling and analysis. • AMD Management Plan, with regular review. • Mine Management Plan. • Sediment and Erosion Control Plan. • Water Management Plan. • Selective materials handling and placement using mine schedule and geochemical model. • Controlled and managed site drainage and release.	2	2	4 Low	• Low sulfur content and significant apparent neutralising capacity in all lithologies (waste and ore). For example, 85% of the waste samples recorded less than 0.05% sulfides, and 97% of the ore samples were less than 0.05% sulfides. • All samples from laboratory assessment had a negative NAPP, indicating that the material is acid-consuming material (ACM) or non-acid-forming (NAF) • Leachability tests indicate the critical leachate constituents in terms of aquatic ecosystems appear to be Al, Zn and to a lesser extent Cu, based on their consistent exceedance of FAE99. • Assumes that ongoing AMD validation monitoring is undertaken, and material classified, handled and placed according to the AMD Management Plan. • Additional AMD testing to be undertaken pre-production and during production.
2	Ex-pit AMD material present resulting in uncontrolled AMD	• Impact on groundwater quality. • Downstream water quality impacts on ecological values from acidity, salinity or metals. • Impact on processing waters • Reputational risk.	3	2	6 Medium	• Testing to confirm chemical properties. • Dumps and fill areas profiled to shed and capture runoff. • Clean, dirty and contaminated water drainage systems. • Surface water management basins.	• Ongoing AMD sampling and analysis. • AMD Management Plan, with regular review. • Mine Management Plan. • Sediment and Erosion Control Plan. • Water Management Plan. • Selective materials handling and placement using mine schedule and geochemical model. • Controlled and managed site drainage and release. • Compaction of construction material and waste rock. • Covering / lining any PAF with NAF in wet season. • Returning low volumes of PAF to pit on completion of mining.	2	2	4 Low	• Low sulfur content and significant apparent neutralising capacity in all lithologies (waste and ore). For example, 85% of the waste samples recorded less than 0.05% sulfides, and 97% of the ore samples were less than 0.05% sulfides. • All samples from laboratory assessment had a negative NAPP, indicating that the material is acid-consuming material (ACM) or non-acid-forming (NAF) • Additional AMD testing to be undertaken pre-production and during production.
3	IWL cover material and design appropriateness	• Rainfall ingress into IWLs resulting in excessive leachate generation leading to increased likelihood of Risks 1 and 2. • Erosion and exposure of waste rock. • Downstream water quality impacts on ecological values from sediment and AMD. • Reputational risk.	2	3	6 Medium	• Use of appropriate cover material. • Cover materials resource assessment. • Cover trials to determine a suitable cover design.	• Mine Management Plan. • Sediment and Erosion Control Plan. • Water Management Plan. • Controlled and managed site drainage and release • Controlled placement of cover material. • Controlled and managed site drainage and release	2	2	4 Low	• Preliminary assessment indicates suitable material available – i.e. AC material. • Formal cover material resource assessment to be carried out as part of pre-production-detailed design work. • Ongoing IWL cover materials testing and design trials required.

Item	Risk	Impact	Primary (unmanaged) risk level			Design control measure	Operational management measure	Residual (managed) risk level			Comments
			L	C	Risk			L	C	Risk	
4	Dispersive waste management	• Downstream water quality impacts on ecological values from sediment. • Reputational risk.	2	3	6 Medium	• Identification and selection of appropriate cover material and cover design. • Clean, dirty and contaminated water systems	• Controlled and managed site drainage and release • Sediment and erosion control plan	2	2	4 Low	• Additional sampling and analysis to assess dispersion risk proposed pre-production.

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