PRIMARY GOLD

Appendix B - Risk Assessment Register

CDM Smith

cdmsmith.com

Section 1 Introduction

In accordance with the environment impact assessment guidance for proponents prepared by the NT EPA, and standard good practice, a risk assessment has been developed for the Project. The risk framework and assessment as described below has been used to identify the nature of risks and potential impacts associated with the Project and informed the development of appropriate management measures detailed in the Draft EIS.

In accordance with Table 1 of the NT EPA Environmental Impact Assessment Guidance for Proponents (Rev1) (NT EPA 2021a), the risk assessment framework for the Project has been developed and implemented in accordance with international best practice standard methodologies including:

- AS/NZS ISO 31000:2018: Risk management— Principles and guidelines (Standard); and
- HB 203:2006: Environmental risk management — Principles and process (Guide).

This risk assessment has also been developed with consideration of the NT EPA Environmental Factors and Objectives (NT EPA 2021b), inputs from stakeholders during Project consultation and submissions received on the Project referral documentation, and subsequent ToR. The framework has been developed and assessment completed to ensure that residual impacts can be managed in a manner that the objectives of each environmental factor and stakeholder expectations can be met.

The Project and associated activities have been subject to a site-specific risk assessment. The objective of the risk assessment is to ensure that any significant risks are identified, evaluated and 'treated' to mitigate these risks. The risk assessment framework provides a mechanism for the proponent to identify and proactively address potential significant risk. It also demonstrates to stakeholders and regulators that the proposed Project risks have been considered in accordance with relevant guidelines and good practice, and that risk mitigation is appropriate to minimise any potential impacts.

While the assessment is specific to this Project, the basis of the framework stems from the risk assessment developed for Primary Gold's Toms Gully Underground Project. The risk framework for that project was submitted with the draft EIS, but reconfigured and resubmitted in the Supplement to the EIS where it addressed comments from the NT EPA. Given the NT EPA's acceptance of the updated risk framework for the Toms Gully Underground Project, and with alignment with the contemporary approach to risk assessment and evaluation, the same framework has been broadly utilised for this Project.

Section 2 Risk Assessment Process and Methodology

The requirement for a risk assessment for the Project was identified in the EIS ToR, with specific reference to considering impacts to terrestrial ecosystems and hydrological processes. In accordance with NT EPA Environmental Impact Assessment Guidance for Proponents (NT EPA 2021a), the risk assessment accounts for all six environmental factors listed in the EIS ToR:

1. Terrestrial environmental quality;
2. Terrestrial ecosystems;
3. Hydrological processes:
4. Inland water environmental quality;
5. Aquatic ecosystems; and
6. Community and economy.

This section describes how potential environmental risks from the implementation of the Project have been identified, evaluated and treated. Primary Gold has considered risks arising from all phases of the Project including recommissioning, operation, temporary shutdowns, care and maintenance, decommissioning and closure.

Primary Gold has undertaken consultation with the relevant stakeholders (outlined in Section 3) to determine the perceived key risks associated with the Project. Through this consultation, PGO has collaborated with relevant stakeholders and developed the risk assessment and management of key risks.

The risk assessment will be re-evaluated annually during the life of the mine (or when a significant change is made to the Project). This will ensure any new risks can be identified and treated to be maintained at a "As Low As Reasonably Practicable" (ALARP) level.

2.1 Risk Identification

Risk relates to the effect of uncertainty on objectives. These objectives are primarily environmental goals within the Draft EIS, as well as the objectives of the NT EPA for each environmental factor applicable to the Project. Risks are determined and assessed using a combination of the likelihood of occurrence and the consequence of an event. Identifying risks for the Project recommissioning, operational, decommissioning and closure phases are based on the failure of control(s) associated with the environment, people, infrastructure or equipment in hazardous situations. The assessment considered potential direct, indirect and cumulative impacts.

Identifying the source of the risk, the likelihood of occurrence and the consequence of that occurring; the treatment or mitigation of the risk to reduce its impact, and determining the remaining residual risk has been undertaken using a standard qualitative risk matrix (Table 2-1). This process is aligned to the AS /NZS ISO 31000:2018 standard. This framework also aligns with the NT EPA Environmental Impact Assessment Guidance for Proponents (NT EPA 2021a), which states:

"Provide information that permits the general reader to understand the likelihood of occurrence and severity of each potentially significant environmental impact presented by the proposal. Consideration of risks presented by the proposal may be guided by undertaking a risk assessment consistent with the AS/ISO 31000 risk management series…..the analysis, including development of likelihood and consequence ratings for inherent and residual risk assessments, is to be based on referenced and relevant actual data and modelled predictions as appropriate." (p.15 - 16)

The NT EPA decision to require an EIS for the Project was based on risks detailed in the Statement of Reasons for the decision. These included risks to:

- Threatened species;
- Sensitive vegetation;
- Aquatic ecosystems; and
- Community safety.

An initial risk assessment was undertaken early, at the preliminary stage of the Draft EIS development to identify the key environmental, community and cultural risks. The initial assessment identified key risks to guide the site-specific technical studies that needed to be undertaken. This initial risk assessment was supported by two internal risk assessment workshops in June and July 2021.

The initial workshop was completed by a group of environmental professionals with wide-ranging expertise in environmental assessment and the relevant technical aspects. The first workshop was aimed at identifying known risks and completing the initial risk assessment. This allowed for an informed second workshop involving the same practitioners (including suitably experienced environmental scientists and hydrogeologists) and technical mining personnel from Primary Gold. The risk assessment workshop focused on the following key risk areas:

- Failure of existing / new infrastructure;
- Acid, Neutral and Saline Mine Drainage;
- Implication from geochemistry of the overburden material;
- Water management;
- Erosion and Sedimentation;
- Biodiversity;
- Human Health and Safety;
- Rehabilitation and Closure;
- Cultural Heritage; and
- Community and economic impacts.

A preliminary risk register was developed as a result of this initial risk assessment workshop. Once all technical assessments for the Draft EIS were completed, the assessment was revisited to confirm any additional risks that had been identified through the technical assessment, and to validate inherent and residual risk conclusions, and update these conclusions where relevant. The methodology is presented in Figure 2-1.

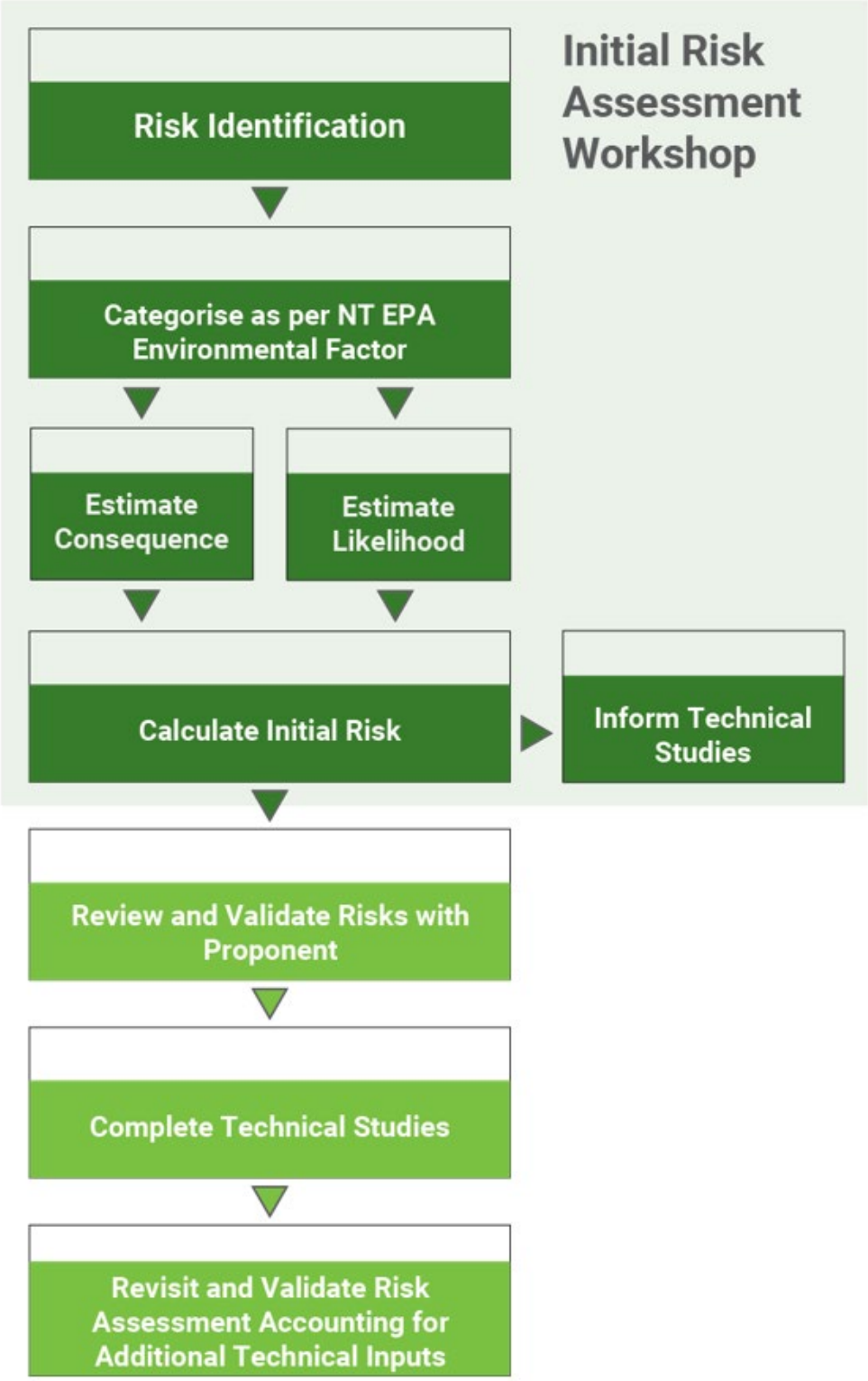


Figure 2-1 Project Risk Assessment Methodology

The risk assessment process is generally consistent with the basic methodology for hazard analysis presented in the NSW Guidelines for Hazard Analysis (Department of Planning 2011); however, has been augmented to align better with the NT EPA EIS development process, and the review of risks once technical studies were completed.

2.2 Risk Matrix

Assessment of risk has been conducted through pragmatic consideration of the circumstances around risks, identifying necessary controls to address potential impacts and assuming effective implementation of planned and committed mitigation of potential impacts. While prioritisation has been given to avoidance as per the environmental decision-making framework, mitigation is proposed, where possible, to achieve a reduced residual risk (risk after mitigation) to below "Extreme" or "High" risk outcomes to the extent reasonably practicable.

Table 2-1 provides a summary of the qualitative risk matrix adopted and the levels of risk for the various consequence and likelihood combinations.

Table 2-1 Qualitative Risk Analysis Matrix

	Consequence				
Likelihood	**(1) Insignificant**	**(2) Minor**	**(3) Moderate**	**(4) Major**	**(5) Significant**
(A) Almost certain	High (15)	High (10)	Extreme (6)	Extreme (3)	Extreme (1)
(B) Likely	Moderate (19)	High (14)	High (9)	Extreme (5)	Extreme (2)
(C) Possible	Low (22)	Moderate (18)	High (13)	Extreme (8)	Extreme (4)
(D) Unlikely	Low (24)	Low (21)	Moderate (17)	High (12)	Extreme (7)
(E) Rare	Low (25)	Low (23)	Moderate (20)	High (16)	High (11)

Extreme	1	8
High	9	16
Moderate	17	20
Low	21	25

Definitions of likelihood are provided in Table 2-2. Likelihoods are categorised around the probability of occurrence, within the context of reasonable timeframes and frequencies given the Project life. A brief description of each risk classification and interpreted outcome is also provided below in Table 2-3.

Table 2-2 Definition of Likelihood Classification

Rating	Likelihood	Frequency	Probability	Occurrence as Percentage
A	Almost certain	More than once per month	The event is expected to occur at some time as there is a history of continuous occurrence with similar projects/activities	91-100%
B	Likely	Less than once per month, but more than once per year	There is a strong possibility the event will occur as there is a history of frequent occurrence with similar projects/activities.	61-90%
C	Possible	Less than once per year, but more than once per five years	The event might occur at some time as there is a history of infrequent occurrence of similar issues with similar projects/activities.	41-60%
D	Unlikely	Less than once per five years	Not expected, but there's a slight possibility it may occur at some time.	11-40%
E	Rare	Unlikely to ever occur	Highly unlikely, but it may occur in exceptional circumstances.	0-10%

Table 2-3 Description of Risk Classification

Rating	Definition
Extreme	Unacceptable risks primarily critical in nature in terms of consequences (e.g. extensive and long term environmental harm, permanent sacred site damage, fatality, massive economic impacts) that are considered a possibility through to almost certain to occur. Such risks significantly exceed the risk acceptance threshold and require comprehensive control measures, and additional urgent and immediate attention towards the identification and implementation of measures to reduce the level of risk.
High	Typically relate to significant to critical consequences (e.g. a major environmental or heritage damage, and considerable safety, social or economic impacts) that are inclined to cut across the possible to almost certain likelihood ratings. These are also likely to exceed the risk acceptance threshold and although proactive control measures have been planned or implemented, a very close monitoring regime and additional actions towards achieving further risk reduction is required
Moderate	As suggested by the classification, medium level risks span a group of risk combinations varying from relatively low consequence / high likelihood to mid-level consequences /mid-level likelihood, to relatively high consequence / low likelihood scenarios across environmental, social and economic areas. These risks are likely to require active monitoring as they are positioned on the risk acceptance threshold
Low	These risks are below the risk acceptance threshold and although they may require additional monitoring in certain cases are not considered to require active management. In general, such risks represent relatively low likelihood and low to mid-level consequence scenarios.

Table 2-4 describes the types of consequences that have been identified and assessed as part of the risk assessment process. These are grouped into the NT EPA environmental themes and factors, to demonstrate direct line-of-sight of the evaluation of risk with the key environmental factors as per the NT EPA objectives.

Table 2-4 Consequence Classification

NT EPA Themes and Factors		Consequence				
Theme	**Factors**	**(1) Insignificant**	**(2) Minor**	**(3) Moderate**	**(4) Major**	**(5) Significant**
Land	**Terrestrial Environmental Quality**	Negligible impact to isolated area	Contained low impact, not impacting on any environmental values of soil or land	Uncontained impact, able to be rectified in short-term without causing pollution or contamination to soil or land	Extensive hazardous impact on an environmental value requiring long-term remediation of soil or land	Uncontained hazardous impact with residual effect, even with long term remediation of soil or land
	Terrestrial Ecosystem	Alteration or disturbance to an isolated area that is unlikely to affect the habitat, species or ecosystem functioning	Alteration or disturbance to less than 5% of a habitat, species or ecosystem functioning resulting in a minor, recoverable impact within 1 year	Alteration or disturbance to 5-30% of a habitat, species or ecosystem functioning resulting in a moderate, recoverable impact within 1-2 years	Alteration or disturbance to 30-70% of a habitat, species or ecosystem functioning result in a major, recoverable impact within 3-10 years	Alteration of more than 70% of a habitat, species or ecosystem functioning resulting in an extinction or permanent change, or reduce threshold level below 30%. Recovery, if possible is greater than 10 years
Water	**Hydrological Processes**	Negligible impact to hydrological processes in Project area (surface or groundwater) and no consequence to the use of water	Contained low impact to hydrological processes in Project area (surface or groundwater) with minor recoverable impact within 1 year	Uncontained impact to hydrological processes that will affect the use of the water including outside the Project area but can be remediated in the short-term (1-2 years)	Extensive impact to hydrological processes that will affect the use of the water including outside the Project area and requires long-term remediation (3-10 years)	Uncontained hazardous impact to hydrological processes with residual effect, even with long-term remediation (greater than 10 years)
	Inland Water Environmental Quality	Negligible impact to water quality (surface or groundwater) in Project area and no consequence to the human or ecological uses of the water	Contained low impact to water quality (surface or groundwater) in Project area with minor recoverable impact within 1 year	Uncontained impact to water quality that will affect the human or ecological use of the water including outside the Project area but can	Extensive impact to water quality that will affect the human or ecological use of the water including outside the Project area and	Uncontained hazardous impact to water quality with residual effect, even with long-term remediation (greater than 10 years)

NT EPA Themes and Factors		Consequence				
				be remediated in the short-term (1-2 years)	requires long-term remediation (3-10 years)	
	Aquatic Ecosystems	Negligible impact to aquatic ecosystems through quality or flow changes in Project area, but unlikely to affect the habitat, species or ecosystem functioning	Contained low impact to aquatic ecosystems through quality or flow changes in Project area, with minor recoverable impact within 1 year	Uncontained impact to aquatic ecosystems through quality or flow changes, with moderate consequence to habitat, species or ecosystem functioning including outside the Project area but can be remediated in the short-term (1-2 years)	Extensive impact to aquatic ecosystems that will affect the species or ecosystem functioning including outside the Project area and requires long-term remediation (3-10 years)	Uncontained impact to aquatic ecosystem with residual effect, even with long-term remediation (greater than 10 years)
People	**Community and Economy**	Incident with or without minor injury. No impact on human health or very minor short term inconvenience or symptoms OR Adverse local social or economic implications that are brief or periodic	Injuries requiring first aid treatment. Minor short term inconvenience or symptoms to human health OR Adverse local or regional, social or economic implications that last for 1 year	Injury or illness requiring medical treatment. Short term or reversible disabling effect (impairment) to human health OR Adverse local or regional, social or economic implications that last for 1-2 years	Injuries requiring hospitalisation. Serious long term or permanent disabling effects on human health Adverse local, regional or territory-wide, social or economic implications that last for 3-10 years	Loss of life / fatality or long term or permanent disabling effects on human health Adverse local, regional territory-wide or national, social or economic implications that last for greater than years

The level of certainty surrounding the proposed risk rankings was also assessed in accordance with Table 2-5. Where proposed mitigation measures resulted in a reduction in risk ranking from inherent risk to residual risk, justifications for this were also provided.

Table 2-5 Level of Certainty

Control Rank	Description	Guidance
C1	Low	Risk ranking is based on subjective opinion or relevant past experiences.
C2	Moderate	Risk ranking is based on similar conditions being observed previously and/or qualitative analysis.
C3	High	Risk ranking is based on testing, high fidelity modelling or simulation, use of prototype or experiments. Analysis is based on verified models and/or data. Assessment is based on an historical basis.

2.3 Risk Treatment

In accordance with the NT EPA Guidance on preparing an Environmental Impact Statement (NT EPA 2021a), when considering risk mitigation, the environmental decision-making hierarchy has been used to guide the identification and selection of appropriate controls. As per the guideline, proponents must demonstrate that the environmental decision-making hierarchy has been applied to avoid or mitigate potentially significant environmental impacts where practicable. Section 26 of the *Environment Protection Act 2019* states the environmental decision-making hierarchy is as follows:

a. *"Ensure that actions are designed to avoid adverse impacts on the environment;*

b. *Identify management options to mitigate adverse impacts on the environment to the greatest extent practicable; and*

c. *If appropriate, provide for environmental offsets in accordance with the Act for residual adverse impacts on the environment that cannot be avoided or mitigated.*

In making decisions in relation to actions that affect the environment, proponents must ensure that the potential for actions to enhance or restore environmental quality is identified and provided for to the extent practicable."

The hierarchy has been used in developing the risk assessment matrix to assist in applying appropriate mitigation measures where risks cannot be avoided. Generally, mitigation measures for significant environmental risks include adaptive management or ongoing monitoring. Each of the key environmental factor sections also provide an avoidance, mitigation and management sub-section that prioritises measures to avoid in accordance with the hierarchy.

2.4 Risk Evaluation and Assessment

The risk evaluation and assessment section provides a discussion of the key outcomes of the risk assessment. The risk assessment provides a good understanding of the Project risk profile and has enabled priority risks to be highlighted in order to minimise the likelihood of occurrence and / or the consequence severity. Risk assessments were based on the outcomes of planned mitigation and monitoring to detect incipient or actual failure of management systems.

It is important to note that the likelihood and consequence of risks vary across the Project stages. For example, the risk of impacts from vegetation clearing are highest during the construction stage, whereas failure from the tailings dam may be greatest during operations. The risk assessment process has considered the applicable stages and based the assessment of residual risk on the stage for which the greatest risk is expected.

2.4.1 Identified Risks

In total, 47 different sources of environmental, health, social and economic risks were identified and evaluated. Of these, 26 of the risks applied to the land theme, 29 to the water theme and 11 to the people theme. The risk assessment was completed against each of the environmental factors and many of the risks applied to multiple factors. A full list of the identified risk and the applicable factors is provided in Table 2-6. While the risk or source of potential impact may be the same, the consequence is different based on the environmental factor considered (e.g. a chemical spill has different consequences to terrestrial environmental quality (land and soil) then to aquatic ecosystems). These differences have been considered in the risk assessment.

Table 2-6 Identified Risks and Relevant Factors

		Relevant Factor					
No.	Risk / Potential Source of Impact	Terrestrial Environmental Quality	Terrestrial Ecosystem	Hydrological Processes	Inland Water Environmental Quality	Aquatic Ecosystems	Community and Economy
1	Vegetation clearing for the Project	✓	✓	✓	✓	✓	
2	Overtopping, embankment failure or seepage from the new TSF at Rustlers Roost leading to uncontrolled release of tailings material to surrounding environment.	✓	✓	✓	✓	✓	
3	Overtopping, embankment failure or seepage from the process water storage ponds at Rustlers Roost leading to uncontrolled release of process water to surrounding environment.	✓	✓	✓	✓	✓	
4	Embankment failure or seepages from the new WRDs at Rustlers Roost and Quest 29 to surrounding environment.			✓	✓	✓	
5	Embankment failure of Annies Dam water storage and uncontrolled water and sediment release (temporary risk noting closure of dam for Rustlers Roost TSF).	✓		✓	✓	✓	
6	Poor quality runoff or seepage from the historic WRDs and heap leaches.	✓			✓	✓	
7	Groundwater drawdown			✓			
8	Poor water quality released from site during wet season (stormwater).		✓		✓	✓	
9	Geotechnical instability and failure of pit wall, TSF or WRD walls.	✓					
10	Indiscriminate use of existing waste rock for construction. Storage of waste rock outside of pit footprint for too long.	✓		✓	✓		
11	Pit and groundwater dewatering exposing PAF and causing AMD			✓	✓		
12	Failure of process tanks/pipes/pumps.	✓					
13	Planned pit over topping or release to surface water features during extreme rainfall and flooding events.			✓	✓	✓	

No.	Risk / Potential Source of Impact	Relevant Factor					
		Terrestrial Environmental Quality	Terrestrial Ecosystem	Hydrological Processes	Inland Water Environmental Quality	Aquatic Ecosystems	Community and Economy
14	Unplanned pit overtopping or release to surface water features during extreme rainfall and flooding events.			✓	✓	✓	
15	Erosion of site infrastructure leading to sedimentation	✓		✓	✓		
16	Release of hazardous chemicals or materials during storage and handling onsite.	✓	✓	✓	✓	✓	
17	Release of hazardous chemicals or materials during transportation to site.	✓	✓				
18	Poor handling and management of tailings and waste rock			✓	✓	✓	
19	Production of domestic waste and storage of the waste onsite	✓	✓	✓	✓		
20	Unfinished/unsuccessful rehabilitation of Project due to inadequate funds or natural disaster (e.g. cyclone).	✓	✓	✓	✓	✓	
21	Long term positive water balance.			✓		✓	
22	Pit lake becomes a groundwater source.				✓	✓	
23	Inability to establish native vegetation by local provenance species with resultant cover comparable to nearby areas	✓	✓				
24	Lack of rehabilitation materials leads to inadequate tailings closure and poor quality site rehabilitation.	✓	✓		✓	✓	
25	Inappropriate management of the decommissioned site, post closure landform.	✓	✓	✓	✓	✓	✓
26	Ineffective operational implementation of site environmental management system, plans and procedures.	✓	✓	✓	✓	✓	
27	Use of project machinery, equipment, vehicles and activities causing fire through sparks or heat ignition source.	✓	✓		✓		
28	Dust generation from project activities such as vehicular movements and earthworks.	✓	✓		✓		
29	Noise and vibration emissions from construction and operational activities (e.g. vehicle movements and blasting).		✓				
30	Emissions or project infrastructure visible in publicly accessible lands.						
31	Construction and operational activities (incl. vegetation clearing) result in introduction of new weeds and spread of existing weeds into new areas.		✓			✓	
32	Increased density of weed infestations.		✓				

No.	Risk / Potential Source of Impact	Relevant Factor					
		Terrestrial Environmental Quality	Terrestrial Ecosystem	Hydrological Processes	Inland Water Environmental Quality	Aquatic Ecosystems	Community and Economy
33	Emissions from clearing, dust, noise, artificial light associated with construction and/or operation of the mine site.						✓
34	Vehicle/machinery interaction with terrestrial fauna		✓				
35	Inappropriate liquid and solid waste disposal.	✓		✓	✓	✓	
36	As part of closure and rehabilitation, creeks and drainage alignments are not consistent to the surrounding landforms and catchment area			✓			
37	Financial capacity or feasibility to implement project becomes unviable due to Au price change, fuel cost increases or change in metallurgical recoveries of ore.						✓
38	Major mechanical failure of processing plant				✓	✓	✓
39	Ore Reserve modelling estimation error						✓
40	Skilled labour shortages						✓
41	Additional highway commuter traffic and associated road safety concerns.						✓
42	Influx of workers to the local community seeking housing						✓
43	Influx of workers to the local community in general						✓
44	Increased demand for local services and supplies						✓
45	Disturbance of sites/objects of heritage significance heritage items or places and sacred sites.						✓
46	Artificial light emissions from construction and/or operation of the mine site.		✓				
47	Construction of waterway crossing altering flow regimes with increased risk of erosion and sedimentation.					✓	

2.4.2 Risk Assessment Results

Table 2-7 summarises the outcomes of the risk assessment process. The specific consequence and likelihood scenarios are detailed in the attached spreadsheet along with the residual risk rating, based on a reasonable assumption of effective implementation of the control measures described. Ongoing monitoring and management will be required to validate the effectiveness of these controls, audit their implementation and identify other measures or different approaches that may be required to achieve and maintain acceptable risk levels.

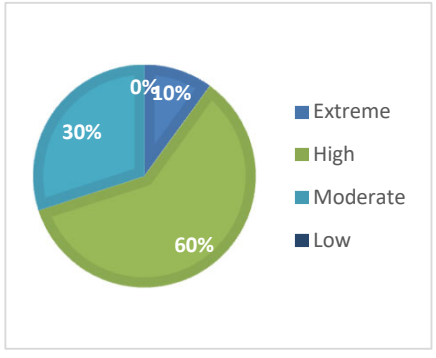
The results of the risk assessment have been used to inform an assessment of whether the Project achieves the NT EPA objectives for the relevant environmental factors (refer to Table 12-1 in the Draft EIS).

Table 2-7 Summary of Risks

	Land				Water						People	
	Terrestrial Environmental Quality		Terrestrial Ecosystems		Hydrological Processes		Inland Water Environmental Quality		Aquatic Ecosystems		Community and Economy	
Risk Level	**Inherent**	**Residual**	**Inherent**	**Residual**	**Inherent**	**Residual**	**Inherent**	**Residual**	**Inherent**	**Residual**	**Inherent**	**Residual**
Extreme	2	0	2	0	4	0	5	0	5	0	2	0
High	12	0	13	1	8	1	9	0	8	0	2	0
Moderate	6	11	4	12	7	9	9	12	7	11	2	2
Low	0	9	0	6	1	10	1	12	1	10	5	9
Total	**20**	**20**	**19**	**19**	**20**	**20**	**24**	**24**	**21**	**21**	**11**	**11**

Terrestrial Environmental Quality

Inherent Risk



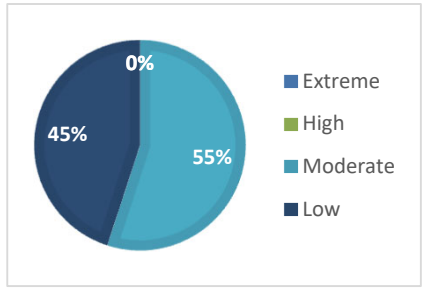
Extreme	High	Moderate	Low
2	12	6	0

Total	20

Residual Risk

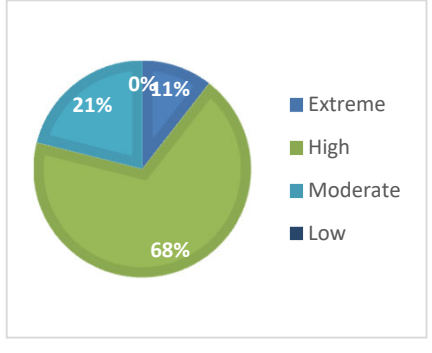
Extreme	High	Moderate	Low
0	0	11	9

Total	20



Terrestrial Ecosystems

Inherent Risk



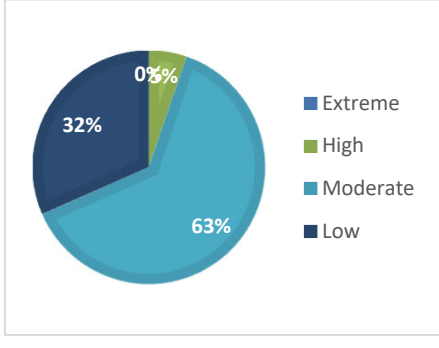
Extreme	High	Moderate	Low
2	13	4	0

Total	19

Residual Risk

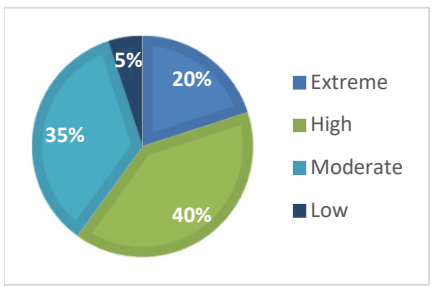
Extreme	High	Moderate	Low
0	1	12	6

Total	19



Hydrological Processes

Inherent Risk



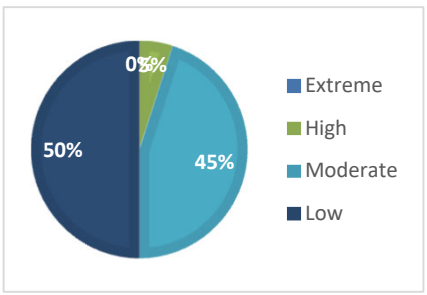
Extreme	High	Moderate	Low
4	8	7	1

Total	20

Residual Risk

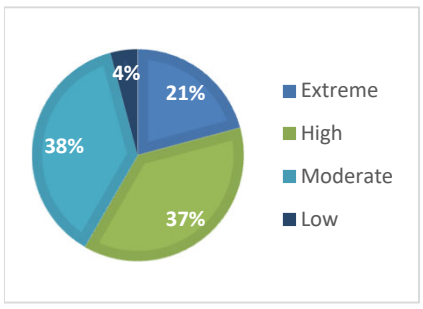
Extreme	High	Moderate	Low
0	1	9	10

Total	20



Inland Water Environmental Quality

Inherent Risk



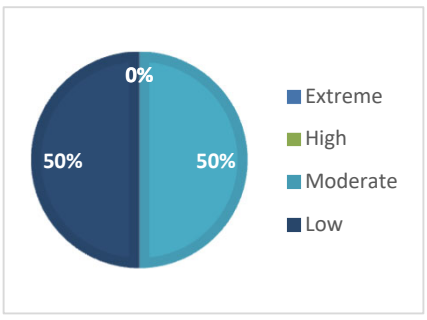
Extreme	High	Moderate	Low
5	9	9	1

Total	24

Residual Risk

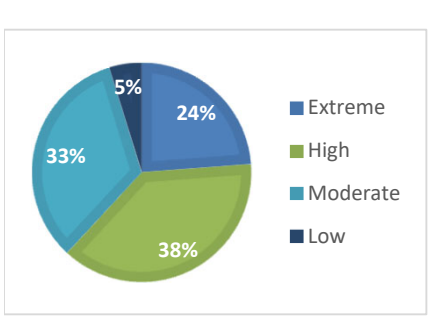
Extreme	High	Moderate	Low
0	0	12	12

Total	24



Aquatic Ecosystems

Inherent Risk



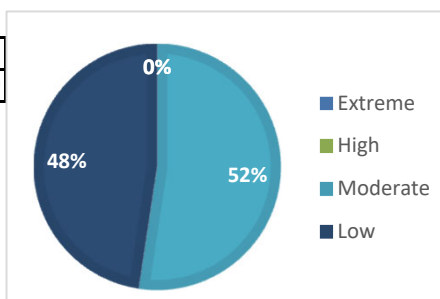
Extreme	High	Moderate	Low
5	8	7	1

Total	21

Residual Risk

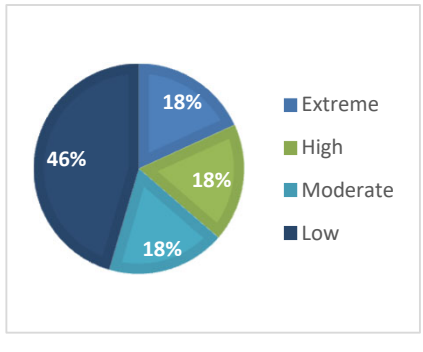
Extreme	High	Moderate	Low
0	0	11	10

Total	21



Community and Economy

Inherent Risk



Extreme	High	Moderate	Low
2	2	2	5

Total	11

Residual Risk

Extreme	High	Moderate	Low
0	0	2	9

Total	11

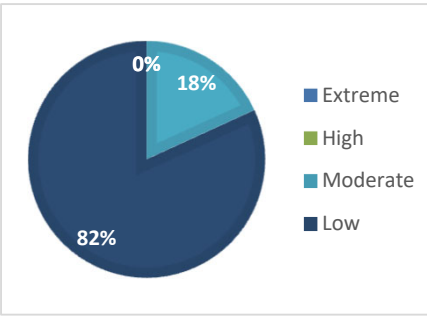


Table 1: Terrestrial Environmental Quality

Inherent Risk										Residual risk					
Risk #	Source of Impact	Consequence	Project Phase(s)	Discussion	Likli	Cons	Risk	Risk	Mitigation & Management	Likli	Cons	Risk	Risk	Level of Certainty	Justification of Certainty and Residual Risk
TEQ-1	Vegetation clearing for the Project	**Direct** - Disturbing an additional 344.5 ha of land for the Rustlers Roost. 44.6 ha for Q29, 7.3 ha for the accommodation camp and 1.1 ha for the haul road (total of 397.5 ha). Resulting in destabilised soils. Potential soil erosion, loss of topsoil and sedimentation (through both water and wind erosive forces). Characteristics of soils, including chemical, physical, biological and aesthetic qualities are degraded in the vegetation clearing area. Resulting in less productive soils and potential impacts (through the abovementioned erosion) on adjacent land. **Indirect or Cumulative** - Increased disturbance and lost productivity of soils in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area. Resulting in reduced local capacity of soils to perform ecological functions and a cumulative increase in erosion contributing to dust and waterway sedimentation.	Construction Operation	The proposal area is predominantly low hills to rises. Existing vegetation and extensive stone surface outcrops provide land stability; however, land disturbed on slopes >2 % may have increased surface water runoff velocities and consequently a higher erosion risk. Rudosols, kandosols and hydrosols are all mapped as occurring within the proposed vegetation clearing area. Rudosols and kandosols are known to be highly erodible soils types and will thus need appropriate controls to prevent offsite movement through erosion. TSF at Rustlers Roost construction will occur during the dry season of the construction and development phase. The area will be cleared and topsoil stripped and stockpiled for later use. The foundation will be worked and any unsuitable material removed to prepare the ground for construction.	A	4	3	Extreme	> Adherence to Ground Disturbance Procedures. > Progressive clearing and rehabilitation. > Implement erosion and sediment controls in accordance with an ESCP. >Only clearing what is absolutely necessary for the portion of the project to be implemented. > Implementation of Biodiversity Management Plan. > Clearly mark limits of clearing. > Make use of already disturbed areas where possible. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines. > Avoid land clearing during the Wet Season (Dec-May).	C	2	18	Moderate	C3	Adherence to ESCP controlled developed in accordance with IECA international standards is widely accepted as preventing or limiting offsite impacts from soils destabilisation and erosive factors.
TEQ-2	Overtopping, embankment failure or seepage from the new TSF at Rustlers Roost leading to uncontrolled release of tailings material to surrounding environment.	**Direct -** Contamination of surrounding land and alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on soil quality (pyrite, pyrrhotite and arsenopyrite are expected to be present in tailings in quantities that will be Potentially Acid Forming). Impact on structural integrity of engineered embankments threatening additional failures and contaminant releases (e.g. adjacent decommissioned heap leach pad). **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminate of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants. There is also risks from NORMS through use of waste rock for construction material.	Construction Operation Decommissioning Closure	The TSF will have a total 40 MT capacity. The TSF is to be constructed of geochemically benign and structurally appropriate material. The finalised TSF lining design requirements will be determined from the geochemical characterisation of the ore. It is not expected that tailings will contain high levels of cyanide as residual cyanide will we removed from tailings during the refining process and reused in the processing circuit. The TSF construction will include the following features: > An underdrainage system will be constructed to minimise seepage losses and maximise recovery. > A seepage recovery tower will be installed to pump the underdrainage back into the TSF. > A decant tower will be installed within the decant pond of the TSF to return water to the processing facility for reuse. > An emergency spillway constructed as part of each wall raise. Design criteria set for the spillway in accordance with ANCOLD. Likelihood of uncontrolled releases from the spillway into the environment under 'emergency' conditions (e.g. extreme rainfall) is low as the TSF wall is to be built higher than the level of the waste and the spillway during each of the operational stages. The risk is only likely when the tailings dam is in the final stage. A number of seepage control and underdrainage collection features have been integrated into the design. The seepage control and underdrainage collection systems will consist of the components as follows: > Cut-off trench. > Compacted soil liner (CSL). > Basin underdrainage collection system overlying the CSL, including collectors (in drainage courses) and finger drains (30 m spacing over TSF basin area). > Underdrainage collection sump. > Embankment toe drain.	E	5	11	High	> TSF to be planned, designed, constructed and operated in accordance with approaches details in the guideline Tailings Management: Leading Practice Sustainable Development Program for the Mining Industry (DFAT 2016). > Design TSF to contain a range of design storm and rainfall sequence events up to and greater than the required design criteria. > An operational emergency spillway to be constructed as part of each embankment raise. > Development of Monitoring Plan / Operational Manual which includes weekly inspections of the TSF, survey pins to monitor the embankment and piezometers to measure pore water pressure. > Tailings performance monitoring (e.g. TSF water volume, collection efficiency of underground system). > Install seepage control and underground drainage including a cut-off trench, compact soil liner, basin underdrainage collection system, underdrain collection sump and embankment tow drain. > Groundwater monitoring to check quality and any seepage. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water.	E	3	20	Moderate	C3	High level of certainty that the new tailings embankment will remain stable. Based on historical use of the TSF at the nearby Toms Gully Mine in the same geology. Geotech studies and engineering design and modelling. Specifically: > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021); > Geotechnical assessment for the site Further, no previous instability issues with either the existing waste rock dumps or leach pads at the Rustlers Roost or Quest 29 sites. Justification also based on the TSF being designed, constructed and operated in accordance with leading practice (ANCOLD).
TEQ-3	Overtopping, embankment failure or seepage from the process water storage at Rustlers Roost leading to uncontrolled release of process water to surrounding environment.	**Direct -** Contamination of surrounding land and alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on soil quality (pyrite, pyrrhotite and arsenopyrite are expected to be present in tailings in quantities that will be Potentially Acid Forming). Impact on structural integrity of engineered embankments threatening additional failures and contaminant releases (e.g. adjacent decommissioned heap leach pad). **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants in environmental pathways should the same contaminants be released from the nearby Toms Gully Mine or already be present in the environment due to historic activities.	Operation, Decommissioning Closure	The process water will be stored in the northern portion of the TSF, utilising the TSF structure and safety features. This will hold water from the process circuit and provides buffering between the TSF decant and the process itself. Process water quality may contain AMD contaminants. The process water storage will receive both return water from decant pond and stormwater runoff from processing plant. Mined ore will be processed using a CIL processing method, which extracts gold from the ore by mixing with a cyanide solution. Tailings within the processing circuit, will be screened to recover carbon and then will go through a detoxification to remove residual cyanide. The recovered carbon and residual cyanide will be reused in the processing circuit. Despite the reuse of cyanide there is potential for residual cyanide in the process water.	E	5	11	High	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams. > Groundwater monitoring. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water. > Storage and management of cyanide in accordance with the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (2008). > Water quality monitoring, reporting in accordance with ANZECC & ARMCANZ(2000) guidelines.	E	3	20	Moderate	C3	High level of certainty that the new process water dam embankments (TSF embankments) will remain stable. Based on historical use of dams at the Rustlers Roost Mine in the same geology and general soil structure. Geotech studies and engineering design and modelling. > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021); > Geotechnical assessment for the site. No previous instability issues with either the existing dams or other structures (e.g. Leach pads) at the Rustlers Roost or Quest 29 sites. Justification also based on the process water dam being designed, constructed and operated in accordance with leading practice.

TEQ-4	Embankment failure of Annies Dam water storage and uncontrolled water and sediment release.	**Direct -** Adverse impacts to Marrakai Creek and downstream aquatic ecosystems with movement and deposition of sediments and damage to vegetation and fauna downstream. Localised severe scouring of the topsoils in the area surrounding the breach and exposure of subsoils to erosive factors. Impact on structural integrity of engineered embankments. **Indirect or Cumulative** - Potential increase in cumulative concentration of sediments within the Marrakai Creek and Adelaide Rivers as a result of any sediment discharged. Increased downstream depositions and siltation impacts. Also, indirect impact of reduced ability for successful revegetation due to loss of topsoils.	Construction, Operation	Annies Dam is in the western portion of the Rustlers Roost Mine Lease/Project area and is positioned on the boundary of the Mount Bundey Creek catchment to the east and Marrakai Creek to the west. The dam is an earthen embankment constructed on the upper reaches of the Marrakai Creek catchments. Any overflow or discharges from the dam flow to the west and north of the ML towards Marrakai Creek. There are no known habitable dwellings on the reach of the contributing creek to Marrakai Creek down to the Adelaide River. The capacity of the dam is relatively small at 200,000 kL. Any breach would likely be partial and is unlikely to result in the complete discharge of the entire 200,000 kL; nevertheless, such worst-case scenario must be considered in the risk assessment. It is also important to note that Annies Dam is a retention dam created to supply raw water for previous operations at the site. Therefore, the dam has been in place since at least cessation of the previous mining operation in 1997. Further, there is a high-level diversion south of the dam wall aimed at preventing overtopping. Given the long-term emplacement, the very limited upstream catchment and the existing high level diversion, the likelihood of an embankment failure should be considered in the low range. Further, Annies Dam is located in the area of the proposed TSF. Annies Dam is proposed to be decommissioned (drained and embankment removed to allow free draining) early in the project (1-4 years). Therefore, the period that this risk is relevant is limited.	E	3	20	Moderate	> Structural stability and integrity inspections of the existing dam wall and diversion in accordance with standard engineering practices. > Water Management Plan. > Weekly inspections to check sufficient freeboard and structural integrity.	E	2	23	Low	C3	High level of certainty that the wall will not fail based on longevity of the existing structure, lack of issues since original construction, existence of a diversion to prevent overtopping and regular monitoring. Note - this risk and confidence ratings are based on the current design that does not include construction of any additional impervious areas in the dam runoff area/catchment (i.e. no significant increase in runoff).
TEQ-5	Poor quality runoff or seepage from the historic WRDs and heap leaches.	**Direct -** Contamination of soil and groundwater medium. alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct species health implication (reduced physical health or mortality) depending on contaminant in seepage material. Inability of impacted soils to maintain biological qualities to support standard flora and fauna. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants in environmental pathways should the same contaminants be released from the nearby Toms Gully Mine or already be present in the environment due to historic activities.	Construction Operation Decommissioning Closure	On completion of mining Zamu pit, the pit will be backfilled with waste material from mining of the remaining Quest 29 pits. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. The sulphide WRD has AMD material within it and therefore drainage and runoff needs to be managed appropriately. The historic WRDs at Rustlers Roost and Q29 will be augmented to either new pits (Q29) or expansion as a WRD (Rustlers Roost) Seepage and runoff from WRD is highly likely and therefore almost certain for AMD to occur. This will be monitored closely during all phases of the Project. Sampling of the waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019)	D	3	17	Moderate	> Continued use of drainage controls and bunds > Maximise runoff pond capacity prior to wet season >Ongoing monitoring of existing groundwater bores > Investigation and consideration of long-term closure options > Cap with suitable waste rock > Calculations, identification and provisioning of suitable cap material > Implementation of AMD management plan > Daily inspections for runoff and drainage problem areas	D	2	21	Low	C3	High level of certainty that the seepage and runoff can be contained and treated based on the water balance model. Previous mitigation used at Toms Gully. Site treatment plant in use. WRD material sampling data. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019)
TEQ-6	Geotechnical instability and failure of pit wall, TSF or WRD walls.	**Direct -** Loss of ground stability in the are surrounding the wall failure resulting movement and deposition of sediments and damage to vegetation and fauna habitat. Localised increase in groundwater levels. Impact on structural integrity of engineered embankments. Ecological impacts of the earth failure in the immediate area. **Indirect or Cumulative** - Potential indirect ground or landform instability beyond the initial failure area (unlikely to be widespread).	Construction Operation Decommissioning Closure	The WRDs and the TSF have been positioned based landform, soil and geotechnical understanding of the area to ensure competent ground conditions (i.e. not situated on the fault window and/or over historical resource drilling locations). Treatments will be implemented as per an ESCP to divert runoff away from the TSF and WRDs to limited interaction and potential to cause instability. Standard mining techniques will be employed for the construction of the pit to bench the walls and maintain stability. Design is in accordance with geotechnical analysis and reporting. The benching significantly reduces the risk of pit wall failure. The open pit geotechnical assessment noted mining to the recommended wall parameters is expected to be accompanied by some local batter scale wall failures. Careful slope monitoring will be required throughout all stages of mining (including stability monitoring of interim slopes). In the unlikely case that a wall failure occurs, this is likely to be localised to a small area for the WRDs. A larger area may be impacted by a TSF wall failure and the inherent risk has considered such event.	E	4	16	High	> Detailed design and quality assurance/control of TSF, WRD and pit wall designs. > Geotechnical studies and assessment to ensure structural stability. > Engineering design to ANCOLD standard. > Water Management Plan. > Weekly inspections to check sufficient freeboard and structural integrity.	E	2	23	Low	C3	High level of certainty that walls will not fail based on using leading industry practice and regular monitoring. Geotech studies and engineering design and modelling. Specifically: > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021); > Geotechnical Assessment for Open Pit (Peter O'Bryan & Associates, 2019); and > Open Pit Design (LJ Puntland & Associates 2019). Further, no previous instability issues with either the existing waste rock dumps or leach pads at the Rustlers Roost or Quest 29 sites.

TEQ-7	Indiscriminate use of existing waste rock for construction. Storage of waste rock outside of pit footprint for too long.	**Direct** - AMD, heavy metals and NORMS leading to contamination of soils. Contamination of surrounding land and alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on soil quality. **Indirect or Cumulative** - Potential transportation of leaching material, with potential to cause contamination, throughout the Project area and external. Indirect biological and human health implications in the immediate location of the placement and areas subject to seepage or runoff.	Construction Operation Decommissioning Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Waste oxide material may also be used in the haul road formation with potential to cause offsite impacts if the material used leaches AMD, heavy metals or NORMS. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.	C	3	17	Moderate	> Development and implementation of a geochemical block model. > Tracking of the waste rock and dumping locations. > Waste rock dump plan. > ESCP to prevent mobilisation. > Hydrological studies to ensure WRDs are outside flood affected areas. > Implementation of AMD Management Plan and Water Management Plan. > Maximisation of placement within pits. > Testing of waste rock for AMD, heavy metals and NORMS prior to use as on or offsite construction material.	D	2	21	Low	C3	High probability that the existing WRD are not accidentally or indiscriminately disturbed and waste stays within footprint integrated into operational plan and management. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019)
TEQ-8	Failure of process tanks/pipes/pumps.	**Direct** - Slurry or water released from process water circuit causing localised soil contamination or surface water contamination. Loss of native vegetation or habitat causing instability or soils and leading to erosion. **Indirect or Cumulative** - Potential increase in cumulative concentration of sediments within the Mount Bundey (Mary River) catchment as a result of any sediment erosion indirectly caused by loss of vegetation from contamination. Increased downstream depositions and siltation impacts. Also, indirect impact of reduced ability for successful revegetation due to loss of topsoils and contamination of soils in the location of the spill.	Operation	The primary risk area for a process tank, pipe or pump failure is the processing plant in the northern portion of the Rustlers Roost project area. The processing plant is located in the portion of the project area that drains to Mount Bundey Creek; however, several large components of the project will be located between Mount Bundey Creek and the plant (including laydowns and workshops, south WRD, mine pit, the TSF and historic heap leach pad). Therefore, the position of the plant is setback from the primary offsite release pathway. The processing plant will be locate in a bunded area with only minor piping outside the bunds. The entire process plant area will drain to a central sump should a failure and release occur. The tailing storage piping arrangement is such that the pipeline will be located on the upstream crest of the embankment, which will have a minimum cross fall to the tailings beaches of 2%. Any leakage from the pipeline should therefore flow towards the TSF.	C	3	13	High	> Water storage tanks stored in containment bunding. > Pipelines, pumps and tanks selected for appropriate water capacity. > Engineering standards adhered to for equipment. > Drainage to processing plant area sump. > Pumps are operated in accordance to supplier specification and operating manuals. > Installation of automated operating alarms to alert of pipe pressure drops. > Weekly inspections for structural integrity, leaks and subsequent maintenance. > Bunding of the area around the process plan and piping. > Completion of maintenance as per manufacture scheduled recommendations. > Emergency response procedures. > Training and induction including emergency response.	D	2	21	Low	C3	High levels of certainty that there is low potential for pipes and tank ruptures. Based on engineering design. Standard Industry practice. Similar mitigation used previously at Toms Gully.
TEQ-9	Erosion of site infrastructure leading to sedimentation	**Direct** - movement of soil or rock material from site infrastructure (e.g. WRD or TSF embankments) contributing to exposed surface and erosions, lack of vegetation, loss of topsoils, inability to re-establish vegetation. **Indirect or Cumulative** - Contribution to exposed ground in the project area and general locality. Diminished complexity and biological integrity of project area and located soils. Potential indirect structure stability issues.	Operation, Decommissioning Closure	Embankments for onsite infrastructure are proposed to be constructed from material sourced onsite. Suitable material will be selected back on the onsite infrastructure purpose. Where erosion is considered likely during the design and construction, controls will be included to manage runoff and reduce risk (e.g. rock rip rap). It is considered the highest likelihood for site infrastructure erosion is during the wet season. The potential impacts could occur both onsite and in the wider offsite area.	B	3	9	High	> Implementation of Erosion and Sediment Control Plan (ESCP). > Ongoing and regular (weekly) inspections of project areas and after rainfall events. > Avoid land clearing during wet season. > Minimise concentrated flow of surface water and ponding (drain lines, sediment bunds, liners etc). > Revegetation of exposed areas where not proposed to be utilised. > Stable design of landforms. > Construction of project infrastructure with suitable materials.	C	2	18	Moderate	C2	Moderate level of certainty as the site contains soils that are dispersive and are susceptible to erosion where using for construction of onsite infrastructure. Howevr, adherence to ESCP controlled developed in accordance with IECA international standards is widely accepted as preventing or limiting offsite impacts from soils destabilisation and erosive factors, improves certainty.

TEQ-10	Release of hazardous chemicals or materials during storage and handling onsite.	**Direct** - Contamination of soil and alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on soil quality. **Indirect or Cumulative** - Indirect spread of chemicals throughout the environment through indiscriminate or unknown movement of soils (e.g. on vehicle tyres) or in downstream drainage line.	Construction, Operation, Decommissioning	Diesel, oil and lubricants as well as processing chemicals (cyanide etc.) will be the principle dangerous goods transported and stored. Failure of containment during transportation of chemicals within the site or onsite tanks or storage containers is possible. Hydrocarbons will be stored on site for refuelling as well as servicing of vehicles and machinery. Process chemicals will also be stored on site (i.e. processing plant). These will be stored on previously cleared areas and will be bunded. Based on similar operations small spills could easily occur during all stages; however, larger spills are highly unlikely with standard controls. Drill and blasting techniques with the use of ammonium nitrate (ANFO) will be required for the open-cut mining operations. An explosives compound (i.e. magazine) will be located within MLN1083. The magazine will be used for both Rustlers Roost and Q29 Projects. With exception of ANFO and a diesel tank, all operating chemicals will be stored within the processing plant area. The list and volume of hazardous chemicals to be stored for processing is as follows: > Cyanide - 165 m³. > Hydrochloric acid - 70 m³. > Sodium hydroxide - 30 m³. > Copper sulphate - 10 m³. > Hydrogen peroxide - 16.7 m³. > Blanking agent - 700 m³. > Quicklime - 100 t. > Flocculent - 54.0 m³. > Liquid petroleum Gas (LPG) - 66 m³. > Smelting fluxes - 4 t. > Diesel fuel - 68,000 L (two storages onsite one will be within the process plant and the other in the mine laydown area. Fuel truck will fuel the Quest 29 machinery - no onsite storage at Quest 29).	C	3	13	High	> Design, storage and handling of hazardous materials to Australian Standards and regulations. > Specific adherence of the *ANFO storage to Dangerous Goods Act 1998* and the *NT Work Health and Safety (National Uniform Legislation) Act 2011*. > Regular maintenance of storage facilities. > Bunding of the process plant. > Ensure containment bunding and MDSDs available. > Diesel in bunded storage tanks, waste oil in stored bunded tanks. > Develop Emergency Response Plan and include in inductions. > Weekly inspections of storage areas, tanks, containers. > Weekly inspections of storage areas for leaks or damages. > Spill kits available around the site and procedures and training for the cleaning up of hazardous spills. > Implementation of hazardous materials management plan training for emergency response. > Cyanide management and storage will be aligned to the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (2008). > Chemical storage will be located a minimum 30 m from any drainage line or watercourse.	C	2	18	Moderate	C3	Highly unlikely for major spill as well tested industry standards used. While minor spills that are easily contained and cleaned are possible, there is high certainty that large spills are highly unlikely based on other mining operations. Weekly inspections will ensure any minor leaks or spills are contained and cleaned up preventing larger spills.
TEQ-11	Release of hazardous chemicals or materials during transportation to site.	**Direct -** Contamination of soil and alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on soil quality. **Indirect or Cumulative -** Indirect spread of chemicals throughout the environment through indiscriminate or unknown movement of soils (e.g. on vehicle tyres) or in downstream drainage line.	Construction, Operation, Decommissioning	The list and volume of hazardous chemicals to be stored for processing is as follows: > Cyanide - 165 m³. > Hydrochloric acid - 70 m³. > Sodium hydroxide - 30 m³. > Copper sulphate - 10 m³. > Hydrogen peroxide - 16.7 m³. > Blanking agent - 700 m³. > Quicklime - 100 t. > Flocculent - 54.0 m³. > Liquid petroleum Gas (LPG) - 66 m³. > Smelting fluxes - 4 t. > Diesel fuel - 68,000 L. This risk relates to the transportation of these chemicals to site. It is likely that all of these chemicals will be transport at on public roads from Darwin. The largest volume truck is expected to be around 60,000L diesel tanker. Diesel tankers and trucks transporting chemicals must adherer to strict standards including the Australian Dangerous Goods code. However, transport to site is considered a higher risk for incident and spill than whilst in storage or use on site. There would also be offsite impacts and the transport route from Darwin is in close proximity to several national parks. Therefore, if a crash occurred there is risk of release into sensitive environments.	D	4	12	High	> Standard pre-requirements for contractors (must meet standard requirements and licencing). > Appropriate site access for large vehicles. > Ensure transportation contractors undertake standard pre-departure checks. > All external operators to complete induction that includes transportation safety considerations. > Emergency management plan, spill response for transport incidents on site.	D	3	17	Moderate	C3	Highly unlikely for major spill to occur as well tested industry standards are used. High levels of certainty that large spills are highly unlikely.
TEQ-12	Production of domestic waste and storage of the waste onsite.	**Direct** - Contamination of soil in the area proximal to the domestic waste receptacle where inappropriate storage vessels and management is used. Alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities. Aesthetic qualities of the land is degraded due to the disposal of waste in the area. **Indirect or Cumulative** - Indirect spread of chemicals and/or living organisms (e.g. bacteria - E.coli) throughout the environment through indiscriminate or unknown movement of contaminated soils (e.g. on vehicle tyres or wind) or via downstream drainage lines.	Construction, Operation, Decommissioning.	While domestic waste may be produced in low levels at both the Rustlers Roost and Q29 areas, the primary location of production and this risk, is the accommodation camp located on ML29814 near the separate Toms Gully project. Onsite operations require waste disposal and storage areas, creating opportunities for feral fauna species. The landfill site will located at Rustlers Roosts. The landfill will be buried and must be appropriately lined and capped to prevent production and spread of leachate into the environment.	B	2	18	Moderate	> Secure dustbin lids. > Establish dedicated hardstand at accommodation camp for waste receptacles. > Weekly inspections of waste areas, landfill and general tidiness of site. > Burial of landfill (non-contaminating) waste. > Design and construct landfill in accordance with relevant standards. > Implement leachate prevention and capture into landfill design. > Groundwater monitoring. > Segregation of general waste and recycling of waste where possible. > Adhering to disposal licence conditions.	D	1	24	Low	C3	Low probability as inert rubbish is continually managed and the waste areas will be small/contained. Waste area for the accommodation camp will be impervious. Standard lining and capping will be employed for the small site landfill.

TEQ-13	Unfinished/unsuccessful rehabilitation of Project due to inadequate funds or natural disaster (e.g. cyclone).	**Direct** - Site not rehabilitated to required standards. Increased potential for offsite impacts from AMD, erosion and sedimentation. Degradation of land onsite and various forms of erosion (sheet, rill, wind etc.) transporting soils throughout the site and offsite. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Given proponent is the same for nearby Toms Gully project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large area of disturbed and unrehabilitated land in the Mount Bundey catchment cumulatively resulting in increased sediment loads to Mount Bundey Creek and the downstream Mary River.	Construction, Operation, Decommissioning and Closure	Potential legacy issues with expansive areas of unrehabilitated land maintaining exposed surfaces. An un-rehabilitated site can compromise natural functioning ecosystems. Early closure planning needs to be undertaken and where possible rehabilitation trials to understand the most effective methods for successful rehabilitation. The MMP will account for the project financial security as per NT EPA requirements.	C	4	8	Extreme	> Progressive rehabilitation of disused areas. > Implementation of detailed mine closure plan. > Early planning and financial provision for closure works. > Infrastructure design to withstand extreme events. > Ongoing management of levels in water infrastructure. > Improve site drainage controls. > Topsoil stockpiling. > Progressively push down the sides of the waste dump walls during the mining so that most earthworks are completed during the operational period.	D	3	17	Moderate	C3	Implement closure planning into mine plan. Site operated to accommodate natural disasters. MMP obligates provision of financial security for approval.
TEQ-14	Inability to establish native vegetation by local provenance species with resultant cover comparable to nearby areas.	**Direct** - Completion criteria and environmental outcomes unable to be met. Potential soil erosion, loss of topsoil and sedimentation (through both water and wind erosive forces). Characteristics of soils, including chemical, physical, biological and aesthetic qualities are degraded in the vegetation clearing area. Resulting in less productive soils and potential impacts (through the abovementioned erosion) on adjacent land. **Indirect or Cumulative** - Increased disturbance and lost productivity of soils in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area. Resulting in reduced local capacity of soils to perform ecological functions and a cumulative increase in erosion contributing to dust and waterway sedimentation.	Operation, Decommissioning Closure	Areas to be cleared of vegetation shall have any useful materials (i.e. seed, timber) salvaged, before vegetation is pushed aside. Topsoil (notionally 10 cm) and other useful growth media or construction materials are stockpiled for later use. Rehabilitation monitoring shall be completed in the first wet season and any remedial actions identified and implemented by the next wet season. Of note, the project is located on an impacted pastoral property and therefore rehabilitating the proposed areas of disturbance to existing vegetated condition with current species is anticipated to be more straightforward than for an unimpacted area. Appropriate topsoils to be maintained and/or growing media needs to be provisioned in the planning to enable sufficient volumes for the rehabilitation. Further, ongoing management of weeds and the fire regime through operation and into rehabilitation may play an important role in the ability to re-establish native vegetation.	C	3	13	High	> Financial provisioning for closure implementation. > Rehabilitation trials to determine effective methods Rehabilitation monitoring. > Final closure design to account for rehabilitation potential. > Planning and allocation of appropriate rehabilitation media (topsoil and organic matter). > Establishment of a fire regime that promotes native vegetation. > Implement active weed control. > Topsoil stockpiling.	D	3	17	Moderate	C3	Effective use of topsoil and growth mediums. Appropriate rehabilitation is being completed on numerous sites throughout the NT (ERA, South 32) and is expected to be highly achievable in the project setting.
TEQ-15	Lack of rehabilitation materials leads to inadequate tailings closure and poor quality site rehabilitation.	**Direct** - Completion criteria and environmental outcomes unable to be met. Potential soil erosion, loss of topsoil and sedimentation (through both water and wind erosive forces). Characteristics of soils, including chemical, physical, biological and aesthetic qualities are degraded in the vegetation clearing area. Resulting in less productive soils and potential impacts (through the abovementioned erosion) on adjacent land. **Indirect or Cumulative** - Increased disturbance and lost productivity of soils in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area. Resulting in reduced local capacity of soils to perform ecological functions and a cumulative increase in erosion contributing to dust and waterway sedimentation.	Decommissioning and Closure	Areas to be cleared of vegetation shall have any useful materials (i.e. seed, timber) salvaged, before vegetation is pushed aside, topsoil (notionally 10 cm) and other useful growth media or construction materials are stockpiled for later use. Rehabilitation monitoring shall be completed in the first wet season and any remedial actions identified and implemented by the next wet season. Appropriate topsoils to be maintained and/or growing media needs to be provisioned in the planning to enable sufficient volumes for the rehabilitation.	C	3	13	High	> Financial provisioning for closure implementation. > Calculation of material requirements in EIS and identification of extraction areas. > Recover topsoil from TSF, WRD and processing plant footprints. > Progressively rehabilitating the mine. > Clearing and Topsoil Procedures Implementation of Mine Closure.	D	3	17	Moderate	C3	Implement management of rehabilitation resources as part of mine scheduling. Volumes of tailings and waste rock and the material estimates for caping have been produced and included in the Project Description. Based on these there is confidence that sufficient material is available.
TEQ-16	Inappropriate management of the decommissioned site, post closure landform.	**Direct** - Unauthorised access to the site by externals (including public, leaseholders and livestock) negatively affecting rehabilitation potential and contributing to rehabilitation failure. Potential soil erosion, loss of topsoil and sedimentation (through both water and wind erosive forces). **Indirect or Cumulative** - Increased disturbance and lost productivity of soils in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area. Resulting in reduced local capacity of soils to perform ecological functions and a cumulative increase in erosion contributing to dust and waterway sedimentation.	Closure	The decommissioned landform will need restricted access to prevent vehicles and livestock from accessing areas that are undergoing active rehabilitation. Inappropriate access could disturb unestablished vegetation, cause erosion and lead to rehabilitation failure.	C	2	18	Moderate	> Implement fencing and access restriction to prevent vehicle and livestock accessing rehabilitation areas. > Ongoing monitoring of rehabilitation. > Progressive rehabilitation during mining to enable more established areas upon closure.	D	2	21	Low	C3	Progressive rehabilitation is likely to result in significant areas of the site have highly established vegetation by closure. Appropriate rehabilitation is being completed on numerous sites throughout the NT (ERA, South 32) and is expected to be highly achievable in the project setting.

TEQ-17	Ineffective operational implementation of site environmental management system, plans and procedures.	**Direct** - Environmental incidents causing degradation or enabling degradation of land and soils to spread unabated. Potential to result in degradation or contamination of soil and groundwater medium. alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct species health implication (reduced physical health or mortality) depending on contaminant in seepage material. Inability of impacted soils to maintain biological qualities to support standard flora and fauna. **Indirect or Cumulative** - Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rehabilitation goals and closure requirements following decommissioning. Agreed Post Mine Land Use (PMLU) cannot be achieved due to significant environment incidents resulting in widespread ongoing exposure of soils. Potential increase in cumulative concentration of sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts. Also, indirect impact of reduced ability for successful revegetation due to loss of topsoils.	Construction, Operation, Decommissioning Closure	Ineffective environmental management during any stage can lead to significant ongoing environmental issues which are often more expansive than if addressed properly when they arise. For example, if a new invasive weed is identified onsite but not appropriately addressed initially could require widespread management after several years, may encroach into offsite areas, could adversely impact fire regimes, impact native vegetation composition and thus fauna habitat. Appropriate procedures and levels of resourcing must be implemented during all stages of the project.	C	3	13	High	> Corporate commitment to EMS implementation via policy. > Environmental Management System and various management plans (EMP, WMP, MMP etc.). > All events/incidents to be reported and managed through to resolution via event/incident reporting procedures. > All personnel will be inducted into the area and informed of the hazards and relevant management protocols of the areas. > All personnel will be trained in the appropriate management practices as is relevant to their position.	D	3	17	Moderate	C3	High. Based on similar conditions. Operational activities will be undertaken according to relevant management plans and appropriate procedures. Environmental Management Plan structures and inclusive are well established.
TEQ-18	Use of project machinery, equipment, vehicles and activities causing fire through sparks or heat ignition source.	**Direct** - Damage to topsoil composition and vegetation binding soils. Thus, resulting in the increased ability for soils to erode and disperse. Also, potential contamination of soils due to fire extinguishers (depending on where it happens) and material consumed by the fire. **Indirect or Cumulative** - Indirect loss of nutrients from topsoil dispersal and reduced viability of soils to re-establish vegetation, leading to potential introduction or spread of weeds. Potential increase in cumulative concentration of sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts. Also, indirect impact causing reduced ability for successful revegetation due to loss of topsoils.	Construction, Operation, Decommissioning Closure	Bushfires commonly occur in the dry season within the region. Should fires be started due to project activities they could impact onsite operations and easily spread offsite. Primary Gold will need to implement a Fire Management Plan to ensure that bushfires are not started as a result of the Project operations.	C	3	13	High	> Liaise with Bushfires NT regarding regional (and site) fire break. > Establish hot work procedures. > Regular inspections of generators and other sources of heat/power. > Fire extinguishers available around site and on all vehicles and machinery. > Training and inductions include Emergency Response Plan. > Establish and implement appropriate control fire regime for area in the MLs.	D	3	17	Moderate	C3	High. Based on similar conditions. Adherence to the hot works procedures and implementation of the Fire Management Plan are standard arrangements for preventing fires.
TEQ-19	Dust generation from project activities such as vehicular movements and earthworks.	**Direct** - Dust emissions impacting neighbours or Arnhem Highway. Creating safety issue during operations. Loss of productive topsoil inhibiting growth potential of retained media. **Indirect or Cumulative** - Potential cumulative dust lift-off and deposition in the wider area in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area. Potential increase in cumulative concentration of sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts. Also, indirect impact causing reduced ability for successful revegetation due to loss of topsoils.	Construction, Operation, Decommissioning Closure	Dust is not expected to be a significant issue during operations. Periodically there will be higher levels of dust during clearing; however, clearing will be prioritised for days with low wind forecasts. Dust suppression will be implemented via a water cart during clearing operations. There are however risks associated with excessive dust generation from project activities which could result in deposition on surrounding vegetation, risks being inhaled by site personnel and could impact drivers visibility when operating vehicles/machinery.	B	1	19	Moderate	> Dust suppression around site. > Implementation of Dust Management Plan. > Progressive clearing and progressive rehabilitation. > Avoid clearing on windy days. > Visual monitoring of emissions. > Speed limits for vehicle movements.	C	1	22	Low	C3	Controls are industry standards and easily implemented. All mining sites implement such controls.
TEQ-20	Inappropriate liquid and solid waste disposal.	**Direct -** Contamination of soil in the area proximal to the domestic waste receptacle where inappropriate storage vessels and management is used. Alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities. Aesthetic qualities of the land is degraded due to the disposal of waste in the area. **Indirect or Cumulative** - Indirect spread of chemicals and/or living organisms (e.g. bacteria - E.coli) throughout the environment through indiscriminate or unknown movement of contaminated soils (e.g. on vehicle tyres or wind) or in downstream drainage line.	Construction, Operation, Decommissioning Closure	Generation of waste oils, lubricants and solid waste (e.g. batteries, scrap metal and oily rags etc.) need to be disposed of in an appropriate manner such as waste oil bins and taken off site. If this is managed properly, it is unlikely that waste should cause impacts to the surrounding environment. Onsite operations require a landfill site for non-hazardous materials. . The landfill site will located at Rustlers Roosts. The landfill will be buried and must be appropriately lined and capped to prevent production and spread of leachate into the environment.	D	3	12	High	> Manage disposal of wastes in accordance with the Project EMP (including bunded waste oil bins). > Hazardous materials stored in accordance with Australian standards. > Spill kits available around site and spill clean-up procedures implemented. > Employees and contractors trained in clean up procedures. > Weekly inspections of waste areas, landfill and general tidiness of site. > Burial of landfill (non-contaminating) waste. > Design and construct landfill in accordance with relevant standards. > Implement leachate prevention and capture into landfill design. > Groundwater monitoring.	E	2	23	Low	C3	Low probability of occurrence as inert rubbish is continually managed. Standard lining and capping will be employed for the small site landfill.

Table 2: Terrestrial Ecosystems

Inherent Risk									Mitigation & Management	Residual risk					
Risk #	Source of Impact	Consequence	Project Phase(s)	Discussion	Likli	Cons	Risk	Risk		Likli	Cons	Risk	Risk	Level of Certainty	Justification of Certainty and Residual Risk
TE-1	Vegetation clearing for the Project	**Direct -** Disturbing an additional 344.5 ha of land for the Rustlers Roost. 44.6 ha for Q29, 7.3 ha for the accommodation camp and 1.1 ha for the haul road. Loss of 397.5 ha of habitat. Fragmentation of a population and/or habitat modification and/or lifecycle disruption and/or impact on the size of a population for flora and terrestrial fauna. Impact to protect sensitive NT terrestrial flora species and their habitat. **Indirect or Cumulative -** Clearing for the Project increasing habitat loss and fragmentation within the wider area where previous or future clearing has or will occur as a result of nearby activities (including Toms Gully Mine, quarrying and the Mount Bundey Training Area). Increase in local weed population in areas of disturbance.	Construction	Ecological surveys undertaken by Low Ecological Services P/L (LES) during 2017 describe the natural vegetation of the undisturbed land and surrounding areas as savanna woodlands dominated by *Eucalyptus miniata* , *E. tetrodonta, E. tintinnan* s with a *Sarga spp* . grass understory, which is common in the region. Habitat modelling prepared by NTG indicates that two threatened species, *Helicteres macrothrix* and *Stylidium ensatum* could occur in the proposal areas. Targeted surveys of the proposal area conducted during September 2020 did not identify *Helicteres macrothix.* Due to the seasonal detectability of *Stylidium ensatum* , only habitat suitability was assessed during September 2020 for the species and only a small pacth (approx 3,000m^2) was considered to be marginally-suitable habitat based on the known ecology of the plant. Targeted surveys for this species have been completed and did not identify presence of the listed threatened flora. During the vegetation survey undertaken in 2020, invasive weed species incidentally observed within proposal area were recorded, with the majority established in disturbed areas, and occasionally occurring in native bushland.	A	3	6	Extreme	> Adhere to Ground Disturbance Procedures. > Progressive clearing and rehabilitation. > Implement erosion and sediment controls in accordance with an ESCP. >Only clear what is absolutely necessary for the portion of the project to be implemented. > Implementation of Biodiversity Management Plan. > Clearly mark limits of clearing. > Make use of already disturbed areas where possible. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines. > Avoid land clearing during the Wet Season (Dec-May). > Have a trained fauna spotter on site during clearing operations. > Limit construction and clearing to times of the year when fauna are least vulnerable (e.g. avoiding breeding period).	C	2	13	High	C3	High. Clearing minimised as far as practical and will be marked out prior to any clearing activities. Communication with employees and contractors. Low chance of habitat fragmentation due to widespread vegetation within the region.
TE-2	Overtopping, embankment failure or seepage from the new TSF at Rustlers Roost leading to uncontrolled release of tailings material to surrounding environment.	**Direct -** Contamination of surrounding land and water. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on soil quality. Direct result in the loss of ecological integrity and suitable native fauna habitat in the impacted area. **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminat of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals).	Construction, Operation, Decommissioning or Closure	The TSF is to be constructed of geochemically benign and structurally appropriate material. The finalised TSF lining design requirements will be determined from the geochemical characterisation of the ore. It is not expected that tailings will contain high levels of cyanide as residual cyanide will we removed from tailings during the refining process and reused in the processing circuit. The TSF construction will include the following features: > The TSF design will be for a peripheral discharge paddock-style, multi-zone earth and rockfill dam. > Deposition of tailings will be via sub-areal deposition method from spigots in a deposition pipeline around the perimeter of the TSF. > Solids will settle and water will flow to the supernatant (decant) pond. > The decant water from the TSF will returned to the processing facility for reuse. Nevertheless, given the size of the TSF, any embankment failure risks widespread offsite degration of the surrounding terrestrial environment. Design criteria set for the spillway in accordance with ANCOLD. Likelihood of uncontrolled releases from the spillway into the environment under 'emergency' conditions (e.g. extreme rainfall) is low as the TSF wall is to be built higher than the level of the waste and the spillway during each of the operational stages. The risk is only likely when the tailings dam is in the final stage. A number of seepage control and underdrainage collection features have been integrated into the design. The seepage control and underdrainage collection systems will consist of the components as follows: > Cut-off trench. > Compacted soil liner (CSL). > Basin underdrainage collection system overlying the CSL, including collectors (in drainage courses) and finger drains (30 m spacing over TSF basin area). > Underdrainage collection sump. > Embankment toe drain.	E	5	11	High	> TSF to be planned, designed, constructed and operated in accordance with approaches details in the guideline Tailings Management: Leading Practice Sustainable Development Program for the Mining Industry. (DFAT 2016). > Design TSF to contain a range of design storm and rainfall sequences events up to and greater than the required design criteria. > An operational emergency spillway to be constructed as part of each embankment raise. > Development of Monitoring Plan / Operational Manual which includes weekly inspections of the TSF, survey pins to monitor the embankment and piezometers to measure pore water pressure. > Tailings performance monitoring (e.g. TSF water volume, collection efficiency of underground system). > Install seepage control and underground drainage including a cut-off trench, compact soil liner, basin underdrainage collection system, underdrain collection sump and embankment tow drain. > Groundwater monitoring to check quality and any seepage. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water.	E	3	20	Moderate	C3	High certainty that the new tailings embankment will remain stable. Based on historical use of the TSF at the nearby Toms Gully Mine in the same geology, Geotech studies and engineering design and modelling. Geotech studies and engineering design and modelling. Specifically: > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021). > Geotechnical assessment for the site. No previous instability issues with either the existing waste rock dumps or leach pads at the Rustlers Roost or Quest 29 sites. Justification also based on the TSF being designed, constructed and operated in accordance with leading practice.
TE-3	Overtopping, embankment failure or seepage from the the process water storage at Rustlers Roost leading to uncontrolled release of process water to surrounding environment.	**Direct -** Contamination of surrounding environment, potential destruction of vegetation, loss of biodiversity, ecological integrity and ecological functioning in the area of impact. **Indirect or Cumulative -** Potential transportation of contaminates in water and sediments throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within native fauna (e.g. heavy metals).	Operation, Decommissioning and Closure	The process water will be stored in the northern portion of the TSF, utilising the TSF strucuture and safety features. This will hold water from the process circuit and provides buffering between the TSF decant and the process itself. Process water quality may contain AMD contaminants. The process water storage will receive both return water from decant pond and stormwater runoff from processing plant. Mined ore will be processed using a CIL processing method, which extracts gold from the ore by mixing with a cyanide solution. Tailings within the processing circuit, will be screened to recover carbon and then will go through a detoxification to remove residual cyanide. The recovered carbon and residual cyanide will be reused in the processing circuit. Despite the reuse of cyanide there is potential for residual cyanide in the process water. Despite the above, it is noted that the process plant and the process water storage are set back from the drainage line feeding to Mount Bundey and is separated by various site infrastructure (e.g. the main pit and TSF).	E	5	11	High	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams. > Groundwater monitoring. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water. > Storage and management of cyanide in accordance with the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (2008).	E	3	20	Moderate	C3	High level of certainty as site water management can be undertaken in a manner that prevents overtopping based on the site water balance. High level of certainty that the new process water dam embankments (TSF embankments) will remain stable. Based on historical use of dams at the Rustlers Roost Mine in the same geology and general soil structure. Geotech studies and engineering design and modelling. > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021); > Geotechnical assessment for the site. No previous instability issues with either the existing dams or other structures (e.g.leach pads) at the Rustlers Roost or Quest 29 sites. Justification also based on the process water dam being designed, constructed and operated in accordance with leading practice.

TE-4	Poor water quality released from site during wet season (stormwater).	**Direct** - Primary contaminants of concern in wet season stormwater release is acidity and sediment, thus resulting in increased turbidity of waterways. This could result in poor quality drinking water for fauna and sedimentation of riparian environments for which terrestrial fauna inhabit. Habitat modification and/or lifecycle disruption and/or impact on the size of a population (flora and/or terrestrial fauna). Depending on the geochemistry of the waste rock material to be exposed in the new pits and the placement on site, runoff may also contain heavy metals and NORMS. These would have direct terrestrial fauna health implications should this water be ingested. **Indirect or Cumulative** - Decrease in fish populations and species richness resulting in decreased suitability of the environment for terrestrial species that may utilise the watercourses (e.g. birds). Potential for bioaccumulation of excessive contaminants within native fauna (e.g. heavy metals).	Construction, Operation, Decommissioning or Closure	Water storages will be dewatered prior to the wet season to provide capacity. Dewatering will be completed in accordance with discharge criteria which sets an appropriate water quality to avoid downstream impacts. Altered hydrology is not expected to impact on any population size (only species level). Potential impact if species ingest contaminated water. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model. Sampling of the existing waste materials and water quality indicates that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019).	C	4	8	Extreme	> Development and implementation of a geochemical block model. > Compliance with the Waste Discharge Licence . > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. >All water storage facilities geotechnically stable and engineered ANCOLD guidelines. > Groundwater / surface water quality monitoring > Weekly inspections of freeboard, structural integrity and pipelines.	D	3	17	Moderate	C3	Highly unlikely as water quality and volumes monitored with controlled discharge. Site water balance provides high certainty water volumes can be appropriately managed. Implementation of the ESCP also provides high certainty that sediment runoff from site will be limited. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019)
TE-5	Release of hazardous chemicals or materials during storage and handling onsite.	**Direct** - Contamination of soil and water. Contamination of surrounding environment, potential destruction of vegetation, loss of biodiversity, ecological integrity and ecological functioning in the area of impact. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct mortality of flora and fauna that come into contact with the released chemical. **Indirect or Cumulative** - Indirect spread of chemicals throughout the environment through indiscriminate or unknown movement of contaminated materials (e.g. soil on vehicle tyres) or in downstream drainage line. Potential transportation of contaminated sediments and material throughout the Project area and external. Potential for bioaccumulation of excessive contaminants within native fauna (e.g. heavy metals).	Construction, Operation, Decommissioning	Diesel, oil and lubricants as well as processing chemicals (cyanide etc.) will be the principle dangerous goods transported and stored and used onsite. Failure of containment during transportation of chemicals within the site or onsite tanks or storage containers is possible. Hydrocarbons will be stored on site for refuelling as well as servicing of vehicles and machinery. Process chemicals will also be stored on site (i.e. processing plant). These will be stored on previously cleared areas and will be bunded. Based on similar operations small spills could easily occur during all stages; however, larger spills are highly unlikely with standard controls. Drill and blasting techniques with the use of ammonium nitrate (ANFO) will be required for the open-cut mining operations. An explosives compound (i.e. magazine) will be located within MLN1083. The magazine will be used for both Rustlers Roost and Q29 Projects. With exception of ANFO and a diesel tank, all operating chemicals will be stored within the processing plant area. The list and volume of hazardous chemicals to be storedf for processing is as follows: > Cyanide - 165 m³. > Hydrochloric acid - 70 m³. > Sodium hydroxide - 30 m³. > Copper sulphate - 10 m³. > Hydrogen peroxide - 16.7 m³. > Blanking agent - 700 m³. > Quicklime - 100 t. > Flocculent - 54.0 m³. > Liquid petroleum Gas (LPG) - 66 m³. > Smelting fluxes - 4 t. > Diesel fuel - 68,000 L (two storages onsite one will be within the process plant and the other in the mine laydown area. Fuel truck will fuel the Quest 29 machinery - no onsite storage at Quest 29).	C	3	13	High	> Design, storage and handling of hazardous materials to Australian Standards and regulations. > Specific adherence of the ANFO storade to Dangerous Goods Act 1998 and the NT Work Health and Safety (National Uniform Legislation) Act 2011. > Regular maintenance of storage facilities. > Bunding of the process plant. > Ensure containment bunding and MDSDs available. > Diesel is stored in bunded storage tanks, waste oil in stored bunded tanks . > Waste oil is stored in bunded tanks/containers e.g. IBC. > Weekly inspections of storage areas, tanks, containers. > Develop Emergency Response Plan and include in inductions. > Weekly inspections of storage areas for leaks or damages. > Spill kits are available around the site and procedures and training for the cleaning up of hazardous spills is provided. > Implementation of hazardous materials management plan training for emergency response. > Cyanide management and storage will be aligned to the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (2008). > Chemical storage will be located a minimum 30 m from any drainage line or watercourse.	C	2	18	Moderate	C3	It is highly unlikely for major spills to occur as well tested industry standards are used. While minor spills that are easily contained and cleaned are possible, there is high certainty that large spills are highly unlikely, based on other mining operations. Weekly inspections will ensure any minor leaks or spills are contained and cleaned up preventing larger spills.
TE-6	Release of hazardous chemicals or materials during transportation to site.	**Direct** - Contamination of soil and water. Contamination of surrounding environment, potential destruction of vegetation, loss of biodiversity, ecological integrity and ecological functioning in the area of impact. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct mortality of flora and fauna that come into contact with the released chemical. **Indirect or Cumulative** - Indirect spread of chemicals throughout the environment through indiscriminate or unknown movement of contaminated materials (e.g. soil on vehicle tyres) or in downstream drainage line. Potential transportation of contaminated sediments and material throughout the Project area and external. Potential for bioaccumulation of excessive contaminants within native fauna (e.g. heavy metals).	Construction, Operation, Decommissioning	The list and volume of hazardous chemicals to be storedf for processing is as follows: > Cyanide - 165 m³. > Hydrochloric acid - 70 m³. > Sodium hydroxide - 30 m³. > Copper sulphate - 10 m³. > Hydrogen peroxide - 16.7 m³. > Blanking agent - 700 m³. > Quicklime - 100 t. > Flocculent - 54.0 m³. > Liquid petroleum Gas (LPG) - 66 m³. > Smelting fluxes - 4 t. > Diesel fuel - 68,000 L. This risk relates to the transportation of these chemicals to site. It is likely that all of these checmials will be transportat on public roads from Darwin. The largest truck is expected to be around a 60,000 L diesel tanker. Diesel tankers and trucks transporting chemicals must adherer to strict standards including the Australian Dangerous Goods code. However, transport to site is considered a higher risk for incident and spill than whilst in storage or use on site. There would also be offsite impacts and the transport route from Darwin is in close proximity to several national parks. Therefore, if a crash occured there is risk of release into sensitive environments.	D	4	12	High	> Standard pre-requirements for contractors (must meet standard requirements and licencing). > Appropriate site access for large vehicles. > Ensure transportation contractors undertake standard pre-departure checks. > All external operators to complete induction that includes transporation safety considerations.	D	3	17	Moderate	C3	It is highly unlikely for major spills to occur as well tested industry standards are used. High certainty large spills are highly unlikely.

TE-7	Production of domestic waste and storage of the waste onsite	**Direct** - Where innappropriate storage vessels and management is used there is potential to increase pest fauna (i.e. rats/mice) and feral/predator species (i.e. dingoes, cats) causing reduction in native wildlife population. This could directly increase native fauna mortality in the local area. **Indirect or Cumulative** - Potential for cumulative pest fauna increases in the Mount Bundey locality due to nearby operators also producing waste.	Construction, Operation, Decommissioning.	While domestic waste may be produced in low levels at both the Rustlers Roost and Q29 areas, the primary location of production and this risk, is the accommodation camp located on ML29814 near the separate Toms Gully project. Onsite operations require a landfill site and dustbins etc. creating opportunities for feral fauna species. The landfill site will located at Rustlers Roosts. The landfill will be buried and must be appropriately lined and capped to prevent production and spread of leachate into the environment.	B	2	18	Moderate	> Secure dustbin lids. > Establish dedicated hardstand at accommodation camp for waste receptacles. > Weekly inspections of, waste area, landfill and general tidiness of site. > Burial of landfill (non-contaminating) waste. > Design and construct landfill in accordance with relevant standards. > Landfill location will avoid intersection with natural drainage channels. > Implement leachate prevention and capture into landfill design. > Segregation of wastes and recycling of wastes where possible. > Groundwater monitoring.	D	1	24	Low	C3	Low probability as inert rubbish is continually managed. Waste area for the accommodation camp will be impervious. Standard lining and capping will be employed for the small site landfill.
TE-8	Unfinished/unsuccessful rehabilitation of Project due to inadequate funds or natural disaster (e.g. cyclone).	**Direct** - Site not rehabilitated to required standards. Increased potential for offsite impacts from AMD, erosion and sedimentation. Degradation of land and fauna habitat onsite. Direct risk of fauna mortality from falls and being trapped in open pits and excavations. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminat of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourses to the extraction of drinking water, recreation and fishing. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct mortality if contaminants (e.g. heavy metals or NORMS) are released from site. Given proponent is the same for nearby Toms Gully project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large area of disturbed and unrehabilited land in the Mount Bundey catchment cumulatively resultiing in loss of fauna habitat.	Construction, Operation, Decommissioning and Closure	Potential legacy issues with expansive areas of unrehabillated land maintaining exposed surfaces. An un-rehabilitated site can result in the compromisation of natural functioning ecosystems. Early closure planning needs to be undertaken and where possible rehabilitation trials to understand the most effective methods for successful rehabilitation. The MMP will account for the project financial security as per NT EPA requirements.	C	3	13	High	> Progressive rehabilitation of disused disturbed areas. > Implementation of detailed mine closure plan. > Early planning and financial provision for closure works. > Infrastructure design to withstand extreme events. > Ongoing management of levels in water infrastructure. > Improve site drainage controls.	D	2	21	Low	C3	Implement closure planning into mine plan. Site operated to accommodate natural disasters. MMP obligates provision of financial security for approval.
TE-9	Inability to establish native vegetation by local provenance species with resultant cover comparable to nearby areas.	**Direct** - Site not rehabilitated to required standards. Increased potential for offsite impacts from AMD, erosion and sedimentation. Degradation of land and fauna habitat onsite. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminat of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourses to the extraction of drinking water, recreation and fishing. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct mortality if contaminants (e.g. heavy metals or NORMS) are released from site. Given proponent is the same for nearby Toms Gully project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large area of disturbed and unrehabilited land in the Mount Bundey catchment cumulatively resulting in loss of fauna habitat.	Construction, Operation, Decommissioning and Closure	Areas to be cleared of vegetation shall have any useful materials (i.e. seed, timber) salvaged, before vegetation is pushed aside, topsoil (notionally 10 cm) and other useful growth media or construction materials are stockpiled for later use. Rehabilitation monitoring shall be completed in the first wet season and any remedial actions identified and implemented by the next wet season. Of note, the project is located on an impacted pastoral property and therefore rehabilitating the proposed areas of disturbance to existing vegetated condition with current species is anticipated to be more straingforward than for an unimpacted areas. Appropriate topsoils to be maintained and/or growing media needs to be provisioned in the planning to enable sufficient volumes for the rehabilitation. Further, ongoing management of weeds and the fire regime through operation and into rehabilitation may play an important role in the ability to re-establish native vegetation.	C	3	13	High	> Financial provisioning for closure implementation. > Rehabilitation trials to determine effective methods. > Final closure design to account for rehabilitation potential. > Planning and allocation of appropriate rehabilitation media (topsoil and organic matter). > Establishment of a fire regime that promotes native vegetation. > Implement active weed control.	D	3	17	Moderate	C3	Effective use of topsoil and growth mediums. Appropriate rehabilitation is being completed on numerous sites throughout the NT (ERA, South 32) and is expected to be highly achievable in the project setting.
TE-10	Lack of rehabilitation materials leads to inadequate tailings closure and poor quality site rehabilitation.	**Direct** - Completion criteria and environmental outcomes unable to be met. Faulire to establish appropriate capping and native vegetation. Therefore, lost potential for rehabilitation area to serve appropriate post closure ecologial function. **Indirect or Cumulative** - Reduced area of vegetation in the general Mount Bundy locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.	Decommissioning and Closure	Areas to be cleared of vegetation shall have any useful materials (i.e. seed, timber) salvaged, before vegetation is pushed aside, topsoil (notionally 10 cm) and other useful growth media or construction materials are stockpiled for later use. Rehabilitation monitoring shall be completed in the first wet season and any remedial actions identified and implemented by the next wet season. Appropriate topsoils to be maintained and/or growing media needs to be provisioned in the planning to enable sufficient volumes for the rehabilitation.	C	3	13	High	> Financial provisioning for closure implementation. > Calculation of material requirements in EIS and identification of extraction areas. > Recover topsoil from TSF, WRD and processing plant foorprints. > Progressively rehabilitating the mine. > Clearing and Topsoil Procedures Implementation of Mine Closure.	D	3	17	Moderate	C3	Implement management of rehabilitation resources as part of mine scheduling. Volumes of tailings and waste rock and the material estimates for caping have been produced and included in the Project Description. Based on these there is confidence that sufficient material is available.
TE-11	Inappropriate management of the decommissioned site, post closure landform.	**Direct** - Unauthorised access to the site by externals (including public, leaseholders and livestock) negatively affecting rehabilitation potential and contributing to rehabilitation failure. Failure to establish appropriate capping and native vegetation. Inappropriate management could also allow for the introduction and/or spread of flora weeds, reducing native flora species composition. **Indirect or Cumulative** - Reduced areas of vegetation in the general Mount Bundy locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.	Closure	Rehabilitation areas will need restricted access to prevent vehicles and livestock from acccessing areas that are undergoing active rehabilitation. Innappropriate access could disturb unestablished vegetation and lead to rehabilitation failure. Rehabilitation monitoring shall be completed in the first wet season and any remedial actions identified and implemented by the next wet season.	C	2	18	Moderate	> Implement fencing and access restriction to prevent vehicle and livestock accessing rehabilitation areas. > Ongoing monitoring of rehabilitation. > Progressive rehabilitation during mining to enable more established areas upon closure. > Weed prevention and management during operation and closure.	D	2	21	Low	C3	Progressive rehabilitation is likely to result in significant areas of the site have highly established vegetation by closure. Appropriate rehabilitation is being completed on numerous sites throughout the NT (ERA, South 32) and is expected to be highly achievable in the project setting.

TE-12	Ineffective operational implementation of site environmental management system, plans and procedures.	**Direct** - Environmental incidents causing degradation of environmental features that support flora and fauna. Potential direct species health implication (reduced physical health or mortality) depending on whether the ineffective management leads to contamination. Inability of impacted areas to maintain biological qualities to support standard flora and fauna. **Indirect or Cumulative** - Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rehabilitation goals and closure requirements following decommissioning. Agreed Post Mine Land Use (PMLU) cannot be achieved due to unsuccessful rehabilitation process (e.g vegetation stablishment, weed infestation etc). Given proponent is the same for nearby Toms Gully project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large area of disturbed and unrehabilited land in the Mount Bundey catchment cumulatively resultining in loss of fauna habitat.	Construction, Operation, Decommissioning Closure	Ineffective environmental management during any stage can lead to significant ongoing environmental issues which are often more expansive than if addressed properly when they arise. For example, if a new invasive weed is identified onsite but not appropriately addressed initially could require widespread management after several years, may encroach into offsite areas, could adversely impact fire regimes, impact native vegetation composition and thus fauna habitat. Appropriate procedures and levels of resourcing must be implemented during all stages of the project.	C	3	13	High	> Corporate commitment to EMS implementation via policy. > Environmental Management System and various management plans (EMP, WMP, MMP etc.). > All events/incidents to be reported and managed through to resolution via event/incident reporting procedures. > All personnel will be inducted into the area and informed of the hazards and relevant management protocols of the areas. > All personnel will be trained in the appropriate management practices as is relevant to their position.	D	3	17	Moderate	C3	Moderate. Based on similar conditions. Operational activities will be undertaken according to relevant management plans and appropriate procedures. Environmental Management Plan structures and inclusives are well established.
TE-13	Use of project machinery, equipment, vehicles and activities causing fire through sparks or heat ignition source.	**Direct** - Damage to existing fauna habitat, including areas that potentially provide for listed threatened flora or fauna species. Potential contamination of soils due to fire extinguishers (depending on where it happens) and material consumed by the fire which could adversily affect the establishment of vegetation and success of rehabilitation. **Indirect or Cumulative** - Indirect loss of nutrients from topsoil dispersal and rediced viability of soils to reestablish vegetation, leading to potential introduction or spread of weeds. Indirect impact of reduced ability for successful revegetation due to loss of topsoils. Reduced area of vegetation in the general Mount Bundy locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.	Construction, Operation, Decommissioning Closure	Bushfires commonly occur in the dry season within the region. Should fires be started due to project activities they could impact onsite fauna and flora and easily spread offsite. Primary Gold will need to implement a Fire Management Plan to ensure that bushfires are not started as a result of the Project operations.	C	3	13	High	> Liaise with Bushfires NT regarding regional (and site) fire break. > Establish hot work procedures. > Regular inspections of generators and other sources of heat/power. > Fire extinguishers available around site and on all vehicles and machinery. > Training and inductions include Emergency Response Plan. > Establish and implement appropriate control fire regime for area in the MLs.	D	3	17	Moderate	C3	High. Based on similar conditions. Adherence to the hot works procedures and implementation of the Fire Management Plan are standard arrangements for preventing fires.
TE-14	Dust generation from project activities such as vehicular movements and earthworks.	**Direct** - Dust emissions impact upon onsite and surronding vegetation and fauna health. Loss of productive topsoil inhibiliting growth potential of retained media. **Indirect or Cumulative** - Potential cumulative dust lift-off and deposition on vegetation within the Project area and wider area in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area. Also, indirect impact causing reduced ability for successful revegetation due to loss of topsoils.	Construction, Operation, Decommissioning Closure	Dust is not expected to be a significant issue during operations. Periodically there will be higher levels of dust during clearing; however, clearing will be prioritised for days with low wind forecasts. Dust suppression will be implemented via a water cart during clearing operations. However, excessive dust from project activities could result in deposition on surrounding vegetation and also impacting local fauna. Deposited dust/sediment can be mobilised and transported by surface water during rainfall events ultimately discharging into drainage lines which can result in negative impacts on water quality. Specifically, increased suspended sediments can reduce light penetration, decreasing photosynthesis of aquatic flora and decrease dissolved oxygen. This could impact terrestrial species that rely on aquatic fauna (e.g. birds).	B	1	19	Moderate	> Dust suppression around site. > Implementation of Dust Management Plan. > Progressive clearing and progressive rehabilitation. > Avoid clearing on windy days. > Visual monitoring and individual assessment of dust emissions prior to undertaking tasks or attending work areas.	C	1	22	Low	C3	Controls are industry standards and easily implemented. All mining sites implement such controls.
TE-15	Noise and vibration emissions from construction and operational activities (e.g. vehicle movements and blasting).	**Direct** - Ground vibration from blasting, material dropping or large vehicle movements could have an adverse impact on local fauna. **Indirect or Cumulative** - Potential increase in cumulative impact on fauna in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area.	Construction, Operation, Decommissioning Closure	Noise may adversely affect wildlife by interfering with communication, masking the sound of predators and prey, causing stress or avoidance reactions, and in some cases, may lead to changes in reproductive or nesting behaviour. Excessive noise may lead some species to avoid noisy areas, potentially resulting in the fragmentation of species habitat. Radle (2007) states the consensus that terrestrial fauna will avoid any industrial plant or construction area where noise or vibration presents an annoyance to them. Additionally, many animals react to new noise initially as a potential threat, but quickly 'learn' that the noise is not associated with a threat (Radle 2007). The nature and levels of noise and vibration emitted by the mine will vary with the activities being undertaken however, impacts are expected to be highly localised and terrestrial fauna is expected to largely avoid areas of persistent noise and any impact is expected to be minor.	B	2	14	High	> Monitoring of area surrounding high vibration activites for ground instability. > ESCP controls implemented where ground cracking identified. > Enforcing speed limits to ensure that all operations are operating at the lowest possible noise level to minimise the impacts of noise and vibration upon wildlife. >Mitigate noise by properly maintaining all equipment in accordance with manufacturers specifications. > Noise management and controls to be addressed in project EMP. > Where possible, choose the "Buy Quiet" option for the purchase of equipment. > Undertake noise monitoring at area/ when areas are found to be high risk. > Develop and implement Noise and Vibration Managementlt Plan.	B	1	19	Moderate	C3	The project is remote from sensitive receptors and potential impacts from vibrations are easily controlled. However, noise and vibration is a standard emission for such projects and the likelihood of occurrence has been set as such.
TE-16	Construction and operational activities (incl. vegetation clearing) result in introduction of new weeds and spread of existing weeds into new areas.	**Direct** - Impact of reduced ability for successful revegetation due to weed spread. Impact on native vegetation. Increased fire risk. Reduced foraging and nesting grounds for fauna. **Indirect or Cumulative** - Increased weed species in the area negatively affecting rehabilitation potential and contributing to rehabilitation failure. Failure to establish appropriate capping and native vegetation. Post Mine Land Use (PMLU) cannot be achieved due to unsuccessful rehabilitation process (e.g vegetation stablishment, weed infestation etc). Cumulative impact as a result of reduced area of natural vegetation in the general Mount Bundy locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.	Construction, Operation, Decommissioning or Closure	During the 2020 vegetation survey, invasive weed species incidentally observed within proposal area were recorded, with the majority established in disturbed areas, and occasionally occurring in native bushland. The declared weed species, Hyptis *(Hyptis suaveolens*) was the most abundant within the Project area; it was recorded in high densities in Quest 29 south. Scattered Perennial Mission Grass (*Cenchrus polystachios*) and Gamba Grass *(Andropogon gayanus*) were also observed, mostly within Quest 29 south and along roadsides. Gamba Grass and Perennial Mission Grass are listed as Class B weeds under the NT Weeds Management Act, with Gamba Grass also listed as a Weed of National Significance (WoNS). Spread of new weed infestations is likely with movement of vehicles and machinery around site.Weed Management Plan should be implemented to minimise potential spread and introduction of new weeds in the Project area.	B	2	14	High	> Annual weed mapping (by June each year) to understand nature of the spread of weeds and plan weed control activities accordingly. > Conduct seasonal weed control activities in consultation with local landholders as necessary and in accordance with the Project Weed and Pest Management (grazing control as option). > Implementation of the Biodiversity MP Project EMP. > Weed hygiene procedures - including inspection and wash down of all vehicles and machinery entering site. > Establish and implement appropriate control fire regime for area in the MLs. > Develop and Implement Weed Management Plan. > Construction Material required for site will be inspected prior to entry to site (e.g. any fill material). > No unauthorised plant or vegetative material to be brought to site.	C	2	18	Moderate	C3	The level of certainty is high for weed control as mitigation measures have been used successfully for weed management.

TE-17	Increased density of weed infestations.	**Direct** - Impact of reduced ability for successful revegetation due to weed spread. Impact on native vegetation. Increased fire risk. Reduced foraging and nesting grounds for fauna **Indirect or Cumulative** - Increased weed species in the area negatively affecting rehabilitation potential and contributing to rehabilitation failure. Failure to establish appropriate capping and native vegetation. Post Mine Land Use (PMLU) cannot be achieved due to unsuccessful rehabilitation process (e.g vegetation stablishment, weed infestation etc). Cumulatrive impact as a result of reduced area of natural vegetation in the general Mount Bundy locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.	Construction, Operation, Decommissioning or Closure	During the 2020 vegetation survey, invasive weed species incidentally observed within proposal area were recorded, with the majority established in disturbed areas, and occasionally occurring in native bushland. The declared weed species, Hyptis *(Hyptis suaveolens*) was the most abundant within the Project area; it was recorded in high densities in Quest 29 south. Scattered Perennial Mission Grass (*Cenchrus polystachios*) and Gamba Grass *(Andropogon gayanus*) were also observed, mostly within Quest 29 south and along roadsides. Gamba Grass and Perennial Mission Grass are listed as Class B weeds under the NT Weeds Management Act, with Gamba Grass also listed as a Weed of National Significance (WoNS). Spread of new weed infestations is likely with movement of vehicles and machinery around site. Weed Management Plan should be implemented to minimise potential spread and introduction of new weeds in the Project area.	B	2	14	High	> Annual weed mapping (by June each year) to understand nature of the spread of weeds and plan weed control activities accordingly. > Conduct seasonal weed control activities in consultation with local landholders as necessary and in accordance with the Project Weed and Pest Management (grazing control as option). > Implementation of the Biodiversity MP Project EMP. > Weed hygiene procedures - including inspection and wash down of all vehicles and machinery entering site. > Establish and implement appropriate control fire regime for area in the MLs. > Develop and Implement Weed Management Plan.	C	2	18	Moderate	C3	The level of certainty is high for weed control as mitigation measures have been used successfully for weed management.
TE-18	Artificial light emissions from construction and/or operation of the mine site.	**Direct** - Disrupt lifecycle processes of fauna and or impact on the size of the populations. Emissions including artificial light can affect both nocturnal and diurnal animals by disrupting natural behaviour, with intensity and duration of exposure potentially evoking different responses. Impacts from increased light levels include disorientation from or attraction toward artificial sources of light; mortality from collisions with structures; and effects on light-sensitive cycles of species (e.g. breeding and migration for fauna and flowering in plants). **Indirect or Cumulative** - Potential increase in cumulative impact on fauna in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area. An artificial increase in lighting can also influence the abundance and behaviour of predators.	Construction, Operation, Decommissioning or Closure	An on-site flora and fauna survey of the Toms Gully, Rustlers Roost and Quest 29 survey areas was undertaken from 1st –7th November 2016 to assess fauna presence in the late dry season. One hundred and thirty-nine fauna species were recorded during the on-ground surveys of Toms Gully, Rustlers Roost and Quest 29. This included 89 bird species, 20 mammal species, 15 reptile species, 12 amphibian species and three arthropod species. No threatened fauna species were recorded despite targeted survey effort for eleven potential threatened species identified by the NT Fauna Atlas and PMST. Nevertheless, light may adversely affect wildlife by causing stress or avoidance reactions, and in some cases, may lead to changes in reproductive or nesting behaviour. Excessive light may lead some species to avoid areas, potentially resulting in the fragmentation of species habitat.	B	2	14	High	> Implementation of Project EMP (incorporating light management measures). > Implementation of Biodiversity MP (incorporating Irtificial lighting mitigation measures). > Vehicles, plant and machinery to be switched off when not in use. > Use of low voltage/wattage light bulbs where possible.	D	2	21	Low	C3	The level of certainty is high as the project will not greatly affect threatened species in the localised area.
TE-19	Vehicle/machinery interaction with terrestrial fauna	**Direct** - Loss of life or injury to fauna species. **Indirect and Cumulative** - Potential increase in cumulative impact on fauna in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area.	Construction, Operation, Decommissioning or Closure	Injury or death of fauna species are likely to occur during construction and operation of the Project. Management measures will be implemented to minimise the impact to fauna species as a result of vehicle/machinery interaction.	C	2	18	Moderate	> Vehicles not to park on vegetation areas (to prevent hot engines causing wildfire). > Vehicles to remain on designated tracks. > Speed limit to be implemented across the Project area. > Inductions include information regarding fauna species. > Vehicles to drive to conditions (e.g. dawn and dusk).	D	2	21	Low	C3	High certainty that project will not greatly effect threatened species in the localised area. Driving behaviour enforced.

Table 3: Hydrological Processes

Inherent Risk									Mitigation & Management	Residual risk					
Risk #	Source of Impact	Consequence	Project Phase(s)	Discussion	Likli	Cons	Risk	Risk		Likli	Cons	Risk	Risk	Level of Certainty	Justification of Certainty and Residual Risk
HP-1	Vegetation clearing for the Project	**Direct** - Disturbing an additional 344.5 ha of land for the Rustlers Roost. 44.6 ha for Q29, 7.3 ha for the accommodation camp and 1.1 ha for the haul road. Loss of 397.5 ha of habitat. Resulting in potential decreased infiltration during precipitation, increased runoff (quantities and velocitites) resulting alterations to drainage line (including scoruing and incising). Disruption to the natural alignment of creeks and streams reducing or presenting flows downstream. **Indirect or Cumulative** - Increased disturbance and lost productivity of surface water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the the nearby Mount Bundey Training Area. Resulting in reduced local capacity of surface water features to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation.	Construction Operation	The proposal area is predominantly low hills to rises. Existing vegetation and extensive stone surface outcrops provide land stability; however, land disturbed on slopes >2 % may have increased surface water runoff velocities and consequently a higher erosion risk. Rudosols, kandolsols and hydrosols are all mapped as occuring within the proposed vegetation clearing area. Rudosols and kandosols are known to be highly erodable soils types and will thus need appropriate controls to prevent offsite movement through erosion. TSF at Rustlers Roost construction will occur during the dry season of the construction and development phase.	A	4	3	Extreme	> Adherence to Ground Disturbance Procedures. > Progressive clearing and rehabilitation. > Implement erosion and sediment controls in accordance with an ESCP. >Only clearing what is absolutely necessary for the portion of the project to be implemented. > Implementation of Biodiversity Management Plan. > Clearly mark limits of clearing. > Make use of already disturbed areas where possible. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines. > Avoid land clearing during the Wet Season (Dec-May), if possible.	C	2	18	Moderate	C3	Adherence to ESCP controlled developed in accordance with IECA international standards is widely accepted as preventing or limiting offsite impacts from soils destabilisation and erosive factors.
HP-2	Overtopping, embankment failure or seepage from the new TSF at Rustlers Roost leading to uncontrolled release of tailings material to surrounding environment.	**Direct -** Direct alteration of the hydological regime including potential influx that causes significant destruction to existing drainage lines on and off site. Potential for persistent alteration of the local groundwater regime through seepage and mounding. Potential alteration of the water table that would impact features of the natural environment that are reliant on existing conditions (e.g. GDEs). Impact on structural integrity of engineered embankments threatening additional failures and contaminant releases (e.g. adjacent decommissioned heap leach pad). Groundwater interaction with contaminants from TSF seepage. **Indirect or Cumulative -** Contribution of overtopping flows of embankment failures to discharges from Toms Gully Mine into the Mount Bundey catchment resulting in increased water levels, flooding of area typically not susceptable to inundation, higher watercourse velocities, scouring and downstream deposition. Negative implications on the riparian environment and capacity to naturally accommodate wet season events.	Construction, Operation, Decommissioning or Closure	The Bureau of Meteorology (BoM) GDE Atlas classifies the Mount Bundey, Marrakai Creek and Mary River system as being a high potential GDEs. There is a low-moderate potential for terrestrial GDEs, at two locations approximately 2-3 km downstream, north-east of Rustlers Roost, and one low potential terrestrial GDE, approximately 5 km downstream, north-west of Quest 29 lease. The TSF will have a total 40 MT capacity. The TSF is to be constructed of geochemically benign and structurally appropriate material. The finalised TSF lining design requirements will be determined from the geochemical characterisation of the ore. It is not expected that tailings will contain high levels of cyanide as residual cyanide will we removed from tailings during the refining process and reused in the processing circuit. The TSF construction will include the following features: > An underdrainage system will be constructed to minimise seepage losses and maximise recovery. > A seepage recovery tower will be installed to pump the underdrainage back into the TSF. > A decant tower will be installed within the decant pond of the TSF to return water to the processing facility for reuse. > An emergency spillway constructed as part of each wall raise. Design criteria set for the spillway in accordance with ANCOLD. Likelihood of uncontrolled releases from the spillway into the environment under 'emergency' conditions (e.g. extreme rainfall) is low as the TSF wall is to be built higher than the level of the waste and the spillway during each of the operational stages. The risk is only likely when the tailings dam is in the final stage. A number of seepage control and underdrainage collection features have been integrated into the design. The seepage control and underdrainage collection systems will consist of the components as follows: > Cut-off trench. > Compacted soil liner (CSL). > Basin underdrainage collection system overlying the CSL, including collectors (in drainage courses) and finger drains (30 m spacing over TSF basin area). > Underdrainage collection sump. > Embankment toe drain.	E	5	11	High	> TSF to be planned, designed, constructed and operated in accordance with approaches details in the guideline Tailings Management: Leading Practice Sustainable Development Program for the Mining Industry (DFAT 2016). > Design TSF to contain a range of design storm and rainfall sequences events up to and greater than the required design criteria. > An operational emergency spillway to be constructed as part of each embankment raise. > Development of Monitoring Plan / Operational Manual which includes weekly inspections of the TSF, survey pins to monitor the embankment and piezometers to measure pore water pressure. > Tailings performance monitoring (e.g. TSF water volume, collection efficiency of underground system). > Install seepage control and underground drainage including a cut-off trench, compact soil liner, basin underdrainage collection system, underdrain collection sump and embankment tow drain. > Groundwater monitoring to check quality and any seepage. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water.	E	3	20	Moderate	C3	The level of certainty is high as the new tailings embankment will remain stable based on the historical use of the TSF at the nearby Toms Gully Mine in the same geology, geotech studies and engineering design and modelling. Geotech studies and engineering design and modelling. Specifically: > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021). > Geotechnical assessment for the site. No previous instability issues with either the existing waste rock dumps or leach pads at the Rustlers Roost or Quest 29 sites. Justification also based on the The TSF being designed, constructed and operated in accordance with leading practice.
HP-3	Overtopping, embankment failure or seepage from the the process water storage at Rustlers Roost leading to uncontrolled release of process water to surrounding environment.	**Direct -** Direct alteration of the hydological regime including potential influx that causes significant destruction to existing drainage lines on and off site. Potential for persistent alteration of the local groundwater regime through seepage and mounding. Potential alteration of the water table that would impact features of the natural environment that are reliant on existing conditions (e.g. GDEs). Impact on structural integrity of engineered embankments threatening additional failures and contaminant releases (e.g. adjacent decommissioned heap leach pad). Groundwater interaction with contaminants from process water storage dam. **Indirect or Cumulative -** Contribution of overtopping flows of embankment failures to discharges from Toms Gully Mine into the Mopunt Bundey catchment resulting in increased water levels, flooding of area typically not susceptable to inundation, higher watercourse velocities, scouring and downstream deposition. Negative implications on the riparian environment and capacity to naturally accommodate wet season events.	Operation, Decommissioning and Closure	The process water will be stored in the northern portion of the TSF, utilising the TSF structure and safety features. This will hold water from the process circuit and provides buffering between the TSF decant and the process itself. Process water quality may contain AMD contaminants. The process water storage will receive both return water from decant pond and stormwater runoff from processing plant. Mined ore will be processed using a CIL processing method, which extracts gold from the ore by mixing with a cyanide solution. Tailings within the processing circuit, will be screened to recover carbon and then will go through a detoxification to remove residual cyanide. The recovered carbon and residual cyanide will be reused in the processing circuit. Despite the reuse of cyanide there is potential for residual cyanide in the process water. Despite the above, it is noted that the process plant and the process water storage are set back from the drainage line feeding to Mount Bundey and is separated by various site infrastructure (e.g. the main pit and TSF). There are no GDEs within either of the proposal areas. The Bureau of Meteorology (BoM) GDE Atlas classifies the Mount Bundey, Marrakai Creek and Mary River system as being high potential GDEs. There is a low-moderate potential for terrestrial GDEs, at two locations approximately 2-3 km downstream, north-east of Rustlers Roost, and one low potential terrestrial GDE, approximately 5 km downstream, north-west of Quest 29 lease. As the process water will be stored in the TSF, the seepage design criteria are the same. A number of seepage control and underdrainage collection features have been integrated into the design. The seepage control and underdrainage collection systems will consist of the components as follows: > Cut-off trench. > Compacted soil liner (CSL). > Basin underdrainage collection system overlying the CSL, including collectors (in drainage courses) and finger drains (30 m spacing over TSF basin area). > Underdrainage collection sump. > Embankment toe drain.	E	5	11	High	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams. > Groundwater monitoring. > Manage the site water balance to reduce any build-up of water.	E	3	20	Moderate	C3	The level of certainty is high as site water management can be undertaken in a manner that previous overtopping based on the site water balance. The level of uncertainty is high as the new process water dam embankments (TSF embankments) will remain stable based on historical use of dams at the Rustlers Roost Mine in the same geology and general soil structure, geotech studies and engineering design and modelling. Specifically: > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021). > Geotechnical assessment for the site. No previous instability issues with either the existing dams or other structures (e.g.leach pads) at the Rustlers Roost or Quest 29 sites. Justification also based on the process water dam being designed, constructed and operated in accordance with leading practice.

HP-4	Embankment failure or seepages from the new WRDs at Rustlers Roost and Quest 29 to surrounding environment.	**Direct -** Direct alteration of the hydological regime including potential influx that causes significant destruction to existing drainage lines on and off site. Potential for persistent alteration of the local groundwater regime through seepage and mounding. Potential alteration of the water table that would impact features of the natural environment that are reliant on existing conditions (e.g. GDEs). Impact on structural integrity of engineered embankments threatening additional failures and contaminant releases (e.g. adjacent decommissioned heap leach pad). Groundwater interaction with contaminants from WRDs. **Indirect or Cumulative -** Contribution of overtopping flows of embankment failures to discharges from Toms Gully Mine into the Mount Bundey catchment resulting in increased water levels, flooding of area typically not susceptable to inundation, higher watercourse velocities, scouring and downstream deposition. Negative implications on the riparian environment and capacity to naturally accommodate wet season events.	Operation, Decommissioning and Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. It is possible for seepage to occur throughout the year for the WRDs, an embankment failure is far more rare but potentially more consequential. Due to the source risk including seepage, the liklihood has been applied as Possible. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and managed so that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is supported by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.	A	4	3	Extreme	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams. > Groundwater monitoring. > Manage the site water balance to reduce any build-up of water. > Capping of the WRDs to reduce ongoing water infiltration and seepage.	C	2	18	Moderate	C3	The level of certainty is high as the seepage and runoff can be contained and treated based on the water balance model and ESCP. WRD material sampling data. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019) There is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.
HP-5	Embankment failure of Annies Dam water storage or process water ponds and uncontrolled water and sediment release.	**Direct -** Adverse impacts to Marrakai Creek including potential influx surface water that causes significant destruction to existing drainage lines on and off site. Direct disturbance of the hydrological regime of Marrakai Creek and alteration of the riparian environment. Localised severe scouring of the topsoils in the area surrounding the breach and exposure of subsoils to erosive factors which could lead to further impact to surface water features. Impact on structural integrity of engineered embankments. **Indirect or Cumulative -** Addition of affected drainage lines to the Adelaide River catchment contributing to minor but cumulative catchment runoff, higher watercourse velocities, scouring and downstream deposition. Potential contribution to the formation of anthropogenic induced depositions, damming and backflow lagoons downstream. This could result in inundation of areas not previously subject to flooding and thus alteration of ecological conditions in those areas.	Construction, Operation	Annies Dam is in the western portion of the Rustlers Roost Mine Lease/Project area and is positioned on the boundary of the Mount Bundey Creek catchment to the east and Marrakai Creek to the west. The dam is an earthern embankment construced on the upper reaches of the Marrakai Creek catchments. Any overflow or discharges from the dam flow to the west and north of the ML towards Marrakai Creek. There are no known habitable dwellings on the reach of the contributing creek to Marrakai Creek down to the Adelaide River. The capacity of the dam is relatively small at 200,000 kL. Any breach would likely be partial is unlikely to result in the complete discharge of the entire 200,000 kL; nevertheless, such worstcase scenario must be considered in the risk assessment. It is also important to note that Annies Dam is a retention dam created to supply raw water for previous operations at the site. Therefore, the dam has been in place since at least ceasation of the previous mining operation in 1997. Further, there is a high-level diversion south of the dam wall aimed at preventing overtopping. Given the long-term implacement, very limited upstream catchment and existing high level diversion the likelihood of an embankment failure should be considered in the low range. Further, Annies Dam is located in the area of the proposed TSF. Annies Dam is proposed to be decommissioned (drained and embankment removed to allow free draining) early in the project (1-4 years). Therefore, the period that this risk is relevant is limited.	E	3	20	Moderate	> Geotechnical studies and assessment to ensure structural stability Engineering design to ANCOLD standard. > Water Management Plan. > Weekly inspections to check sufficient freeboard and structural integrity.	E	2	23	Low	C3	High certainty that wall will not fail based on longevity of the existing structure, lack of issues since original construction, existence of a diversion to prevent opertopping and regular monitoring. Note - this risk and confidence ratings are based on the current design that does not include construction of any additional impervious areas in the dam runoff area/catchment (i.e. no significant increase in runoff).
HP-6	Groundwater drawdown.	**Direct -** Reduced water table elevation due to dewatering has the potential to reduce access to groundwater by riparian vegetation (including GDEs). Impact to any GDEs including aquatic ecosystems that are dependent on groundwater to provide dry season refugee. Potential change to surface water quality due to dewatering activity. **Indirect and Cumulative** - Cumulative drawdown of groundwater across three relatively close sites (Rustlers Roost, Q29 and Toms Gully) resulting in drawdown across the upper Mount Bundey Creek catchment. Potential to impact any localised GDE species and recharge of the local tributaries. Cumulative impacts could also occur with drawdown associated with nearby quarries. Potential increase in cumulative impact on groundwater level in conjunction with Toms Gully and nearby quarries.	Construction, Operation	The regional groundwater system is comprised of intermediate-scale aquifers associated with unconsolidated sediments and local-scale aquifers associated with fractured and weathered rocks with minor groundwater resources. There are no GDEs within either of the Project area. The BoM GDE Atlas classifies the Mount Bundey, Marrakai Creek and Mary River system as being high potential GDEs. There is a low-moderate potential for terrestrial GDEs, at two locations approximately 2-3 km downstream, north-east of Rustlers Roost, and one low potential terrestrial GDE, approximately 5 km downstream, north-west of Q29 lease. A numerical groundwater model was developed to estimate the potential maximum drawdown induced by mining the pits at Rustlers Roost and Quest 29, and the potential groundwater inflows to the proposed mining pits. The model predicted that the drawdown induced by the proposed pumping may extend up to 5 km to the north and 3 km to the south of the Rustlers Roost pits and 2 km the south-west of the Quest 29 pits. The modelling suggests that the probability of Marrakai Creek, May River and McKinlay River being impacted by the proposed pits is minimal. Drawdown in groundwater will occur; however, based on the available information for GDEs and modelling the impact of this drawdown is expected to be minor.	A	2	10	High	> Hydrogeological assessment indicated that minimal connection of groundwater to Mount Bundey Creek Water MP. > No documented drawdown impacts from previous operations. >Groundwater monitoring.	A	1	15	High	C3	Given the certainty of drawdown the inherent and residual likelihood of occurrence does not change and is listed as 'Almost Certain' (A). However, the consequence of this drawdown is based on the terrestrial survey findings and groundwater modelling. Unlikely impact as no immediate GDEs are present on the Project area.

HP-7	Indiscriminate use of existing waste rock for construction. Storage of waste rock outside of pit footprint for too long.	**Direct** - Diversion of existing runoff pathways, whether this be overland flow within drainage lines. This would likely result in scouring and incision causing altered flow paths leading to loss of topsoil, sedimentation of waterways and altered upper-catchment hydrological regime. This would adversely affect the biological processes that depend on water quality. Groundwater interaction with contaminants from incorrect storage of waste rock. **Indirect or Cumulative** - Increased disturbance and lost productivity of surface water fearures in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the the nearby Mount Bundey Training Area. Resulting in reduced local capacity of surface water features to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation. Indirect biological and human health implications in the immediate location of the placement and areas subject to seepage or runoff.	Construction Operation Decommissioning Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Waste oxide material may also be used in the haul road formation with potential to cause offsite impacts if the material used leaches AMD, heavy metals or NORMS. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.	D	3	17	Moderate	> Development and implementation of a geochemical block model. > Tracking of the waste rock and dumping locations > Waste rock dump plan > ESCP to prevent mobilisation > Hydrological studies to ensure WRDs are outside flood affected areas > Maximisation of placement within pits > On-going and regular inspections of project areas	D	2	21	Low	C3	High probability that the existng WRD are not accidentially or indiscriminatlly disturbed and waste stays within footprint integrated into operational plan and management. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019)
HP-8	Pit and groundwater dewatering exposing PAF and causing AMD.	**Direct** - Reduction of onsite water quality and potential exceedance of site specific trigger values (SSTVs), if discharged. Adverse impacts on downstream water quality, aquatic environment, and downstream users. Groundwater interaction with PAF. **Indirect and Cumulative** - Potential transportation of PAF material, with potential to cause contamination, throughout the Project area and external. With specific relevance to hydrological processes this would have the potential to lead to dieback of riparian vegetation exposing sediments, reducing infiltration and waterway roughening, thus resulting in higher instream velocities, scouring and downstream sedimentation. Indirect biological and human health implications in the immediate location of the PAF material and areas subject to seepage or runoff.	Construction Operation Decommissioning Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Waste oxide material may also be used in the haul road formation with potential to cause offsite impacts if the material used leaches AMD, heavy metals or NORMS. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model. With appropriate implementation and design and controls, the Project should not contribute to impacts associated with release of chemicals into the environment.	C	3	13	High	> Develop and implement a geochemical block model. > Sump below underground decline to reclaim contaminated water. > Implementation of AMD Management Plan including ore and waste rock controls and tailings controls. > Treatment of pit and underground water to within SSTV criteria. > Upgrading of site drainage measures. > Visual inspection of pit walls to identify locations and volumes of acid producing material.	C	2	18	Moderate	C3	High certainty that AMD affected pit water retained for treatment. Thus not escaping to the surrounding environs.
HP-9	Planned pit over topping or release to surface water features during extreme rainfall and flooding events.	**Direct -** Contamination of surrounding water features and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on water quality (pyrite, pyrrhotite and arsenopyrite are expected to be present in tailings in quantities that will be Potentially Acid Forming). **Indirect and Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implecations (primary contaminat of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing.	Construction Operation	The mining methodology will be consistent over Rustlers Roost and Q29, with the open-cut mining operation being conducted with conventional truck and shovel methods. Dewatering of the pits will be undertaken with diesel powered in-pit sumps. Dewatering will occur as required as a result of direct precipitation from rain events and groundwater in-flow.	C	1	22	Low	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the Pits. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water.	C	1	22	Low	C3	Planned releases have strict water quality criteria applied and may be treated prior to discharge to achieve quality requirements. Planned discharges are often undertaken when surface water flows in the receiving watercourse are sufficient to limit the potential for impacts to environmental values.
HP-10	Unplanned pit overtopping or release to surface water features during extreme rainfall and flooding events.	**Direct** - Direct alteration of the hydological regime including potential influx that causes significant destruction to existing drainage lines on and off site. Potential for persistent alteration of the local groundwater regime through seepage and mounding. Potential alteration of the water table that would impact features of the natural environment that are reliant on existing conditions (e.g. GDEs). Impact on structural integrity of engineered embankments threatening additional failures and contaminant releases (e.g. adjacent decommissioned heap leach pad). **Indirect or Cumulative -** Contribution of overtopping flows of embankment failures to discharge from Toms Gully Mine into the Mount Bundey catchment resulting in increased water levels, flooding of area typically not susceptable to inundation, higher watercourse velocities, scouring and downstream deposition. Negative implications on the riparian environment and capacity to naturally accommodate wet season events.	Construction Operation Decommissioning Closure	The mining methodology will be consistent over Rustlers Roost and Q29, with the open-cut mining operation being conducted with conventional truck and shovel methods. Dewatering of the pits will be undertaken with diesel powered in-pit sumps. Dewatering will occur as required as a result of direct precipitation from rain events and groundwater in-flow. A range of management measures will be employeed to prepare the sites for the wet season and prevent unplanned discharges. The Rustlers Roost site has a freeboard of approximately 10 m and has no known overtopping. At Quest 29 the Zamu pit sits wihtin a drainage line and has water flowing through and thus releasing during the wet season. Therefore, while the inherent likelihood of unplanned overtopping or release from Rustlers Roost is considered 'Unlikely' (D) this has been allocated as 'Almost Certain" (A) due to the existing condition of the Zamu Pit at Quest 29. Diversion around to Zamu pit as part of the Project will significantly reduce the likelihood of this occuring and thus the residual likelihood is allocated as 'Unlikely' (D).	A	3	6	Extreme	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the Pits. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water. > Implement drainage diversions as per the ESCP.	D	2	21	Low	C2	The water balance modelling directly informs the liklihood of this occuring. The analysis and modelling completed as part of the hydological assessment has directly informed development of the ESCP and diversions. Thus, significantly increasing confidence.

HP-11	Erosion of site infrastructure leading to sedimentation.	**Direct** - Potential direct alteration of flow paths onsite and decreased structural integrity of the impacted infrastructure. Movement of soil or rock material from site infrastructure (e.g. WRD or TSF embankments) contributing to sedimentation and blockage of natural drainage lines leading to localised flooding and erosion. **Indirect or Cumulative** - Contribution to exposed ground in the project area and general locality. Thus, contributions to the surface water runoff in the wider area.	Operation, Decommissioning Closure	Embankments for onsite infrastructure are proposed to be constructed from material sourced onsite. Suitable materal will be selected based on the onsite infrastructure purpose. Where erosion is considered likely during the design and construction, controls will be included to manage runoff and reduce risk (e.g. rock rip rap). It is considered the highest likelihood for site infrastructure erosion is during the wet season.The potental impacts could occur both onsite and in the wider offsite area.	B	3	9	High	> Implementation of Erosion and Sediment Control Plan (ESCP). > Ongoing and regular (weekly) inspections of project areas and after rainfall events. > Avoid land clearing during wet season. > Minimise concentrated flow of surface water and ponding (drain lines, sediment bunds, liners etc.). > Revegetation of exposed areas where not proposed to be utilised. > Stable design of landforms. > Construction of project infrastructure with suitable materials.	C	2	18	Moderate	C3	Moderate level of certainty as the site contains soils that are dispersive and are susceptable to erosion where using for construction of onsite infrastructure. Howevr, adherence to ESCP controlled developed in accordance with IECA international standards is widely accepted as preventing or limiting offsite impacts from soils destabilisation and erosive factors, improves certainty.
HP-12	Release of hazardous chemicals or materials during storage and handling onsite.	**Direct** - Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the riparian flora if the contaminants reach drainage lines and leading to vegtation dieback. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Resulting in reduced local capacity of surface water features to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation.	Construction, Operation, Decommissioning	Diesel, oil and lubricants and processing chemicals (i.e. cyanide) will be the principle dangerous goods transported and stored. Failure of containment during transportation of chemicals within the site or onsite tanks or storage containers is possible. Hydrocarbons will be stored on site for refuelling as well as servicing of vehicles and machinery. Process chemicals will also be stored on site (i.e. processing plant). These will be stored on previously cleared areas and will be bunded. Based on similar operations small spills could easily occur during all stages; however, larger spills are highly unlikely with standard controls. Drill and blasting techniques with the use of ammonium nitrate (ANFO) will be required for the open-cut mining operations. An explosives compound (i.e. magazine) will be located within MLN1083. The magazine will be used for both Rustlers Roost and Q29 Projects. With exception of ANFO and a diesel tank, all operating chemicals will be stored within the processing plant area. The list and volume of hazardous chemicals to be stored for processing is as follows: > Cyanide - 165 m³. > Hydrochloric acid - 70 m³. > Sodium hydroxide - 30 m³. > Copper sulphate - 10 m³. > Hydrogen peroxide - 16.7 m³. > Blanking agent - 700 m³. > Quicklime - 100 t. > Flocculent - 54.0 m³. > Liquid petroleum Gas (LPG) - 66 m³. > Smelting fluxes - 4 t. > Diesel fuel - 68,000 L (two storages onsite one will be wihtin the process plant and the other in the mine laydown area. Fuel truck will fuel the Quest 29 machinery - no onsite storage at Quest 29).	D	3	17	Moderate	> Design, storage and handling of hazardous materials to Australian Standards and regulations. > Specific adherence of the *ANFO Storage ofDangerous Goods Act 1998* and the *NT Work Health and Safety (National Uniform Legislation) Act 2011.* > Regular maintenance of storage facilities. > Bunding of the process plant. > Ensure containment bunding and MDSDs available. > Diesel in bunded storage tanks, waste oil in stored bunded tanks. > Weekly inspections of storage areas, tanks, containers. > Develop Emergency Response Plan and include in inductions. > Weekly inspections of storage areas for leaks or damages. > Spill kits available around the site and procedures and training for the cleaning up of hazardous spills. > Implementation of hazardous materials management plan training for emergency response. > Cyanide management and storage will be aligned to the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (2008). > Groundwater monitoring. > Chemical storage will be located a minimum 30 m from any drainage line or watercourse.	E	2	23	Low	C3	Highly unlikely for major spill as well tested industry standards used. While minor spills that are easily contained and cleaned are possible, there is high certainty that large spills are highly unlikely. Based on other mining operations. Weekly inspections will ensure any minor leaks or spills are contained and cleaned up preventing larger spills. Further, the location of chemical storage reduces the likelihood of these receiving at drainage lines and thus impacting the hydrological regime.
HP-13	Poor handling and management of tailings and waste rock	**Direct** - Diversion of existing runoff pathways, whether this be overland flow within drainage lines. This would likely result in scouring and incision causing altered flow paths leading to loss of topsoil, sedimentation of waterways and altered upper-catchment hydrological regime. This would adversely affect the biological processes that depend on water quality. Potential alteration of flow paths resulting in decreased structural integrity of the impacted infrastructure. Movement of soil or rock material from site infrastructure (e.g. WRD or TSF embankments) contributing to sedimentation and blockage of natural drainage lines leading to localised flooding and erosion. Groundwater interaction with contaminants from tailings and waste rock. **Indirect or Cumulative** - Increased disturbance and lost productivity of surface water fearures in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the the nearby Mount Bundey Training Area. Resulting in reduced local capacity of surface water features to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation. Indirect biological and human health implications in the immediate location of the placement and areas subject to seepage or runoff.	Operation, Decommissioning	The TSF will have a total 40 MT capacity. The TSF is to be constructed of geochemically benign and structurally appropriate material. The finalised TSF lining design requirements will be determined from the geochemical characterisation of the ore. It is not expected that tailings will contain high levels of cyanide as residual cyanide will we removed from tailings during the refining process and reused in the processing circuit. The TSF construction will include the following features: > An underdrainage system will be constructed to minimise seepage losses and maximise recovery. > A seepage recovery tower will be installed to pump the underdrainage back into the TSF. > A decant tower will be installed within the decant pond of the TSF to return water to the processing facility for reuse. > An emergency spillway constructed as part of each wall raise. Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Waste oxide material may also be used in the haul road formation with potential to cause offsite impacts if the material used leaches AMD, heavy metals or NORMS. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced.	D	3	17	Moderate	> Daily monitoring of waste rock handling and tailings disposal. > Tailings and Waste Rock will be managed in accordance with the Tailings Management Plan and Operational Manual (including inspections). >Use of a perimeter spigot with regular movement to evenly distribute tailings. > Regular surveys to measure the tailings and waste rock deposition and water depths. > Groundwater monitoring.	D	2	21	Low	C3	Highly unlikely as the technology used to deposit tailings and waste rock is well tested industry standards used.
HP-14	Production of domestic waste and storage of the waste onsite	**Direct** - Contamination of surface water and groundwater in the area promixal to the domestic waste receptacle where inappropriate storage vessels and management is used. Alteration of water characteristics, including chemical, physical, biological and aesthetic qualities resulting in riparian or GDE impacts that impact hydrological processes (e.g. dieback of vegetation and increase scouring). **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Resulting in reduced local capacity of surface water features to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation.	Construction, Operation, Decommissioning.	While domestic waste may be produced in low levels at both the Rustlers Roost and Q29 areas, the primary location of production and this risk, is the accommodation camp located on ML29814 near the separate Toms Gully project. Onsite operations require waste disposal and storage areas, creating opportunities for feral fauna species. The landfill site will be located at Rustlers Roosts. The landfill will be buried and must be appropriately lined and capped to prevent production and spread of leachate into the environment.	C	2	18	Moderate	> Secure dustbin lids. > Establish dedicated hardstand at accommodation camp for waste recepticles. > Weekly inspections of, waste area, landfill and general tidiness of site. > Burial of landfill (non-contaminating) waste. > Design and construct landfill in accordance with relevant standards. > Implement leachate prevention and capture into landfill design. > Groundwater monitoring. > Segregation of general and recycling of waste where possible.	D	1	24	Low	C3	Low probability as inert rubbish is continually managed and areas of waste will be small/contained. Waste area for the accommodation camp will be impervious. Standard lining and capping will be employed for the small site landfill.

HP-15	Unfinished/unsuccessful rehabilitation of Project due to inadequate funds or natural disaster (e.g. cyclone).	**Direct** - Site not rehabilitated to required standards. Increased potential for offsite impacts from AMD, erosion and sedimentation. Degradation of water quality onsite and various forms of erosion (sheet, rill, wind etc.) transporting soils into water features, potentially resulting in sedimentation and backflows (afflux). **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implecations (primary contaminat of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Given proponent is the same for nearby Toms Gully project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large areas of disturbed and unrehabilited land in the Mount Bundey catchment cumulatively resultining in increated sediment loads to Mount Bundey Creek and the downstream Mary River.	Construction, Operation, Decommissioning and Closure	Potential legacy issues with expansive areas of unrehabillated land maintaining exposed surfaces. An un-rehabilitated site can result in the compromisation of natural functioning ecosystems. Early closure planning needs to be undertaken and where possible rehabilitation trials to understand the most effective methods for successful rehabilitation. The MMP will account for the project financial security as per NT EPA requirements.	C	4	8	Extreme	> Progressive rehabilitation of disused areas. > Implementation of detailed mine closure plan. > Early planning and financial provision for closure works. > Infrastructure design to withstand extreme events. > Ongoing management of levels in water infrastructure. > Improve site drainage controls.	D	3	17	Moderate	C3	Implement closure planning into mine plan. Site operated to accommodate natural disasters. MMP obligates provision of financial security for approval.
HP-16	Long term positive water balance	**Direct** - Potential build-up of water onsite and the need for long term treatment and constant discharges of water. Positive water balance could potentially mean surrounding areas (groundwater and surface watrer) are not receiving typical supply. Thus, inbalance of the local hydrological regime which could adversely impact ecological features such as GDEs. **Indirect and Cumulative** - Likely result in a constent requirement for ongoing discharges and a regular pulses of site water into the environment rather than a more steady flow that would occur in a natural system. This could indirectly result in scouring and degration of drainage features that receive the discharged water.	Construction, Operation, Decommissioning and Closure	Close out structures to be water shedding to reduce water build up across site. Reduce and minimise contact water contact with AMD forming material.	D	4	12	High	> Improve and maintain site drainage infrastructure. > Review options for WRD Rehabilitation. > Implementation of Mine Closure Plan and adherence to commitments. > Closure Plan updated and refined throughout mining operations including life of mine closure planning and contingency planning. > Financial provisioning for closure implementation.	E	3	20	Moderate	C3	Progressive capping and rehabilitation will result in limited additional capping work at closure. The Water Management Plan has been developed to prevent onsite build-up of water.
HP-17	Inappropriate management of the decommissioned site, post closure landform.	**Direct** - Unauthorised access to the site by externals (including public, leaseholders and livestock) negatively affecting rehabilitation potential and contributing to rehabilitation failure. Potential scouring, soil erosion, loss of topsoil and sedimentation resulting in the alteration of on and off site drainage features. **Indirect or Cumulative** - Increased disturbance of soils in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area, resulting in alterated hydrological regime (primarily surface water) to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation.	Closure	The decommissioned landform will need restricted access to prevent vehicles and livestock from accessing areas that are undergoing active rehabilitation. Inappropriate access could disturb unestablished vegetation, cause erosion and sedimentation in waterways and lead to rehabilitation failure.	C	2	18	Moderate	> Implement fencing and access restriction to prevent vehicle and livestock accessing accessing rehabilitation areas. > Ongoing monitoring of rehabilitation. > Progressive rehabilitation during mining to enable more established areas upon closure.	D	2	21	Low	C3	Progressive rehabilitation is likely to result in significant areas of the site have highly established vegetation by closure. Appropriate rehabilitation is being completed on numerous sites throughout the NT (ERA, South 32) and is expected to be highly achievable in the project setting.
HP-18	Ineffective operational implementation of site environmental management system, plans and procedures.	**Direct -** Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the riparian flora if the contaminants reach drainage lines leading to vegetation dieback and scouring of surface water features. **Indirect or Cumulative** - Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rahabilitation goals and closure requirements following decommissioning. Agreed Post Mine Land Use (PMLU) cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features. Potential increase in cumulative concentration of sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts.	Construction, Operation, Decommissioning Closure	Ineffective environmental management during any stage can lead to significant ongoing environmental issues which are often more expansive than if addressed properly when they arise. For example, if erosion and sediment runoff is identified onsite but not appropriately addressed initially could require widespread management after several years, may encroach into offsite areas, could adversely impact downstream receptors, impact native vegetation composition and thus fauna habitat. Appropriate procedures and levels of resourcing must be implemented during all stages of the project.	C	3	13	High	> Corporate commitment to EMS implementation via policy. > Environmental Management System and various management plans (EMP, WMP, MMP etc.). > All events/incidents to be reported and managed through to resolution via event/incident reporting procedures. > All personnel will be inducted into the area and informed of the hazards and relevant management protocols of the areas. > All personnel will be trained in the appropriate management practices as is relevant to their position.	D	3	17	Moderate	C3	High. Based on similar conditions. Operational activities will be undertaken according to relevant management plans and appropriate procedures. Environmental Management Plan structures and inclusives are well established.
HP-19	Inappropriate liquid and solid waste disposal.	**Direct -** Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the riparian flora if the contaminants reach drainage lines and leading to vegtation dieback and scouring of surface water features. **Indirect or Cumulative** - Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rahabilitation goals and closure requirements following decommissioning. Agreed Post Mine Land Use (PMLU) cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features. Potential increase in cumulative concentration of sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts.	Construction, Operation, Decommissioning Closure	While domestic waste may be produced in low levels at both the Rustlers Roost and Q29 areas, the primary location of production and this risk, is the accommodation camp located on ML29814 near the separate Toms Gully project. Generation of waste oils, lubricants and solid waste (e.g. batteries, scrap metal and oily rags) need to be disposed of in an appropriate manner such as in waste oil bins and taken off site. If this is managed properly, it is unlikely that waste should cause impacts to the surrounding environment. Onsite operations require a landfill site for non-hazardous materials. The landfill site will located at Rustlers Roosts. The landfill will be buried and must be appropriately lined and capped to prevent production and spread of leachate into the environment.	D	3	12	High	> Manage disposal of wastes in accordance with the Project EMP (including bunded waste oil bins). > Hazardous materials stored in accordance with Australian standards. > Spill kits available around site and spill clean-up procedures implemented. > Employees and contractors trained in clean up procedures. > Weekly inspections of, waste area, landfill and general tidiness of site. > Burial of landfill (non-contaminating) waste. > Design and construct landfill in accordance with relevant standards. > Implement leachate prevention and capture into landfill design. > Groundwater monitoring.	E	2	23	Low	C3	Low probability of occurrence as inert rubbish is continually managed. Standard lining and capping will be employed for the small site landfill.

HP-20	As part of closure and rehabilitation, creeks and drainage alignments are not consistent to the surrounding landforms and catchment area.	**Direct** - Diversion of existing runoff pathways, whether this be overland flow within drainage lines. This would likely result in scouring and incision causing altered flow paths leading to loss of topsoil, sedimentation of waterways and altered upper-catchment hydrological regime. This would adversely affect the biological processes that depend on water quality. **Indirect or Cumulative -** Increased disturbance and lost productivity of surface water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the the nearby Mount Bundey Training Area. Resulting in reduced local capacity of surface water features to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation. Indirect biological and human health implications in the immediate location of the placement and areas subject to seepage or runoff.	Closure	During operations, rehabilitation will be undertaken on the decommissioned heap leach facilities using suitable available oxide waste material. The proposed surface WRD at Q29 will be rehabilitated during year three following mining of the first pit (Zamu). The Rustlers Roost surface WRD will be rehabilitated on completion of mining during year eleven, as oxide material from the existing WRD will be utilised to ensure sufficient available oxide capping material for the WRD expansion. The TSF will be rehabilitated at completion of processing (year eleven) following sufficient drying time prior to capping and revegetation. An important component of the progressive rehabilitation will be appropriate closure planning and placement of material to enable a structurally stable and environmentally benign post-closure landform.	D	3	17	Moderate	> Progressively rehabilitating the mine. > Clearing and Topsoil Procedures Implementation of Mine Closure. > Implementation of the ESCP addressing post closure drainage.	E	2	23	Low	C3	Progressive rehabilitation is likely to result in significant areas of the site being established for closure prior to decommissioning. Implement closure planning into mine plan.

Table 4: Inland Water Environmental Quality

Inherent Risk									Mitigation & Management	Residual risk					
Risk #	Source of Impact	Consequence	Project Phase(s)	Discussion	Likli	Cons	Risk	Risk		Likli	Cons	Risk	Risk	Level of Certainty	Justification of Certainty and Residual Risk
IWEQ-1	Vegetation clearing for the Project	**Direct** - Disturbing an additional 344.5 ha of land for the Rustlers Roost. 44.6 ha for Q29, 7.3 ha for the accommodation camp and 1.1 ha for the haul road (total of 397.5 ha). Resulting in destabilised soils, potential erosion, loss of topsoil and sedimentation of Marrakai Creek and Mount Bundey Creek. Characteristics of soils, including chemical, physical, biological and aesthetic qualities are degraded in the vegetation clearing area. Resulting in less productive soils and potential impacts (through the abovementioned erosion). **Indirect or Cumulative** - Elevated sediments in waterways from the project, nearby major operations (e.g. Toms Gully and Mount Bundey Training Area) and general anthropogenic activities (e.g. runoff from unsealed roads) may result in reduced biodiversity in affected areas. Sediment runoff into aquatic habitats can cause increased turbidity, decreased oxygen levels, reduced light penetration, changes in channel morphology and altered sediment composition in substrates. In addition, interference with flows may alter the local wetting and drying regime, including water heights, flow paths, retention times and ponding. Such changes can have flow-on effects on aquatic habitats, resulting in their loss or alteration and a reduction in the quality and/or quantity of important food sources. Cumulative or indirectly sediments that runoff due to vegetation clearing could adversely impact downstream aquatic habitats that support fish populations important to recreational fishing and traditional activities (reduced fish abundance).	Construction and Operation	The proposal area is predominantly low hills to rises. Existing vegetation and extensive stone surface outcrops provide land stability; however, land disturbed on slopes >2 % may have increased surface water runoff velocities and consequently a higher erosion risk. Rudosols, kandosols and hydrosols are all mapped as occurring within the proposed vegetation clearing area. Rudosols and kandosols are known to be highly erodible soils types and will thus need appropriate controls to prevent offsite movement through erosion. TSF at Rustlers Roost construction will occur during the dry season of the construction and development phase. Mount Bundey Creek and the Mary River main branch are considered important watercourses, with beneficial uses declared under the Water Act. The declared beneficial uses for Mount Bundey Creek are for stock water supply for approximately a 7 km section at the Arnhem Highway flowing north-east (approximately 25 km downstream of the proposal areas), and aquatic ecosystems protection for the remainder (approximately 30 km downstream of the proposal areas). The declared beneficial uses and objectives for Mary River region is for environment, riparian and cultural uses. Sections of Mount Bundey Creek and the Mary River downstream of the proposal area are protected in the Mary River National Park. An aquatic ecosystem survey for Mount Bundey Creek and tributaries downstream of the project area was completed in 2017. While limited fish and macroinvertebrate species were located in Mount Bundey Creek and tributary, the abundance seems to be impacted by historic mining and cattle activity. It also confirmed that Mitchell's and Mertens Water Monitors are present in low numbers downstream of the Project.	A	4	3	Extreme	> Adherence to Ground Disturbance Procedures. > Progressive clearing and rehabilitation. > Implement erosion and sediment controls in accordance with an ESCP. >Only clearing what is absolutely necessary for the portion of the project to be implemented. > Implementation of Biodiversity Management Plan. > Clearly mark limits of clearing. > Make use of already disturbed areas where possible. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines. > Avoid land clearing during the wet Season (Dec-May).	C	2	18	Moderate	C3	Adherence to ESCP controlled developed in accordance with IECA international standards is widely accepted as preventing or limiting offsite impacts from soils destabilisation and erosive factors.
IWEQ-2	Overtopping, embankment failure or seepage from the new TSF at Rustlers Roost leading to uncontrolled release of tailings material to surrounding environment.	**Direct** - Contamination of surrounding water. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on water quality (surface and groundwater). Direct result in the loss of ecological integrity and suitable native fauna habitat in the impacted areas. **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish.	Construction, Operation, Decommissioning or Closure	The TSF will have a total 40 MT capacity. The TSF is to be constructed of geochemically benign and structurally appropriate material. The finalised TSF lining design requirements will be determined from the geochemical characterisation of the ore. It is not expected that tailings will contain high levels of cyanide as residual cyanide will we removed from tailings during the refining process and reused in the processing circuit. The TSF construction will include the following features: > An underdrainage system will be constructed to minimise seepage losses and maximise recovery. > A seepage recovery tower will be installed to pump the underdrainage back into the TSF. > A decant tower will be installed within the decant pond of the TSF to return water to the processing facility for reuse. > An emergency spillway constructed as part of each wall raise. Design criteria set for the spillway in accordance with ANCOLD. Likelihood of uncontrolled releases from the spillway into the environment under 'emergency' conditions (e.g. extreme rainfall) is low as the TSF wall is to be built higher than the level of the waste and the spillway during each of the operational stages. The risk is only likely when the tailings dam is in the final stage. A number of seepage control and underdrainage collection features have been integrated into the design. The seepage control and underdrainage collection systems will consist of the components as follows: > Cut-off trench. > Compacted soil liner (CSL). > Basin underdrainage collection system overlying the CSL, including collectors (in drainage courses) and finger drains (30 m spacing over TSF basin area). > Underdrainage collection sump. > Embankment toe drain.	E	5	11	High	> TSF to be planned, designed, constructed and operated in accordance with approaches details in the guideline Tailings Management: Leading Practice Sustainable Development Program for the Mining Industry (DFAT 2016). > Design TSF to contain a range of design storm and rainfall sequences events up to and greater than the required design criteria. > An operational emergency spillway to be constructed as part of each embankment raise. > Development of Monitoring Plan / Operational Manual which includes weekly inspections of the TSF, survey pins to monitor the embankment and piezometers to measure pore water pressure. > Tailings performance monitoring (e.g. TSF water volume, collection efficiency of underground system). > Install seepage control and underground drainage including a cut-off trench, compact soil liner, basin underdrainage collection system, underdrain collection sump and embankment tow drain. > Groundwater monitoring to check quality and any seepage. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water.	E	3	20	Moderate	C3	High certainty that the new tailings embankment will remain stable. Based on historical use of the TSF at the nearby Toms Gully Mine in the same geology, Geotech studies and engineering design and modelling. Geotech studies and engineering design and modelling. Specifically: > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021). > Geotechnical assessment for the site. No previous instability issues with either the existing waste rock dumps or leach pads at the Rustlers Roost or Quest 29 sites. Justification also based on the TSF being designed, constructed and operated in accordance with leading practice.
IWEQ-3	Overtopping, embankment failure or seepage from the process water storage at Rustlers Roost leading to uncontrolled release of process water to surrounding environment.	**Direct** - Contamination of surrounding water. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on water quality (surface and groundwater). Direct result in the loss of ecological integrity and suitable native fauna habitat in the impacted areas. **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish.	Operation, Decommissioning and Closure	The process water will be stored in the northern portion of the TSF, utilising the TSF structure and safety features. This will hold water from the process circuit and provides buffering between the TSF decant and the process itself. Process water quality may contain AMD contaminants. The process water storage will receive both return water from decant pond and stormwater runoff from processing plant. Mined ore will be processed using a CIL processing method, which extracts gold from the ore by mixing with a cyanide solution. Tailings within the processing circuit, will be screened to recover carbon and then will go through a detoxification to remove residual cyanide. The recovered carbon and residual cyanide will be reused in the processing circuit. Despite the reuse of cyanide there is potential for residual cyanide in the process water. Despite the above, it is noted that the process plant and the process water storage are set back from the drainage line feeding to Mount Bundey and is separated by various site infrastructure (e.g. the main pit and TSF). There are no GDEs within either of the proposal areas. The BoM GDE Atlas classifies the Mount Bundey, Marrakai Creek and Mary River system as being high potential GDEs. There is a low-moderate potential for terrestrial GDEs, at two locations approximately 2-3 km downstream, north-east of Rustlers Roost, and one low potential terrestrial GDE, approximately 5 km downstream, north-west of Quest 29 lease. As the process water will be stored in the TSF, the seepage design criteria are the same. A number of seepage control and underdrainage collection features have been integrated into the design. The seepage control and underdrainage collection systems will consist of the components as follows: > Cut-off trench. > Compacted soil liner (CSL). > Basin underdrainage collection system overlying the CSL, including collectors (in drainage courses) and finger drains (30 m spacing over TSF basin area). > Underdrainage collection sump. > Embankment toe drain.	E	5	11	High	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams. > Groundwater / surface WQ monitoring. > Manage the site water balance to reduce any build-up of water.	E	3	20	Moderate	C3	High certainty that the new process water dam embankments (TSF embankments) will remain stable. Based on historical use of dams at the Rustlers Roost Mine in the same geology and general soil structure. Geotech studies and engineering design and modelling. Specifically: > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021) > Geotechnical assessment for the site. No previous instability issues with either the existing dams or other structures (e.g. Leach pads) at the Rustlers Roost or Quest 29 sites. Justification also based on the process water dam being designed, constructed and operated in accordance with leading practice.

IWEQ-4	Embankment failure or seepages from the new WRDs at Rustlers Roost and Quest 29 to surrounding environment.	**Direct** - Contamination of surrounding water. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on water quality (surface and groundwater). Direct result in the loss of ecological integrity and suitable native fauna habitat in the impacted areas. **Indirect or Cumulative -** Potential transportation of contaminants throughout the Project area and external (AMD, heavy metals and NORMS). Biological and human health implications. Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, stock watering, recreation and fishing. Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants in environmental pathways should the same contaminants be released from the nearby Toms Gully Mine or already be present in the environment due to historic activities.	Operation, Decommissioning and Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. It is possible for seepage to occur throughout the year for the WRDs, an embankment failure is far more rare but potentially more consequential. Due to the source risk including seepage, the likelihood has been applied as Possible. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is supported by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.	A	4	3	Extreme	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams. > Groundwater / surface WQ monitoring. > Manage the site water balance to reduce any build-up of water. > Capping of the WRDs to reduce ongoing water infiltration and seepage.	C	2	18	Moderate	C3	High certainty that the seepage and runoff can be contained and treated based on the water balance model and the ESCP. WRD material sampling data. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). There is high certainty that runoff from WRDs can be captured onsite and managed so that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is supported by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.
IWEQ-5	Embankment failure of Annies Dam water storage or process water ponds and uncontrolled water and sediment release (temporary risk noting closure of dam for Rustlers Roost TSF).	**Direct** - Adverse impacts to the structure and quality of Marrakai Creek and downstream aquatic ecosystems with movement and deposition of sediments and damage to vegetation and fauna downstream. Localised severe scouring of the topsoils in the area surrounding the breach and exposure of subsoils to erosive factors leading to sedimentation where not immediately rectified. **Indirect or Cumulative** - Potential increase in cumulative concentration of sediments within the Marrakai Creek and Adelaide Rivers as a result of any sediment discharged. Increased downstream depositions and siltation impacts. Also, indirect impact of reduced ability for successful revegetation due to loss of topsoils. Significant sediment runoff into aquatic habitats could cause widespread turbidity, decreased oxygen levels, reduced light penetration, changes in channel morphology and altered sediment composition in substrates. In addition, interference with flows may alter the local wetting and drying regime, including water heights, flow paths, retention times and ponding. Such changes can have flow-on (indirect) effects on aquatic habitats, resulting in their loss or alteration and a reduction in the quality and/or quantity of important food sources.	Construction and Operation	Annies Dam is in the western portion of the Rustlers Roost Mine Lease/Project area and is positioned on the boundary of the Mount Bundey Creek catchment to the east and Marrakai Creek to the west. The dam is an earthen embankment constructed on the upper reaches of the Marrakai Creek catchments. Any overflow or discharges from the dam flow to the west and north of the ML towards Marrakai Creek. There are no known habitable dwellings on the reach of the contributing cree to Marrakai Creek down to the Adelaide River. The capacity of the dam is relatively small at 200,000 kL. Any breach would likely be partial is unlikely to result in the complete discharge of the entire 200,000 kL; nevertheless, such worst-case scenario must be considered in the risk assessment. It is also important to note that Annies Dam is a retention dam created to supply raw water for previous operations at the site. Therefore, the dam has been in place since at least cessation of the previous mining operation in 1997. Further, there is a high-level diversion south of the dam wall aimed at preventing overtopping. Given the long-term emplacement, very limited upstream catchment and existing high level diversion the likelihood of an embankment failure should be considered in the low range. Further, Annies Dam is located in the area of the proposed TSF. Annies Dam is proposed to be decommissioned (drained and embankment removed to allow free draining) early in the project (1-4 years). Therefore, the period that this risk is relevant is limited.	E	3	20	Moderate	> Geotechnical studies and assessment to ensure structural stability Engineering design to ANCOLD standard. > Water Management Plan. > Weekly inspections to check sufficient freeboard and structural integrity.	E	2	23	Low	C3	High certainty that wall will not fail based on using leading industry practice and regular monitoring. Based on data analysis, engineering design and modelling. However, consequences remains high.
IWEQ-6	Poor quality runoff or seepage from the historic WRDs and heap leaches.	**Direct** - Contamination of surrounding water features and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct species health implication (reduced physical health or mortality) depending on contaminant in seepage material. Inability of impacted water features to maintain biological qualities to support standard flora and fauna. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants in environmental pathways should the same contaminants be released from the nearby Toms Gully Mine or already be present in the environment due to historic activities.	Construction Operation Decommissioning Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. The sulphide WRD has AMD material within it and therefore drainage and runoff need to be managed appropriately. The historic WRDs at Rustlers Roost and Q29 will be augmented to either new pits (Q29) or expansion as a WRD (Rustlers Roost) Seepage and runoff from WRD is highly likely and therefore almost certain for AMD to occur. This will be monitored closely during all phases of the Project. Sampling of the waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019)	D	3	17	Moderate	> Continued use of drainage controls and bunds. > Maximise runoff pond capacity prior to wet season. >Ongoing monitoring of existing groundwater bores. > Investigation and consideration of long-term closure options. > Cap with suitable waste rock. > Calculations, identification and provisioning of suitable cap material. > Implementation of AMD management plan. > Daily inspections for runoff and drainage problem areas.	D	2	21	Low	C3	High certainty that the seepage and runoff can be contained and treated based on the water balance model. Previous mitigation used at Toms Gully. Site treatment plant in use. WRD material sampling data. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019)
IWEQ-7	Poor water quality released from site during wet season (stormwater).	**Direct** - Primary contaminants of concern in wet season stormwater release is acidity and sediment, thus resulting in increased turbidity of waterways. This could result in poor quality drinking water for terrestrial fauna, reduced quality of habitat for aquatic fauna and sedimentation of riparian environments which intrinsically support the health of the inland aquatic ecosystems. Habitat modification and/or lifecycle disruption and/or impact on the size of a population (aquatic flora and fauna). Decrease in fish populations and species richness from ecotoxicity. Depending on geochemistry of the waste rock material to be exposed in the new pits and the placement on site, runoff may also contain heavy metals and NORMS. These would have direct terrestrial fauna health implications should this water be ingested. **Indirect or Cumulative** - Decrease in fish populations and species richness resulting in decreased suitability of the environment for aquatic species. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish. Potential contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourses for the extraction of drinking water, stock water, recreation and fishing.	Construction, Operation, Decommissioning or Closure	Water storages will be dewatered prior to the wet season to provide capacity. Dewatering will be completed in accordance with discharge criteria which sets an appropriate water quality to avoid downstream impacts. Altered hydrology is not expected to impact on any population size (only species level). Potential impact if species ingest contaminated water. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model. Sampling of the existing waste materials and water quality indicates that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019).	C	4	8	Extreme	> Development and implementation of a geochemical block model. > Compliance with the Waste Discharge Licence. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. >All water storage facilities geotechnically stable and engineered ANCOLD guidelines. > Groundwater / surface water quality monitoring. > Weekly inspections of freeboard, structural integrity and pipelines. > Implement erosion and sediment controls in accordance with an ESCP.	D	3	17	Moderate	C3	Highly unlikely as water quality and volumes monitored with controlled discharge. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019).

IWEQ-8	Indiscriminate use of existing waste rock for construction. Storage of waste rock outside of pit footprint for too long.	**Direct** - AMD, heavy metals and NORMS leading to contamination of inland watercourse (specifically Marrakai Creek, Mount Bundey Creek and McKinlay River as initial receiving environments). Contamination of surrounding land and alteration of soil characteristics, including chemical, physical, biological and aesthetic qualities resulting in long-term leaching to inland waters and diversity affecting the biological processes that depend on water quality. **Indirect or Cumulative** - Potential transportation of leaching material, with potential to cause contamination, throughout the Project area and external. Indirect biological and human health implications in the immediate location of the placement and areas subject to seepage or runoff. Decrease in fish populations and species richness resulting in decreased suitability of the environment for aquatic species. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish. Potential contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, stock water, recreation and fishing.	Construction Operation Decommissioning Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Waste oxide material may also be used in the haul road formation which has the potential to cause offsite impacts if the material used leaches AMD, heavy metals or NORMS. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced. Based on the material characterisation study there is a risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and managed so that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.	C	3	17	Moderate	> Development and implementation of a geochemical block model. > Tracking of the waste rock and dumping locations. > Waste rock dump plan. > ESCP to prevent mobilisation. > Hydrological studies to ensure WRDs are outside flood affected areas. > Implementation of AMD Management Plan and Water Management Plan. > Maximisation of placement within pits. > Testing of waste rock for AMD, heavy metals and NORMS prior to use as on or offsite construction material.	E	2	23	Low	C3	High probability that the existing WRD are not accidentally or indiscriminately disturbed and waste stays within footprint integrated into operational plan and management. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019).
IWEQ-9	Pit and groundwater dewatering exposing PAF and causing AMD.	**Direct** - Reduction of onsite water quality and potential exceedance of site specific trigger values (SSTVs), if discharged. AMD, heavy metals and NORMS leading to contamination of inland watercourse (specifically Marrakai Creek, Mount Bundey Creek and McKinlay River as initial receiving environments). Adverse impacts on downstream water quality, aquatic environment, and downstream users. **Indirect and Cumulative** - Potential transportation of PAF material, with potential to cause contamination, throughout the Project area and external. This would have the potential to cause dieback of riparian vegetation. Indirect biological and human health implications in the immediate location of the placement and areas subject to seepage or runoff. Decrease in fish populations and species richness resulting in decreased suitability of the environment for aquatic species. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish. Potential contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, stock water, recreation and fishing.	Construction Operation Decommissioning Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Waste oxide material may also be used in the haul road formation which has the potential to cause offsite impacts if the material used leaches AMD, heavy metals or NORMS. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced. Based on the material characterisation study there is a risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model. With appropriate implementation and design and controls, the Project should not contribute to impacts associated with release of chemicals into the environment.	C	3	13	High	> Develop and implement a geochemical block model. > Sump below underground decline to reclaim contaminated water. > Implementation of AMD Management Plan including ore and waste rock controls and tailings controls. > Treatment of pit and underground water to within SSTV criteria. > Upgrading of site drainage measures. > Visual inspection of pit walls to identify locations and volumes of acid producing material. > Groundwater / surface WQ monitoring.	C	2	18	Moderate	C3	High certainty that AMD affected pit water retained for treatment. Thus not escaping to the surrounding environs.
IWEQ-10	Planned pit over topping or release to surface water features during extreme rainfall and flooding events.	**Direct -** Contamination of surrounding water features and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct species health implication (reduced physical health or mortality) depending on contaminant in seepage material. Inability of impacted water features to maintain biological qualities to support standard flora and fauna. **Indirect and Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminate of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing.	Construction Operation	The mining methodology will be consistent over Rustlers Roost and Q29, with the open-cut mining operation being conducted with conventional truck and shovel methods. Dewatering of the pits will be undertaken with diesel powered in-pit sumps. Dewatering will occur as required as a result of direct precipitation from rain events and groundwater in-flow.	C	1	22	Low	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the Pits. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water. > Groundwater / surface WQ monitoring.	C	1	22	Low	C3	Planned releases have strict water quality criteria applied and may be treated prior to discharge to achieve quality requirements. Planned discharges are often undertaken when surface water flows in the receiving watercourse are sufficient to limit the potential for impacts to environmental values.
IWEQ-11	Unplanned pit overtopping or release to surface water features during extreme rainfall and flooding events.	**Direct** - Contamination of surrounding water features and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct species health implication (reduced physical health or mortality) depending on contaminant in seepage material. Inability of impacted water features to maintain biological qualities to support standard flora and fauna. **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminate of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Contribution of overtopping flows or embankment failures to discharges from Toms Gully Mine into the Mount Bundey catchment resulting in decreased water quality in the catchment. Negative implications on the riparian environment and capacity to naturally accommodate wet season events.	Construction Operation Decommissioning Closure	The mining methodology will be consistent over Rustlers Roost and Q29, with the open-cut mining operation being conducted with conventional truck and shovel methods. Dewatering of the pits will be undertaken with diesel powered in-pit sumps. Dewatering will occur as required as a result of direct precipitation from rain events and groundwater in-flow. A range of management measures will be employed to prepare the sites for the wet season and prevent unplanned discharges. The Rustlers Roost site has a freeboard of approximately 10 m and has no known overtopping. At Quest 29 the Zamu pit sits within a drainage line and has water flowing through and thus releasing during the wet season. Therefore, while the inherent likelihood of unplanned overtopping or release from Rustlers Roost is considered 'Unlikely' (D) this has been allocated as 'Almost Certain" (A) due to the existing condition of the Zamu Pit at Quest 29. Diversion around to Zamu pit as part of the Project will significantly reduce the likelihood of this occurring and thus the residual likelihood is allocated as 'Unlikely' (D).	A	3	6	Extreme	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the Pits. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water. > Groundwater / surface WQ monitoring. > Implement drainage diversions as per the ESCP.	D	2	21	Low	C3	The water balance modelling directly informs the likelihood of this occurring. The analysis and modelling completed as part of the hydrological assessment has directly informed development of the ESCP and diversions. Thus, significantly increasing confidence.
IWEQ-12	Erosion of site infrastructure leading to sedimentation	**Direct -** Reduces surface water quality in the surrounding water features with increased sedimentation in creek bed. Potential AMD in downstream ecosystems. **Indirect and Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminate of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing.	Construction Operation	Embankments for onsite infrastructure are proposed to be constructed from material sourced onsite. Suitable material will be selected based on the onsite infrastructure purpose. Where erosion is considered likely during the design and construction, controls will be included to manage runoff and reduce risk (e.g. rock rip rap). It is considered the highest likelihood for site infrastructure erosion is during the wet season. The potential impacts could occur both onsite and in the wider offsite area.	B	3	9	High	> Implementation of Erosion and Sediment Control Plan (ESCP). > Ongoing and regular (weekly) inspections of project areas and after rainfall events. > Avoid land clearing during wet season. > Minimise concentrated flow of surface water and ponding (drain lines, sediment bunds, liners etc.). > Revegetation of exposed areas where not proposed to be utilised. > Stable design of landforms. > Construction of project infrastructure with suitable materials.	C	2	18	Moderate	C2	Moderate level of certainty as the site contains soils that are dispersive and are susceptible to erosion where using for construction of onsite infrastructure.

IWEQ-13	Release of hazardous chemicals or materials during storage and handling onsite.	**Direct** - Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the riparian flora and fauna if the contaminants reach drainage lines and leading to vegetation dieback. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Resulting in reduced local capacity of surface water features to perform ecological functions. Biological and human health implications (primary contaminate of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing.	Construction, Operation, Decommissioning	Diesel, oil and lubricants and processing chemicals (i.e. cyanide) will be the principle dangerous goods transported and stored. Failure of containment during transportation of chemicals within the site or onsite tanks or storage containers is possible. Hydrocarbons will be stored on site for refuelling as well as servicing of vehicles and machinery. Process chemicals will also be stored on site (processing plant). These will be stored on previously cleared areas and will be bunded. Based on similar operations small spills could easily occur during all stages; however, larger spills are highly unlikely with standard controls. Drill and blasting techniques with the use of ammonium nitrate (ANFO) will be required for the open-cut mining operations. An explosives compound (magazine) will be located within MLN1083. The magazine will be used for both Rustlers Roost and Q29 Projects. With exception of ANFO and a diesel tank, all operating chemicals will be stored within the processing plant area. The list and volume of hazardous chemicals to be stored for processing is as follows: > Cyanide - 165 m³. > Hydrochloric acid - 70 m³. > Sodium hydroxide - 30 m³. > Copper sulphate - 10 m³. > Hydrogen peroxide - 16.7 m³. > Blanking agent - 700 m³. > Quicklime - 100 t. > Flocculent - 54.0 m³. > Liquid petroleum Gas (LPG) - 66 m³. > Smelting fluxes - 4 t. > Diesel fuel - 68,000 L (two storages onsite one will be within the process plant and the other in the mine laydown area. Fuel truck will fuel the Quest 29 machinery - no onsite storage at Quest 29).	D	3	17	Moderate	> Design, storage and handling of hazardous materials to Australian Standards and regulations. > Specific adherence of the *ANFO Storage of Dangerous Goods Act 1998* and the *NT Work Health and Safety (National Uniform Legislation) Act 2011*. > Regular maintenance of storage facilities. > Bunding of the process plant. > Ensure containment bunding and MDSDs available. > Diesel in bunded storage tanks, waste oil in stored bunded tanks. > Weekly inspections of storage areas, tanks, containers. > Develop Emergency Response Plan and include in inductions. > Weekly inspections of storage areas for leaks or damages. > Spill kits available around the site and procedures and training for the cleaning up of hazardous spills. > Implementation of hazardous materials management plan training for emergency response. > Cyanide management and storage will be aligned to the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (2008). > Chemical storage will be located a minimum 30m from any drainage line or watercourse.	E	2	23	Low	C3	Highly unlikely for major spill as well tested industry standards used. While minor spills that are easily contained and cleaned are possible, there is high certainty that large spills are highly unlikely. Based on other mining operations. Weekly inspections will ensure any minor leaks or spills are contained and cleaned up preventing larger spills. Further, the location of chemical storage reduces the likelihood of these receiving at drainage lines and thus impacting the hydrological regime.
IWEQ-14	Poor handling and management of tailings and waste rock	**Direct** - Release of AMD leading to contamination of surface water and groundwater quality and ecosystems. Alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on water quality (surface and groundwater). Direct result in the loss of ecological integrity and suitable native fauna habitat in the impacted areas. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminate of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish.	Construction, Operation, Decommissioning	The TSF will have a total 40 MT capacity. The TSF is to be constructed of geochemically benign and structurally appropriate material. The finalised TSF lining design requirements will be determined from the geochemical characterisation of the ore. It is not expected that tailings will contain high levels of cyanide as residual cyanide will we removed from tailings during the refining process and reused in the processing circuit. The TSF construction will include the following features: - An underdrainage system will be constructed to minimise seepage losses and maximise recovery. - A seepage recovery tower will be installed to pump the underdrainage back into the TSF. - A decant tower will be installed within the decant pond of the TSF to return water to the processing facility for reuse. - An emergency spillway constructed as part of each wall raise. Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Waste oxide material may also be used in the haul road formation with potential to cause offsite impacts if the material used leaches AMD, heavy metals or NORMS. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.	D	3	17	Moderate	> Development and implementation of a geochemical block model. > Daily monitoring of waste rock handling and tailings disposal. > Tailings and Waste Rock will be managed in accordance with the Tailings Management Plan and Operational Manual (including inspections). > Use of a perimeter spigot with regular movement to evenly distribute tailings. > Regular surveys to measure the tailings and waste rock deposition and water depths. > Groundwater / surface WQ monitoring.	D	2	21	Low	C3	Highly unlikely as the technology used to deposit tailings and waste rock is well tested industry standards used.
IWEQ-15	Production of domestic waste and storage of the waste onsite	**Direct** - Contamination of surface water and groundwater in the area proximal to the domestic waste receptacle where inappropriate storage vessels and management is used. Alteration of water characteristics, including chemical, physical, biological and aesthetic qualities resulting in riparian or GDE impacts that impact hydrological processes (e.g. dieback of vegetation and increase scouring). **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Resulting in reduced local capacity of surface water features to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation. Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish.	Construction, Operation, Decommissioning.	While domestic waste may be produced in low levels at both the Rustlers Roost and Q29 areas, the primary location of production and this risk, is the accommodation camp located on ML29814 near the separate Toms Gully project. Onsite operations require a landfill site and dustbins etc. Creating opportunities for feral fauna species. The landfill site will located at Rustlers Roosts. The landfill will be buried and must be appropriately lined and capped to prevent production and spread of leachate into the environment.	C	2	18	Moderate	> Secure dustbin lids. > Establish dedicated hardstand at accommodation camp for waste receptacles. > Weekly inspections of, waste area, landfill and general tidiness of site. > Burial of landfill (non-contaminating) waste. > Design and construct landfill in accordance with relevant standards. > Implement leachate prevention and capture into landfill design > Groundwater monitoring. > Segregation of wastes and recycling of wastes where possible.	D	1	24	Low	C3	Low probability as inert rubbish is continually managed and areas of waste will be small/contained. Waste area for the accommodation camp will be impervious. Standard lining and capping will be employed for the small site landfill.
IWEQ-16	Unfinished/unsuccessful rehabilitation of Project due to inadequate funds or natural disaster (e.g. cyclone).	**Direct** - Site not rehabilitated to required standards. Increased potential for offsite impacts from AMD, erosion and sedimentation. Degradation of water quality onsite and various forms of erosion (sheet, rill, wind etc.) transporting soils into water features, potentially resulting in sedimentation and backflows (afflux). **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminate of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Given proponent is the same for nearby Toms Gully project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large area of disturbed and unrehabilitated land in the Mount Bundey catchment cumulatively resulting in increased sediment loads to Mount Bundey Creek and the downstream Mary River.	Construction, Operation, Decommissioning and Closure	Potential legacy issues with expansive areas of unrehabilitated land maintaining exposed surfaces. An unrehabilitated site can result in the compromising of natural functioning ecosystems. Early closure planning needs to be undertaken and where possible rehabilitation trials to understand the most effective methods for successful rehabilitation. The MMP will account for the project financial security as per NT EPA requirements.	C	4	8	Extreme	> Progressive rehabilitation of disused areas. > Implementation of detailed mine closure plan. > Early planning and financial provision for closure works. > Infrastructure design to withstand extreme events. > Ongoing management of levels in water infrastructure. > Improve site drainage controls.	D	3	17	Moderate	C3	Implement closure planning into mine plan. Site operated to accommodate natural disasters. MMP obligates provision of financial security for approval.

IWEQ-17	Pit lake becomes a groundwater source.	**Direct -** Gradual development of plume of contaminated groundwater. Pit lake water quality may become more acidic and with higher concentration of contaminants which may impact fauna species and local vegetation surrounding the landform. **Indirect and Cumulative -** Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants in environmental pathways should the same contaminants be released from the nearby Toms Gully Mine or already be present in the environment due to historic activities. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish.	Construction, Operation, Decommissioning and Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced. Pit lake water quality as an aquatic ecosystem habitat for the Rustlers Roost pit lake was moderately poor, with high nutrient concentrations and low oxygen concentrations. However, pit lake water quality as COPC concentrations was good, with only slight exceedances of ecosystem values for total iron and ammonium and drinking water for ammonium. While the groundwater modelling and water balance assessment indicate connectivity with the groundwater aquifers and potential loss of water from the pits into the aquifers (more likely during the dry season), the good water quality indicates that seepage of pit lake water into groundwater is unlikely to contribute significant contaminants that would adversely affect the surrounding environment.	C	2	18	Moderate	> Geochemical assessment and modelling of pit water. > Contingency to manage water chemistry changes. > Investigate in pit water treatment options (i.e. use of lime or caustic). > Contaminant transport modelling further refined. > Limit pit catchment post closure to reduce inflow. > Ongoing groundwater monitoring program.	D	3	17	Moderate	C3	Focus to maintain good water quality (monitoring and treatment). Implement closure planning into mine plan. This has been applied a moderate level of uncertainty due to the inherent uncertainty with regard to connectivity of the pits to the surrounding aquifers, inflows and outflows.
IWEQ-18	Lack of rehabilitation materials leads to inadequate tailings closure and poor quality site rehabilitation.	**Direct** - Completion criteria and environmental outcomes unable to be met. Potential soil erosion, loss of topsoil and sedimentation (through both water and wind erosive forces) affecting water quality in the surrounding water features. Characteristics of water, including chemical, physical, biological and aesthetic qualities are degraded in the vegetation clearing area. Resulting in less productive water ecosystems and potential impacts (through the abovementioned erosion) on adjacent catchment. **Indirect or Cumulative -** Increased disturbance and lost productivity of water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area, resulting in reduced local capacity of water to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation.	Decommissioning and Closure	Areas to be cleared of vegetation shall have any useful materials (i.e. seed, timber) salvaged, before vegetation is pushed aside, topsoil (notionally 10 cm) and other useful growth media or construction materials are stockpiled for later use. Rehabilitation monitoring shall be completed in the first wet season and any remedial actions identified and implemented by the next wet season. Appropriate topsoils to be maintained and/or growing media needs to be provisioned in the planning to enable sufficient volumes for the rehabilitation.	C	3	13	High	> Financial provisioning for closure implementation. > Calculation of material requirements in EIS and identification of extraction areas. > Recover topsoil from TSF, WRD and processing plant footprints. > Progressively rehabilitating the mine. > Clearing and Topsoil Procedures Implementation of Mine Closure.	D	3	17	Moderate	C2	Implement management of rehabilitation resources as part of mine scheduling. Volumes of tailings and waste rock and the material estimates for caping have been produced and included in the Project Description. Based on these there is confidence that sufficient material is available.
IWEQ-19	Inappropriate management of the decommissioned site, post closure landform.	**Direct** - Unauthorised access to the site by externals (including public, leaseholders and livestock) negatively affecting rehabilitation potential and contributing to rehabilitation failure. Potential scouring, soil erosion, loss of topsoil and sedimentation resulting in the alteration of water quality on and off site drainage features. **Indirect or Cumulative -** Increased disturbance of water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area, resulting in reduced local capacity of water to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation.	Closure	The decommissioned landform will need restricted access to prevent vehicles and livestock from accessing areas that are undergoing active rehabilitation. Inappropriate access could disturb unestablished vegetation, cause erosion and sedimentation in waterways and lead to rehabilitation failure.	C	2	18	Moderate	> Implement fencing and access restriction to prevent vehicle and livestock accessing rehabilitation areas. > Ongoing monitoring of rehabilitation. > Progressive rehabilitation during mining to enable more established areas upon closure.	D	2	21	Low	C3	Progressive rehabilitation is likely to result in significant areas of the site have highly established vegetation by closure. Appropriate rehabilitation is being completed on numerous sites throughout the NT (ERA, South 32) and is expected to be highly achievable in the project setting.
IWEQ-20	Ineffective operational implementation of site environmental management system, plans and procedures.	**Direct -** Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the riparian flora and fauna if the contaminants reach drainage lines and leading to vegetation dieback and scouring of surface water features. **Indirect or Cumulative -** Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rehabilitation goals and closure requirements following decommissioning. Agreed Post Mine Land Use (PMLU) cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features. Potential increase in cumulative concentration of sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts.	Construction, Operation, Decommissioning Closure	Ineffective environmental management during any stage can lead to significant ongoing environmental issues which are often more expansive than if addressed properly when they arise. For example, if erosion and sediment runoff is identified onsite but not appropriately addressed initially could require widespread management after several years, may encroach into offsite areas, could adversely impact downstream receptors, impact native vegetation composition and thus fauna habitat. Appropriate procedures and levels of resourcing must be implemented during all stages of the project.	C	3	13	High	> Corporate commitment to EMS implementation via policy > Environmental Management System and various management plans (EMP, WMP, MMP etc.). > All events/incidents to be reported and managed through to resolution via event/incident reporting procedures. > All personnel will be inducted into the area and informed of the hazards and relevant management protocols of the areas. > All personnel will be trained in the appropriate management practices as is relevant to their position.	D	3	17	Moderate	C3	High. Based on similar conditions. Operational activities will be undertaken according to relevant management plans and appropriate procedures. Environmental Management Plan structures and inclusive are well established.
IWEQ-21	Use of project machinery, equipment, vehicles and activities causing fire through sparks or heat ignition source.	**Direct** - Damage to topsoil composition and vegetation binding soils. Thus, resulting in the increased ability for soils to erode and disperse which may decreased water quality in the surrounding water features. Also, potential runoff of contaminated soils into water features due to fire extinguishers (depending on where it happens) and material consumed by the fire. **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing.	Construction, Operation, Decommissioning Closure	Bushfires commonly occur in the dry season within the region. Should fires be started due to project activities they could impact onsite operations and easily spread offsite. Primary Gold will need to implement a Fire Management Plan to ensure that bushfires are not started as a result of the Project operations.	C	3	13	High	> Liaise with Bushfires NT regarding regional (and site) fire break. > Establish hot work procedures. > Regular inspections of generators and other sources of heat/power. > Fire extinguishers available around site and on all vehicles and machinery. > Training and inductions include Emergency Response Plan. > Establish and implement appropriate control fire regime for area in the MLs.	D	3	17	Moderate	C3	High. Based on similar conditions. Adherence to the hot works procedures and implementation of the Fire Management Plan are standard arrangements for preventing fires.
IWEQ-22	Dust generation from project activities such as vehicular movements and earthworks.	**Direct -** Dust emissions impact upon local and nearby water features. Creating safety issue during operations. Loss of productive topsoil inhibiting growth potential of retained media. Characteristics of water, including chemical, physical, biological and aesthetic qualities are degraded by dust emission, resulting in less productive water ecosystems and potential impacts (through the abovementioned wind erosion) on adjacent catchment. **Indirect or Cumulative -** Potential cumulative dust lift-off and deposition in the wider area in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area. Potential increase in cumulative concentration of sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts. Also, indirect impact of reduced ability for successful revegetation due to loss of topsoils which may lead to further erosion.	Construction, Operation, Decommissioning Closure	Dust is not expected to be a significant issue during operations. Periodically there will be higher levels of dust during clearing; however, clearing will be prioritised for days with low wind forecasts. Dust suppression will be implemented via a water cart during clearing operations. However, excessive dust from project activities could result in deposition on surrounding vegetation, risks being inhaled by site personnel and could impact drivers visibility when operating vehicles/machinery. An on-site flora and fauna survey of the Toms Gully, Rustlers Roost and Quest 29 survey areas was undertaken from 1st –7th November 2016 to assess fauna presence in the late dry season. One hundred and thirty-nine fauna species were recorded during the on-ground surveys of Toms Gully, Rustlers Roost and Quest 29. This included 89 bird species, 20 mammal species, 15 reptile species, 12 amphibian species and three arthropod species. No threatened fauna species were recorded despite targeted survey effort for eleven potential threatened species identified by the NT Fauna Atlas and PMST. Nevertheless, noise may adversely affect wildlife by interfering with communication, masking the sound of predators and prey, causing stress or avoidance reactions, and in some cases, may lead to changes in reproductive or nesting behaviour. Excessive noise may lead some species to avoid noisy areas, potentially resulting in the fragmentation of species habitat. Radle (2007) states the consensus that terrestrial fauna will avoid any industrial plant or construction area where noise or vibration presents an annoyance to them. Additionally, many animals react to new noise initially as a potential threat, but quickly 'learn' that the noise is not associated with a threat (Radle 2007).	B	1	19	Moderate	> Implementation of Project EMP (incorporating fire and dust management measures). > Implementation of Biodiversity MP (incorporating dust mitigation and artificial lighting mitigation measures). > Site planning to minimise clearing activities, and avoid clearing on significantly windy days. > Comply with approved vegetation clearance. > Ground Disturbance Permit (GDP) procedure to be adhered to. > Operations in line with noise regulations.	C	1	22	Low	C3	Controls are industry standards and easily implemented. All mining sites implement such controls.

IWEQ-23	Inappropriate liquid and solid waste disposal.	**Direct -** Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the riparian flora if the contaminants reach drainage lines and leading to vegetation dieback and scouring of surface water features. **Indirect or Cumulative** - Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rehabilitation goals and closure requirements following decommissioning. Agreed Post Mine Land Use (PMLU) cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features. Potential increase in cumulative concentration of sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts.	Construction, Operation, Decommissioning Closure	While domestic waste may be produced in low levels at both the Rustlers Roost and Q29 areas, the primary location of production and this risk, is the accommodation camp located on ML29814 near the separate Toms Gully project. Generation of waste oils, lubricants and solid waste such as batteries, scrap metal and oily rags etc. need to be disposed of in an appropriate manner such as waste oil bins and taken off site. If this is managed properly, it is unlikely that waste should cause impacts to the surrounding environment. Onsite operations require a landfill site for non-hazardous materials. The landfill site will located at Rustlers Roosts. The landfill will be buried and must be appropriately lined and capped to prevent production and spread of leachate into the environment.	D	3	12	High	> Manage disposal of wastes in accordance with the Project EMP (including bunded waste oil bins). > Hazardous materials stored in accordance with Australian standards. > Spill kits available around site and spill clean-up procedures implemented. > Employees and contractors trained in clean up procedures. > Weekly inspections of, waste area, landfill and general tidiness of site. > Burial of landfill (non-contaminating) waste. > Design and construct landfill in accordance with relevant standards. > Implement leachate prevention and capture into landfill design. > Groundwater monitoring.	E	2	23	Low	C3	Low probability of occurrence as inert rubbish continually managed. Standard lining and capping will be employed for the small site landfill.
IWEQ-24	Major mechanical failure of processing plant	**Direct -** Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the riparian flora if the contaminants reach drainage lines and leading to vegetation dieback and scouring of surface water features. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Agreed Post Mine Land Use (PMLU) cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features.	Operation	The processing plant will be bunded to avoid runoff leaving the area. If major mechanical failure occurs, it is only expected impact to the local area with all potential contaminants being retained within the abandonment bund.	C	3	13	High	> Ensure appropriate warranties in place and maintain appropriate critical mechanical spares inventory. > Regular maintenance and inspections of plant. > Engineer sign off before recommencement of plant. > Construction of abandonment bund around the processing plant.	D	2	21	Low	C2	Moderate certainty. Standard industry practice. Similar mitigation used previously at Toms Gully.

Table 5: Aquatic Ecosystems

Inherent Risk									Mitigation & Management	Residual risk					
Risk #	Source of Impact	Consequence	Project Phase(s)	Discussion	Likli	Cons	Risk	Risk		Likli	Cons	Risk	Risk	Level of Certainty	Justification of Certainty and Residual Risk
AE-1	Vegetation clearing for the Project	**Direct** - Disturbing an additional 344.5 ha of land for the Rustlers Roost. 44.6 ha for Q29, 7.3 ha for the accommodation camp and 1.1 ha for the haul road (total of 397.5 ha). Resulting in destabilised soils, potential erosion, loss of topsoil and sedimentation of Marrakai Creek and Mount Bundey Creek. Alteration of characteristics of water, including chemical, physical, biological and aesthetic qualities are degraded in the vegetation clearing area. Resulting in less productive aquatic ecosystems and potential impacts (through the abovementioned erosion). **Indirect or Cumulative** - Elevated sediments in waterways from the project, nearby major operations (e.g. Toms Gully and Mount Bundey Training Area) and general anthropogenic activities (e.g. runoff from unsealed roads) may result in reduced biodiversity in affected areas. Sediment runoff into aquatic habitats can cause increased turbidity, decreased oxygen levels, reduced light penetration, changes in channel morphology and altered sediment composition in substrates. In addition, interference with flows may alter the local wetting and drying regime, including water heights, flow paths, retention times and ponding. Such changes can have flow-on effects on aquatic habitats, resulting in their loss or alteration and a reduction in the quality and/or quantity of important food sources. Cumulative or indirectly sediments that runoff due to vegetation clearing could adversely impact downstream aquatic habitats that support fish populations important to recreational fishing and traditional activities (reduced fish abundance).	Construction and Operation	The proposal area is predominantly low hills to rises. Existing vegetation and extensive stone surface outcrops provide land stability; however, land disturbed on slopes >2 % may have increased surface water runoff velocities and consequently a higher erosion risk. Rudosols, kandosols and hydrosols are all mapped as occurring within the proposed vegetation clearing area. Rudosols and kandosols are known to be highly erodible soils types and will thus need appropriate controls to prevent offsite movement through erosion. TSF at Rustlers Roost construction will occur during the dry season of the construction and development phase. Mount Bundey Creek and the Mary River main branch are considered important watercourses, with beneficial uses declared under the Water Act. The declared beneficial uses for Mount Bundey Creek are for stock water supply for approximately a 7 km section at the Arnhem Highway flowing north-east (approximately 25 km downstream of the proposal areas), and aquatic ecosystems protection for the remainder (approximately 30 km downstream of the proposal areas). The declared beneficial uses and objectives for Mary River region is for environment, riparian and cultural uses. Sections of Mount Bundey Creek and the Mary River downstream of the proposal area are protected in the Mary River National Park. An aquatic ecosystem survey for Mount Bundey Creek and tributaries downstream of the project area was completed in 2017. While limited fish and macroinvertebrate species were located in Mount Bundey Creek and tributary, the abundance seems to be impacted by historic mining and cattle activity. It also confirmed that Mitchell's and Mertens Water Monitors are present in low numbers downstream of the Project. While Annie's Dam is a constructed feature is has some inherent environmental value as habitat as it is permanent and appears have good water quality with aquatic vegetation. Furthermore, seepage through the dam wall may result in permanent flow (in an otherwise ephemeral drainline) down the creek line feeding pools within the Marrakai Creek catchment outside the lease area.).	A	4	3	Extreme	> Adherence to Ground Disturbance Procedures. > Progressive clearing and rehabilitation. > Implement erosion and sediment controls in accordance with an ESCP. > Only clearing what is absolutely necessary for the portion of the project to be implemented. > Implementation of Biodiversity Management Plan. > Clearly mark limits of clearing. > Make use of already disturbed areas where possible. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines. > Avoid land clearing during the wet Season (Dec-May).	C	2	18	Moderate	C3	Adherence to ESCP controlled developed in accordance with IECA international standards is widely accepted as preventing or limiting offsite impacts from soils destabilisation and erosive factors.
AE-2	Overtopping, embankment failure or seepage from the new TSF at Rustlers Roost leading to uncontrolled release of tailings material to surrounding environment.	**Direct** - Contamination of surrounding water features. Alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on water quality (surface and groundwater). Direct result in the loss of ecological integrity and suitable aquatic fauna habitat in the impacted areas. **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within aquatic fauna (heavy metals) and risks of consumption of fish.	Construction, Operation, Decommissioning or Closure	The TSF will have a total 40 MT capacity. The TSF is to be constructed of geochemically benign and structurally appropriate material. The finalised TSF lining design requirements will be determined from the geochemical characterisation of the ore. It is not expected that tailings will contain high levels of cyanide as residual cyanide will we removed from tailings during the refining process and reused in the processing circuit. The TSF construction will include the following features: > An underdrainage system will be constructed to minimise seepage losses and maximise recovery. > A seepage recovery tower will be installed to pump the underdrainage back into the TSF. > A decant tower will be installed within the decant pond of the TSF to return water to the processing facility for reuse. > An emergency spillway constructed as part of each wall raise. Design criteria set for the spillway in accordance with ANCOLD. Likelihood of uncontrolled releases from the spillway into the environment under 'emergency' conditions (e.g. extreme rainfall) is low as the TSF wall is to be built higher than the level of the waste and the spillway during each of the operational stages. The risk is only likely when the tailings dam is in the final stage. A number of seepage control and underdrainage collection features have been integrated into the design. The seepage control and underdrainage collection systems will consist of the components as follows: > Cut-off trench. > Compacted soil liner (CSL). > Basin underdrainage collection system overlying the CSL, including collectors (in drainage courses) and finger drains (30 m spacing over TSF basin area). > Underdrainage collection sump.	E	5	11	High	> TSF to be planned, designed, constructed and operated in accordance with approaches details in the guideline Tailings Management: Leading Practice Sustainable Development Program for the Mining Industry (DFAT 2016). > Design TSF to contain a range of design storm and rainfall sequences events up to and greater than the required design criteria. > An operational emergency spillway to be constructed as part of each embankment raise. > Development of Monitoring Plan / Operational Manual which includes weekly inspections of the TSF, survey pins to monitor the embankment and piezometers to measure pore water pressure. > Tailings performance monitoring (e.g. TSF water volume, collection efficiency of underground system). > Install seepage control and underground drainage including a cut-off trench, compact soil liner, basin underdrainage collection system, underdrain collection sump and embankment tow drain. > Groundwater monitoring to check quality and any seepage. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water.	E	3	20	Moderate	C3	High certainty that the new tailings embankment will remain stable. Based on historical use of the TSF at the nearby Toms Gully Mine in the same geology, geotech studies and engineering design and modelling. Geotech studies and engineering design and modelling. Specifically: > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021). > Geotechnical assessment for the site. No previous instability issues with either the existing waste rock dumps or leach pads at the Rustlers Roost or Quest 29 sites. Justification also based on the TSF being designed, constructed and operated in accordance with leading practice.
AE-3	Overtopping, embankment failure or seepage from the process water storage at Rustlers Roost leading to uncontrolled release of process water to surrounding environment.	**Direct** - Contamination of surrounding water features. Alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on water quality (surface and groundwater). Direct result in the loss of ecological integrity and suitable aquatic fauna habitat in the impacted areas. **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within aquatic fauna (heavy metals) and risks of consumption of fish.	Operation, Decommissioning and Closure	The process water will be stored in the northern portion of the TSF, utilising the TSF structure and safety features. This will hold water from the process circuit and provides buffering between the TSF decant and the process itself. Process water quality may contain AMD contaminants. The process water storage will receive both return water from decant pond and stormwater runoff from processing plant. Mined ore will be processed using a CIL processing method, which extracts gold from the ore by mixing with a cyanide solution. Tailings within the processing circuit, will be screened to recover carbon and then will go through a detoxification to remove residual cyanide. The recovered carbon and residual cyanide will be reused in the processing circuit. Despite the reuse of cyanide there is potential for residual cyanide in the process water. Despite the above, it is noted that the process plant and the process water storage are set back from the drainage line feeding to Mount Bundey and is separated by various site infrastructure (e.g. the main pit and TSF). There are no GDEs within either of the proposal areas. The BoM GDE Atlas classifies the Mount Bundey, Marrakai Creek and Mary River system as being high potential GDE water systems. There is a low-moderate potential for terrestrial GDEs, at two locations approximately 2-3 km downstream, north-east of Rustlers Roost, and one low potential terrestrial GDE, approximately 5 km downstream, north-west of Quest 29 lease. As the process water will be stored in the TSF, the seepage design criteria are the same. A number of seepage control and underdrainage collection features have been integrated into the design. The seepage control and underdrainage collection systems will consist of the components as follows: > Cut-off trench. > Compacted soil liner (CSL). > Basin underdrainage collection system overlying the CSL, including collectors (in drainage courses) and finger drains (30 m spacing over TSF basin area). > Underdrainage collection sump.	E	5	11	High	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams. > Groundwater monitoring. > Manage the site water balance to reduce any build-up of water.	E	3	20	Moderate	C4	High certainty that the new process water dam embankments (TSF embankments) will remain stable. Based on historical use of dams at the Rustlers Roost Mine in the same geology and general soil structure. Geotech studies and engineering design and modelling. Specifically: > Dam break and consequence assessment for TSF (application of ANCOLD) (Knight Piesold, 2021). > Geotechnical assessment for the site. No previous instability issues with either the existing dams or other structures (e.g. Leach pads) at the Rustlers Roost or Quest 29 sites. Justification also based on the process water dam being designed, constructed and operated in accordance with leading practice.

AE-4	Embankment failure or seepages from the new WRDs at Rustlers Roost and Quest 29 to surrounding environment.	**Direct -** Contamination of surrounding water features. Alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on water quality (surface and groundwater). Direct result in the loss of ecological integrity and suitable aquatic fauna habitat in the impacted areas. **Indirect or Cumulative -** Potential transportation of contaminants throughout the Project area and external (AMD, heavy metals and NORMS). Aquatic ecosystems and human health implications. Contamination of downstream aquatic environments resulting disturbance of ecological integrity and functioning of aquatic ecosystems. Human health risks that would necessitate the closure of watercourse to extraction of drinking water, stock watering, recreation and fishing. Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants in environmental pathways should the same contaminants be released from the nearby Toms Gully Mine or already be present in the environment due to historic activities.	Operation, Decommissioning and Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. It is possible for seepage to occur throughout the year for the WRDs, an embankment failure is far more rare but potentially more consequential. Due to the source risk including seepage, the likelihood has been applied as Possible. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.	A	4	3	Extreme	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams. > Groundwater monitoring. > Manage the site water balance to reduce any build-up of water. > Capping of the WRDs to reduce ongoing water infiltration and seepage.	C	2	18	Moderate	C3	High certainty that the seepage and runoff can be contained and treated based on the water balance model. WRD material sampling data. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). There is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is support by the water balance model and implementation of the proposed control measures, including development of a geochemical block model.
AE-5	Embankment failure of Annies Dam water storage or process water ponds and uncontrolled water and sediment release (temporary risk noting closure of dam for Rustlers Roost TSF).	**Direct** - Adverse impacts to the structure and quality of Marrakai Creek and downstream aquatic ecosystems with movement and deposition of sediments and damage to aquatic vegetation and fauna downstream. Localised severe scouring of the topsoils in the area surrounding the breach and exposure of subsoils to erosive factors leading to sedimentation where not immediately rectified. **Indirect or Cumulative** - Potential increase in cumulative concentration of sediments within the Marrakai Creek and Adelaide Rivers as a result of any sediment discharged. Increased downstream depositions and siltation impacts. Significant sediment runoff into aquatic habitats could cause widespread turbidity, decreased oxygen levels, reduced light penetration, changes in channel morphology and altered sediment composition in substrates. In addition, interference with flows may alter the local wetting and drying regime, including water heights, flow paths, retention times and ponding. Such changes can have flow-on (indirect) effects on aquatic habitats, resulting in their loss or alteration and a reduction in the quality and/or quantity of important food sources.	Construction and Operation	Annies Dam is in the western portion of the Rustlers Roost Mine Lease/Project area and is positioned on the boundary of the Mount Bundey Creek catchment to the east and Marrakai Creek to the west. The dam is an earthen embankment constructed on the upper reaches of the Marrakai Creek catchments. Any overflow or discharges from the dam flow to the west and north of the ML towards Marrakai Creek. There are no known habitable dwellings on the reach of the contributing cree to Marrakai Creek down to the Adelaide River. The capacity of the dam is relatively small at 200,000 kL. Any breach would likely be partial is unlikely to result in the complete discharge of the entire 200,000 kL; nevertheless, such worst-case scenario must be considered in the risk assessment. It is also important to note that Annies Dam is a retention dam created to supply raw water for previous operations at the site. Therefore, the dam has been in place since at least cessation of the previous mining operation in 1997. Further, there is a high-level diversion south of the dam wall aimed at preventing overtopping. Given the long-term emplacement, very limited upstream catchment and existing high level diversion the likelihood of an embankment failure should be considered in the low range. Further, Annies Dam is located in the area of the proposed TSF. Annies Dam is proposed to be decommissioned (drained and embankment removed to allow free draining) early in the project (1-4 years). Therefore, the period that this risk is relevant is limited.	E	3	20	Moderate	> Geotechnical studies and assessment to ensure structural stability Engineering design to ANCOLD standard. > Water Management Plan. > Weekly inspections to check sufficient freeboard and structural integrity.	E	2	23	Low	C3	High certainty that wall will not fail based on using leading industry practice and regular monitoring. Based on data analysis, engineering design and modelling. However consequence remains high.
AE-6	Poor quality runoff or seepage from the historic WRDs and heap leaches.	**Direct** - Contamination of surrounding water features and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct aquatic species health implication (reduced physical health or mortality) depending on contaminant in seepage material. Inability of impacted water features to maintain biological qualities to support standard aquatic flora and fauna. **Indirect or Cumulative** - Potential transportation of contaminants throughout the Project area and external (AMD, heavy metals and NORMS). Aquatic ecosystems and human health implications. Contamination of downstream aquatic environments resulting disturbance of ecological integrity and functioning of aquatic ecosystems. Human health risks that would necessitate the closure of watercourse to extraction of drinking water, stock watering, recreation and fishing. Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants in environmental pathways should the same contaminants be released from the nearby Toms Gully Mine or already be present in the environment due to historic activities.	Construction Operation Decommissioning Closure	On completion of mining Zamu pit, the pit will be backfilled with waste material from mining of the remaining Quest 29 pits. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. The sulphide WRD has AMD material within it and therefore drainage and runoff need to be managed appropriately. The historic WRDs at Rustlers Roost and Q29 will be augmented to either new pits (Q29) or expansion as a WRD (Rustlers Roost) Seepage and runoff from WRD is highly likely and therefore almost certain for AMD to occur. This will be monitored closely during all phases of the Project. Sampling of the waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019)	D	3	17	Moderate	> Continued use of drainage controls and bunds. > Maximise runoff pond capacity prior to wet season. >Ongoing monitoring of existing groundwater bores. > Investigation and consideration of long-term closure options. > Cap with suitable waste rock. > Calculations, identification and provisioning of suitable cap material. > Implementation of AMD management plan. > Daily inspections for runoff and drainage problem areas.	D	2	21	Low	C3	High certainty that the seepage and runoff can be contained and treated based on the water balance model. Previous mitigation used at Toms Gully. Site treatment plant in use. WRD material sampling data. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019)
AE-7	Poor water quality released from site during wet season (stormwater).	**Direct** - Primary contaminants of concern in wet season stormwater release is acidity and sediment, thus resulting in increased turbidity of waterways. This could result in poor quality drinking water for terrestrial fauna, reduced quality of habitat for aquatic fauna and sedimentation of riparian environments which intrinsically support the health of the inland aquatic ecosystems. Habitat modification and/or lifecycle disruption and/or impact on the size of a population (aquatic flora and fauna). Decrease in fish populations and species richness from ecotoxicity. Depending on geochemistry of the waste rock material to be exposed in the new pits and the placement on site, runoff may also contain heavy metals and NORMS. These would have direct aquatic fauna health implications should this water be released. **Indirect or Cumulative** - Decrease in fish populations and species richness resulting in decreased suitability of the environment for aquatic species. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish. Potential contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, stock water, recreation and fishing.	Construction, Operation, Decommissioning or Closure	Water storages will be dewatered prior to the wet season to provide capacity. Dewatering will be completed in accordance with discharge criteria which sets an appropriate water quality to avoid downstream impacts. Altered hydrology is not expected to impact on any population size (only species level). Potential impact if species ingest contaminated water. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination that runoff can be contained and treated is supported by the water balance model and implementation of the proposed control measures, including development of a geochemical block model. Sampling of the existing waste materials and water quality indicates that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019).	C	4	8	Extreme	> Compliance with the Waste Discharge Licence. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. >All water storage facilities geotechnically stable and engineered to ANCOLD guidelines. > Groundwater / surface water quality monitoring. > Weekly inspections of freeboard, structural integrity and pipelines. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines to reduce sedimentation risk.	D	3	17	Moderate	C3	Highly unlikely as water quality and volumes monitored with controlled discharge. This is also based on sampling of the waste materials and water which has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019).

AE-8	Planned pit over topping or release to surface water features during extreme rainfall and flooding events.	**Direct -** Contamination of surrounding water features and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct aquatic species health implication (reduced physical health or mortality) depending on contaminant in seepage material. Inability of impacted water features to maintain biological qualities to support standard aquatic flora and fauna. **Indirect and Cumulative** - Potential transportation of contaminants throughout the Project area and external (AMD, heavy metals and NORMS). Aquatic ecosystems and human health implications. Contamination of downstream aquatic environments resulting disturbance of ecological integrity and functioning of aquatic ecosystems. Human health risks that would necessitate the closure of watercourse to extraction of drinking water, stock watering, recreation and fishing.	Construction Operation	The mining methodology will be consistent over Rustlers Roost and Q29, with the open-cut mining operation being conducted with conventional truck and shovel methods. Dewatering of the pits will be undertaken with diesel powered in-pit sumps. Dewatering will occur as required as a result of direct precipitation from rain events and groundwater in-flow.	C	1	22	Low	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the Pits. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan > Manage the site water balance to reduce any build-up of water. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines to reduce sedimentation risk.	C	1	22	Low	C3	Planned releases have strict water quality criteria applied and may be treated prior to discharge to achieve quality requirements. Planned discharges are often undertaken when surface water flows in the receiving watercourse are sufficient to limit the potential for impacts to environmental values.
AE-9	Unplanned pit overtopping or release to surface water features during extreme rainfall and flooding events.	**Direct -** Contamination of surrounding water features and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct aquatic species health implication (reduced physical health or mortality) depending on contaminant in seepage material. Inability of impacted water features to maintain biological qualities to support standard aquatic flora and fauna. **Indirect and Cumulative -** Potential transportation of contaminants throughout the Project area and external (AMD, heavy metals and NORMS). Aquatic ecosystems and human health implications. Contamination of downstream aquatic environments resulting in disturbance of ecological integrity and functioning of aquatic ecosystems. Human health risks that would necessitate the closure of watercourse to extraction of drinking water, stock watering, recreation and fishing. Contribution of overtopping flows or embankment failures to discharges from Toms Gully Mine into the Mount Bundey catchment resulting in decreased water quality in the catchment. Negative implications on the aquatic ecosystem and functionality and capacity to naturally accommodate wet season events.	Construction Operation Decommissioning Closure	The mining methodology will be consistent over Rustlers Roost and Q29, with the open-cut mining operation being conducted with conventional truck and shovel methods. Dewatering of the pits will be undertaken with diesel powered in-pit sumps. Dewatering will occur as required as a result of direct precipitation from rain events and groundwater in-flow. A range of management measures will be employed to prepare the sites for the wet season and prevent unplanned discharges. The Rustlers Roost site has a freeboard of approximately 10 m and has no known overtopping. At Quest 29 the Zamu pit sits within a drainage line and has water flowing through and thus releasing during the wet season. Therefore, while the inherent likelihood of unplanned overtopping or release from Rustlers Roost is considered 'Unlikely' (D) this has been allocated as 'Almost Certain" (A) due to the existing condition of the Zamu Pit at Quest 29. Diversion around to Zamu pit as part of the Project will significantly reduce the likelihood of this occurring and thus the residual likelihood is allocated as 'Unlikely' (D).	A	3	6	Extreme	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the Pits. > Implementation of Acid Mine Drainage Management Plan and Water Management Plan. > Manage the site water balance to reduce any build-up of water. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines to reduce sedimentation risk. > Implement drainage diversions as per the ESCP.	D	2	21	Low	C3	Unplanned releases are typically emergency events where the water quality may not have been established at the time. Hence, the consequence of such an event is higher than a planned event. The water balance modelling directly informs the likelihood of this occurring. The analysis and modelling completed as part of the hydrological assessment has directly informed development of the ESCP and diversions. Thus, significantly increasing confidence.
AE-10	Release of hazardous chemicals or materials during storage, handling or transport.	**Direct** - Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the aquatic ecosystem if the contaminants reach water features and leading to decrease of aquatic ecological functioning. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external, resulting in reduced local capacity of surface water features to perform ecological functions. Human health implications (primary contaminant of concern being cyanide). Contamination of downstream aquatic environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing.	Construction, Operation, Decommissioning	Diesel, oil and lubricants and processing chemicals (i.e. cyanide) will be the principle dangerous goods transported and stored. Failure of during transportation of chemicals within the site or onsite tanks or storage containers is possible. Hydrocarbons will be stored on site for refuelling as well as servicing of vehicles and machinery. Process chemicals will also be stored on site (i.e. processing plant). These will be stored on previously cleared areas and will be bunded. Based on similar operations small spills could easily occur during all stages; however, larger spills are highly unlikely with standard controls. Drill and blasting techniques with the use of ammonium nitrate (ANFO) will be required for the open-cut mining operations. An explosives compound (magazine) will be located within MLN1083. The magazine will be used for both Rustlers Roost and Q29 Projects. With exception of ANFO and a diesel tank, all operating chemicals will be stored within the processing plant area. The list and volume of hazardous chemicals to be stored for processing is as follows: > Cyanide - 165 m³. > Hydrochloric acid - 70 m³. > Sodium hydroxide - 30 m³. > Copper sulphate - 10 m³. > Hydrogen peroxide - 16.7 m³. > Blanking agent - 700 m³. > Quicklime - 100 t. > Flocculent - 54.0 m³. > Liquid petroleum Gas (LPG) - 66 m³. > Smelting fluxes - 4 t. > Diesel fuel - 68,000 L (two storages onsite one will be within the process plant and the other in the mine laydown area. Fuel truck will fuel the Quest 29 machinery - no onsite storage at Quest 29).	D	3	17	Moderate	> Design, storage and handling of hazardous materials to Australian Standards and regulations. > Specific adherence of the *ANFO Storage of Dangerous Goods Act 1998* and the *NT Work Health and Safety (National Uniform Legislation) Act 2011.* > Regular maintenance of storage facilities. > Bunding of the process plant. > Ensure containment bunding and MDSDs available. > Diesel in bunded storage tanks, waste oil in stored bunded tanks. > Weekly inspections of storage areas, tanks, containers. > Develop Emergency Response Plan and include in inductions. > Weekly inspections of storage areas for leaks or damages. > Spill kits available around the site and procedures and training for the cleaning up of hazardous spills. > Implementation of hazardous materials management plan training for emergency response. > Cyanide management and storage will be aligned to the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (2008). > Chemical storage will be located a minimum 30m from any drainage line or watercourse.	E	2	23	Low	C3	Highly unlikely for major spill as well tested industry standards are used. While minor spills that are easily contained and cleaned are possible, there is high certainty that large spills are highly unlikely. Based on other mining operations. Weekly inspections will ensure any minor leaks or spills are contained and cleaned up preventing larger spills. Further, the location of chemical storage reduces the likelihood of these receiving at drainage lines and thus impacting the hydrological regime.

AE-11	Poor handling and management of tailings and waste rock	**Direct** - Release of AMD leading to contamination of surface water and groundwater quality and ecosystems. Alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Diversion of existing runoff pathways, whether this be overland flow within drainage lines. This would likely result in scouring and incision causing altered flow paths leading sedimentation of waterways and altered aquatic ecosystem and functionality. This would adversely affect the biological processes that depend on water quality. **Indirect or Cumulative** - Increased disturbance and lost productivity of surface water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area, resulting in reduced local capacity of surface water features to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation. Indirect biological and human health implications in the immediate location of the placement and areas subject to seepage or runoff.	Construction, Operation, Decommissioning	The TSF will have a total 40 MT capacity. The TSF is to be constructed of geochemically benign and structurally appropriate material. The finalised TSF lining design requirements will be determined from the geochemical characterisation of the ore. It is not expected that tailings will contain high levels of cyanide as residual cyanide will we removed from tailings during the refining process and reused in the processing circuit. The TSF construction will include the following features: > An underdrainage system will be constructed to minimise seepage losses and maximise recovery. > A seepage recovery tower will be installed to pump the underdrainage back into the TSF. > A decant tower will be installed within the decant pond of the TSF to return water to the processing facility for reuse. > An emergency spillway constructed as part of each wall raise. Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Waste oxide material may also be used in the haul road formation with potential to cause offsite impacts if the material used leaches AMD, heavy metals or NORMS. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced. Based on the material characterisation study there is risk of transporting material throughout the site that could result in contamination if not appropriately managed (inclusive of AMD and NORMS). However, there is high certainty that runoff from WRDs can be captured onsite and management and that seepage from both WRDs and the TSF can be prevented based on the chosen design criteria. The determination	D	3	17	Moderate	> Development and implementation of a geochemical block model. > Daily monitoring of waste rock handling and tailings disposal. > Tailings and waste rock will be managed in accordance with the Tailings Management Plan and Operational Manual (including inspections). > Use of a perimeter spigot with regular movement to evenly distribute tailings. > Regular surveys to measure the tailings and waste rock deposition and water depths. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines to reduce sedimentation risk.	D	2	21	Low	C3	Highly unlikely as the technology used to deposit tailings and waste rock is well tested industry standards used.
AE-12	Unfinished/unsuccessful rehabilitation of Project due to inadequate funds or natural disaster (e.g. cyclone).	**Direct -** Site not rehabilitated to required standards. Increased potential for offsite impacts from AMD, erosion and sedimentation. Degradation of water quality onsite and various forms of erosion (sheet, rill, wind etc.) transporting soils into water features, potentially resulting in sedimentation and decrease in the aquatic ecosystem functioning. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in aquatic ecosystem and human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Given proponent is the same for nearby Toms Gully project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large area of disturbed and unrehabilitated land in the Mount Bundey catchment cumulatively resulting in increased sediment loads to Mount Bundey Creek and the downstream Mary River.	Construction, Operation, Decommissioning and Closure	Potential legacy issues with expansive areas of unrehabilitated land maintaining exposed surfaces. An unrehabilitated site can result in the compromising of natural functioning of terrestrial and aquatic ecosystems. Early closure planning needs to be undertaken and where possible rehabilitation trials to understand the most effective methods for successful rehabilitation. The MMP will account for the project financial security as per NT EPA requirements.	C	4	8	Extreme	> Progressive rehabilitation of disused areas. > Implementation of detailed mine closure plan. > Early planning and financial provision for closure works. > Infrastructure design to withstand extreme events. > Ongoing management of levels in water infrastructure. > Improve site drainage controls.	D	3	17	Moderate	C3	Implement closure planning into mine plan. Site operated to accommodate natural disasters. MMP obligates provision of financial security for approval.
AE-13	Long term positive water balance	**Direct** - Potential build-up of water onsite and the need for long term treatment and constant discharges of water. Positive water balance could potentially mean surrounding areas (groundwater and surface water) are not receiving typical supply. Thus, imbalance of the local hydrological regime which could adversely impact ecological features such as GDEs. **Indirect and Cumulative** - Likely result in a constant requirement for ongoing discharges and a regular pulses of site water into the environment rather than a more steady flow that would occur in a natural system. This could indirectly result in scouring and degradation of water features and its functionality that receive the discharged water.	Construction, Operation, Decommissioning and Closure	Close out structures to be water shedding to reduce water build up across site. Reduce and minimise contact water contact with AMD forming material.	D	4	12	High	> Improve and maintain site drainage infrastructure. > Review options for WRD Rehabilitation. > Implementation of Mine Closure Plan and adherence to commitments. > Closure Plan updated and refined throughout mining operations including life of mine closure planning and contingency planning. > Financial provisioning for closure implementation.	E	3	20	Moderate	C3	Progressive capping and rehabilitation will result in limited additional capping work at closure. The Water Management Plan has been developed to prevent onsite build-up of water.
AE-14	Pit lake becomes a groundwater source.	**Direct -** Gradual development of plume of contaminated groundwater. Pit lake water quality may become more acidic and with higher concentration of contaminants which may impact fauna species and the quality of groundwater in the area through seepage. **Indirect and Cumulative** - Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants in environmental pathways should the same contaminants be released from the nearby Toms Gully Mine or already be present in the environment due to historic activities. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals) and risks of consumption of fish.	Construction, Operation, Decommissioning and Closure	Waste rock will be deposited in surface WRDs and will be used to backfill a number of pits where mine scheduling permits. At Q29, a new surface WRD is proposed to dispose of the waste from mining Zamu pit, with waste material from the remaining pits to be backfilled into Zamu pit and a portion of oxide material from BHS pit used for rehabilitation of the decommissioned heap leach facility. At Rustlers Roost, the majority of the waste rock material will be deposited within the existing surface WRD (expansion to the north-west) and a portion backfilled into Rustlers Roost pit. Sampling of the historic waste materials and water quality has indicated that there is a low risk of contamination from the historical mining activities, which targeted only Non-Acid Forming (NAF) waste rock (CDM Smith, 2019). However, it is expected that as the depth of mining increases higher acid material will be experienced. Pit lake water quality as an aquatic ecosystem habitat for the Rustlers Roost pit lake was moderately poor, with high nutrient concentrations and low oxygen concentrations. However, pit lake water quality as COPC concentrations was good, with only slight exceedances of ecosystem values for total iron and ammonium and drinking water for ammonium. While the groundwater modelling and water balance assessment indicate connectivity with the groundwater aquifers and potential loss of water from the pits into the aquifers (more likely during the dry season), the good water quality indicates that seepage of pit lake water into groundwater is unlikely to contribute significant contaminants that would adversely affect the surrounding environment.	C	2	18	Moderate	> Geochemical assessment and modelling of pit water. > Contingency to manage water chemistry changes. > Investigate in pit water treatment options (i.e. use of lime or caustic). > Contaminant transport modelling further refined. > Limit pit catchment post closure to reduce inflow. > Ongoing groundwater monitoring program.	D	3	17	Moderate	C2	Focus to maintain good water quality (monitoring and treatment). Implement closure planning into mine plan. This has been applied a moderate level of uncertainty due to the inherent uncertainty with regard to connectivity of the pits to the surrounding aquifers, inflows and outflows.
AE-15	Lack of rehabilitation materials leads to inadequate tailings closure and poor quality site rehabilitation.	**Direct** - Completion criteria and environmental outcomes unable to be met. Potential soil erosion, loss of topsoil and sedimentation (through both water and wind erosive forces) affecting water quality and aquatic ecosystems in the surrounding water features. Characteristics of water, including chemical, physical, biological and aesthetic qualities are degraded in the vegetation clearing area, resulting in less productive aquatic ecosystems and potential impacts (thorough the abovementioned erosion) on adjacent catchment. **Indirect or Cumulative** - Increased disturbance and lost productivity of water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area, resulting in reduced local capacity of water to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation and loss of aquatic ecosystem functioning.	Decommissioning and Closure	Areas to be cleared of vegetation shall have any useful materials (i.e. seed, timber) salvaged, before vegetation is pushed aside, topsoil (notionally 10 cm) and other useful growth media or construction materials are stockpiled for later use. Rehabilitation monitoring shall be completed in the first wet season and any remedial actions identified and implemented by the next wet season. Appropriate topsoils to be maintained and/or growing media needs to be provisioned in the planning to enable sufficient volumes for the rehabilitation.	C	3	13	High	> Financial provisioning for closure implementation. > Calculation of material requirements in EIS and identification of extraction areas. > Recover topsoil from TSF, WRD and processing plant footprints. > Progressively rehabilitating the mine. > Clearing and Topsoil Procedures Implementation of Mine Closure.	D	3	17	Moderate	C3	Implement management of rehabilitation resources as part of mine scheduling. Volumes of tailings and waste rock and the material estimates for caping have been produced and included in the Project Description. Based on these there is confidence that sufficient material is available.

AE-16	Inappropriate management of the decommissioned site, post closure landform.	**Direct** - Unauthorised access to the site by externals (including public, leaseholders and livestock) negatively affecting rehabilitation potential and contributing to rehabilitation failure. Potential scouring, soil erosion and sedimentation resulting in the alteration of water quality on and off site drainage features. Site not rehabilitated to required standards. Increased potential for offsite impacts from AMD, erosion and sedimentation. Degradation of water quality onsite and various forms of erosion (sheet, rill, wind etc.) transporting soils into water features, potentially resulting in sedimentation and decrease in the aquatic ecosystem functionality. **Indirect or Cumulative** - Increased disturbance of water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area, resulting in reduced local capacity of water features to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation and decreased aquatic ecological functionality.	Closure	The decommissioned landform will need restricted access to prevent vehicles and livestock from accessing areas that are undergoing active rehabilitation. Inappropriate access could disturb unestablished vegetation, cause erosion and sedimentation in waterways and lead to rehabilitation failure and adverse impact to aquatic ecosystems.	C	2	18	Moderate	> Implement fencing and access restriction to prevent vehicle and livestock accessing rehabilitation areas. > Ongoing monitoring of rehabilitation. > Progressive rehabilitation during mining to enable more established areas upon closure.	D	2	21	Low	C3	Progressive rehabilitation is likely to result in significant areas of the site have highly established vegetation by closure. Appropriate rehabilitation is being completed on numerous sites throughout the NT (ERA, South 32) and is expected to be highly achievable in the project setting.
AE-17	Ineffective operational implementation of site environmental management system, plans and procedures.	**Direct -** Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the aquatic biodiversity if the contaminants reach drainage lines and leading to decreased aquatic ecological functioning of the surrounding water features. **Indirect or Cumulative** - Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rehabilitation goals and closure requirements following decommissioning. Potential increase in cumulative concentration of contaminated sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts leading to decreased aquatic ecological functionality.	Construction, Operation, Decommissioning Closure	Ineffective environmental management during any stage can lead to significant ongoing environmental issues which are often more expensive than if addressed properly when they arise. For example, if erosion and sediment runoff is identified onsite but not appropriately addressed initially could require widespread management after several years, may encroach into offsite areas, could adversely impact downstream receptors, impact native aquatic vegetation composition and thus aquatic fauna habitat. Appropriate procedures and levels of resourcing must be implemented during all stages of the project.	C	3	13	High	> Corporate commitment to EMS implementation via policy. > Environmental Management System and various management plans (EMP, WMP, MMP etc.). > All events/incidents to be reported and managed through to resolution via event/incident reporting procedures. > All personnel will be inducted into the area and informed of the hazards and relevant management protocols of the areas. > All personnel will be trained in the appropriate management practices as is relevant to their position.	D	3	17	Moderate	C3	High. Based on similar conditions. Operational activities will be undertaken according to relevant management plans and appropriate procedures. Environmental Management Plan structures and inclusive are well established.
AE-18	Construction and operational activities (incl. vegetation clearing) result in introduction of new weeds and spread of existing weeds into new areas.	**Direct** - Impact of reduced ability for successful revegetation due to weed spread which could lead to increased erosion and sediment runoff into the surrounding water features. Increased fire risk. **Indirect or Cumulative** - Increased weed species in the area negatively affecting rehabilitation potential and contributing to rehabilitation failure. Failure to establish appropriate capping and native vegetation leading to increased erosion and sediment runoff from rehabilitated areas which has the potential to adversely impact the water quality of surrounding water features and its biological functionality. Agreed Post Mine Land Use (PMLU) cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features. Cumulative impact as a result of reduced area of natural vegetation in the general Mount Bundy locality resulting in a general low aquatic fauna species abundance and lack of biodiversity.	Construction, Operation, Decommissioning or Closure	During the 2020 vegetation survey, invasive weed species incidentally observed within proposal area were recorded, with the majority established in disturbed areas, and occasionally occurring in native bushland. The declared weed species, Hyptis *(Hyptis suaveolens*) was the most abundant within the Project area; it was recorded in high densities in Quest 29 south. Scattered Perennial Mission Grass (*Cenchrus polystachios*) and Gamba Grass *(Andropogon gayanus*) were also observed, mostly within Quest 29 south and along roadsides. Gamba Grass and Perennial Mission Grass are listed as Class B weeds under the NT Weeds Management Act, with Gamba Grass also listed as a Weed of National Significance (WoNS). Spread of new weed infestations is likely with movement of vehicles and machinery around site. Weed Management Plan should be implemented to minimise potential spread and introduction of new weeds in the Project area.	B	2	14	High	> Annual weed mapping (by June each year) to understand nature of the spread of weeds and plan weed control activities accordingly. > Conduct seasonal weed control activities in consultation with local landholder as necessary and in accordance with the Project Weed and Pest Management (grazing control as option). > Implementation of the Biodiversity MP Project EMP. > Weed hygiene procedures - including inspection and wash down of all vehicles and machinery entering site. > Establish and implement appropriate control fire regime for area in the MLs.	C	2	18	Moderate	C3	Certainty high of weed control as mitigation measures have been used successfully for weed management.
AE-19	Inappropriate liquid and solid waste disposal.	**Direct -** Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the aquatic biodiversity if the contaminants reach drainage lines and leading to decreased aquatic ecological functioning of the surrounding water features. **Indirect or Cumulative** - Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rehabilitation goals and closure requirements following decommissioning. Agreed PMLU cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features. Potential increase in cumulative concentration of contaminated sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts leading to decreased aquatic ecological functioning.	Construction, Operation, Decommissioning Closure	While domestic waste may be produced in low levels at both the Rustlers Roost and Q29 areas, the primary location of production and this risk, is the accommodation camp located on ML29814 near the separate Toms Gully project. Generation of waste oils, lubricants and solid waste (e.g. batteries, scrap metal and oily rags) need to be disposed of in an appropriate manner such as in waste oil bins and taken off site. If this is managed properly, it is unlikely that waste should cause impacts to the surrounding environment. Onsite operations require a landfill site for non-hazardous materials. . The landfill site will located at Rustlers Roosts. The landfill will be buried and must be appropriately lined and capped to prevent production and spread of leachate into the environment.	D	3	12	High	> Manage disposal of wastes in accordance with the Project EMP (including bunded waste oil bins). > Hazardous materials stored in accordance with Australian standards. > Spill kits available around site and spill clean-up procedures implemented. > Employees and contractors trained in clean up procedures. > Weekly inspections of, waste area, landfill and general tidiness of site. > Burial of landfill (non-contaminating) waste. > Design and construct landfill in accordance with relevant standards. > Implement leachate prevention and capture into landfill design. > Groundwater monitoring.	E	2	23	Low	C3	Low probability of occurrence as inert rubbish continually managed. Standard lining and capping will be employed for the small site landfill.
AE-20	Major mechanical failure of processing plant	**Direct -** Contamination of surface water and groundwater and alteration of water characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the aquatic biodiversity if the contaminants reach drainage lines and leading to decreased aquatic ecological functioning of the surrounding water features. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in aquatic ecosystem and human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Agreed PMLU cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features.	Operation	The processing plant will be bunded to avoid runoff leaving the area. If major mechanical failure occurs, it is only expected impact to the local area with all potential contaminants being retained within the abandonment bund.	C	3	13	High	> Ensure appropriate warranties in place and maintain appropriate critical mechanical spares inventory. > Regular maintenance and inspections of plant. > Engineer sign off before recommencement of plant. > Construction of abandonment bund around the processing plant.	D	2	21	Low	C3	High certainty. Standard industry practice. Similar mitigation used previously at Toms Gully.

AE-21	Construction of water way crossing altering flow regimes with increased risk of erosion and sedimentation	**Direct -** Adverse impacts to Marrakai Creek and downstream aquatic ecosystems with movement and deposition of sediments and damage to vegetation and fauna downstream. Localised severe scouring of the topsoils in the area surrounding the breach and exposure of subsoils to erosive factors. Localised increase in Impact on structural integrity of engineered embankments. **Indirect or Cumulative** - Potential increase in cumulative concentration of sediments within the Marrakai Creek and Adelaide Rivers as a result of any sediment discharged. Increased downstream depositions and siltation impacts. Also, indirect impact of reduced ability for successful revegetation due to loss of topsoils.	Operation	Waterway crossing will be engineering designed and constructed to minimise any potential impact to water flow regimes and therefore, reduce the risk of erosion and sedimentation. Where erosion is considered likely during the design and construction, controls will be included to manage runoff and reduce risk (e.g. rock rip rap).	C	2	18	Moderate	> Pit-dewatering in drainage lines only during wet season. > Implementation of Biodiversity Management Plan. > Manage the site water balance to reduce any build-up of water. > Ongoing surface water monitoring program.	c	1	22	Low	C3	High level of certainty as the site contains soils that are dispersive and are susceptable to erosion where using for construction of onsite infrastructure.

Table 6: Community & Economy Risk Assessment

Inherent Risk										Residual Risk					
Risk #	Source of impact	Consequence	Project Phase(s)	Discussion	Prob	Cons	Risk	Risk	Mitigation & Monitoring	Prob	Cons	Risk	Risk	Level of Certainty	Certainty and Justification of Residual Risk
CE-1	Inappropriate management of the decommissioned site, post closure landform.	**Direct** - Unauthorised access to the site by externals (including public, leaseholders and livestock) negatively affecting rehabilitation potential, contributing to rehabilitation failure and causing risk of injury or death. Potential scouring, soil erosion, loss of topsoil and sedimentation resulting in the alteration of water quality on and off site drainage features impacting the downstream receptors. **Indirect or Cumulative** - Increased disturbance of water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully and the nearby Mount Bundey Training Area, resulting in reduced local capacity of water to perform ecological functions and a cumulative increase in erosion contributing to waterway sedimentation.	Closure	The decommissioned landform will need restricted access to prevent vehicles and livestock from accessing areas that are undergoing active rehabilitation. Inappropriate access could disturb unestablished vegetation, cause erosion and sedimentation in waterways, lead to rehabilitation failure and result injury or death.	C	2	18	Moderate	> Implement fencing and access restriction to prevent vehicle and livestock accessing rehabilitation areas. > Ongoing monitoring of rehabilitation. > Progressive rehabilitation during mining to enable more established areas upon closure.	D	2	21	Low	C3	Progressive rehabilitation is likely to result in significant areas of the site having highly established vegetation by closure. Appropriate rehabilitation is being completed on numerous sites throughout the NT (ERA, South 32) and is expected to be highly achievable in the project setting.
CE-2	Emissions from clearing, dust, noise, artificial light associated with construction and/or operation of the mine site.	**Direct -** Potential impact to visual amenity due to dust emissions, cleared areas or infrastructure visible from publicly accessible areas. Potential artificial light impact on nearby landholders. Negative impact on tourism. **Indirect and Cumulative** - Potential cumulative impact from the abovementioned risks in the wider area in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area.	Construction, Operation	Dust is not expected to be a significant issue during operations. Periodically there will be higher levels of dust during clearing; however, clearing will be prioritised for days with low wind forecasts. Dust suppression will be implemented via a water cart during clearing operations. If required, lower visual impact of project site from publicly accessible areas using vegetation placement. There is no sensitive receptors in close proximity of the Project area which could be affected by light spill and if required, vegetation screening can be placed.	D	2	21	Low	> If necessary, vegetation for screening. > Detailed engineering design of infrastructure. > Monitor complaints register. > Dust suppression around site. > Implementation of Dust Management Plan. > Progressive clearing and progressive rehabilitation. > Avoid clearing on windy days.	E	2	23	Low	C3	High certainty that project will not greatly effect sensitive receptors in the localised area.
CE-3	Financial capacity or feasibility to implement project becomes unviable due to Au price change, fuel cost increases or change in metallurgical recoveries of ore.	**Direct** - Loss of job opportunities and unemployment. Site not rehabilitated to required standards and potentially affecting downstream receptors. Visual amenity of the area not meeting desired completion criteria. **Indirect or Cumulative** - Impact on local services and employment. Given proponent is the same for nearby Toms Gully project it would likely result in cumulative impact on the abovementioned risks.	Construction, Operation, Decommissioning and Closure	Potential legacy issues with expansive areas of unrehabilitated land maintaining exposed surfaces. An unrehabilitated site can result in the compromising of natural functioning ecosystems and affect nearby receptors. Early closure planning needs to be undertaken and where possible rehabilitation trials to understand the most effective methods for successful rehabilitation. The MMP will account for the project financial security as per NT EPA requirements.	C	4	8	Extreme	> Target Opex costs in lower quartile of Australian production costs combined with a forward gold price hedging strategy. > Target Opex costs in lower quartile of Australian production costs. Consider FX hedge. > Progressive rehabilitation of unused areas. > Implementation of detailed mine closure plan. > Early planning and financial provision for closure works. > Infrastructure design to withstand extreme events. > Ongoing management of levels in water infrastructure. > Improve site drainage controls.	D	3	17	Moderate	C2	Moderate. Similar conditions. Similar mitigation used previously at Toms Gully.
CE-4	Major mechanical failure of processing plant	**Direct -** Potential injury or death of site personnel. Major operational delays and unexpected expenses to fix damages. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Agreed Post Mine Land Use (PMLU) cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features.	Operation	The processing plant will be bunded to avoid runoff leaving the area. If major mechanical failure occurs, it is only expected to impact the local area with all potential contaminants being retained within the abandonment bund. Personnel will be trained and will wear appropriate PPE.	C	3	13	High	> Ensure appropriate warranties in place and maintain appropriate critical mechanical spares inventory. > Regular maintenance and inspections of plant. > Engineer sign off before recommencement of plant. > Construction of abandonment bund around the processing plant. > Provide training to all personnel accessing the processing plant area.	D	2	21	Low	C2	Moderate certainty. Standard industry practice. Similar mitigation used previously at Toms Gully.
CE-5	Ore Reserve modelling estimation error	**Direct** - Early closure resulting in long term loss of job opportunities and increased unemployment. No funding to undertake rehabilitation to required standards and potentially affecting downstream receptors. Visual amenity of the area not meeting desired completion criteria. **Indirect or Cumulative** - Impact on local services and employment.	Operation, Decommissioning and Closure	Potential legacy issues with expansive areas of unrehabilitated land maintaining exposed surfaces. An unrehabilitated site can result in the compromising of natural functioning ecosystems and affect nearby receptors. Early closure planning needs to be undertaken and where possible rehabilitation trials to understand the most effective methods for successful rehabilitation. The MMP will account for the project financial security as per NT EPA requirements.	C	4	8	Extreme	> Grade control and mapping programmes combined with effective production reconciliation studies both present and historical. > Progressive rehabilitation of unused areas. > Implementation of detailed mine closure plan. > Early planning and financial provision for closure works.	E	2	23	Low	C2	Moderate. Standard industry practice. Similar mitigation used previously at Toms Gully.

CE-6	Skilled labour shortages	**Direct -** Potential draw of existing workers from other industries into better paying resource jobs leading to shortfalls in skilled labour. **Indirect and Cumulative** - Potential cumulative skilled labour shortage impact in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area.	Construction, Operation, Decommissioning and Closure	The recommencement of mining operations will enable the employment of approximately 210 people during the production process. 100 people will be required for the construction stage. Construction material will be sourced locally where possible. The Project is approximately 100 km from Darwin and thus shortages of skilled labour is not expected to be significant. The regions industry is mining and therefore an appropriately skilled workforce should be available.	C	2	18	Moderate	> Work with local training providers to develop local training programs to provide unskilled people with opportunities to gain employment. > Adoption of recruitment policies that allow for appropriate notice periods to be served for new employees.	D	2	21	Low	C2	Moderate. Standard industry practice. Similar mitigation used previously at Toms Gully.
CE-7	Additional highway commuter traffic and associated road safety concerns.	**Direct** - Increase in road vehicle traffic and accidents. Increased maintenance of highway and access roads. **Indirect and Cumulative** - Potential cumulative traffic impact in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area.	Construction, Operation, Decommissioning and Closure	The majority of the workforce will be working roster arrangements consisting of consisting of either 2 weeks on 1 week off (2:1) 8 days on 6 days off (8:6) or 14 days on 7 days (14:7). They will reside in the new accommodation camp during their 'on' roster and commute back home for their time off. The roster will be based on 12 hour days, 2 shifts (day/night) and a 3-crew panel. During peak operation the Project is anticipated to result in a negligible increase (3.74%-4.0) to current traffic volumes along the Arnhem Highway.	B	3	9	High	> Schedule delivery's at staged times so road is not inundated with trucks. > Increase road safety signage.	C	2	18	Moderate	C2	Moderate certainty. Similar conditions. Administrative Controls. Implementing thorough road safety planning and administration of traffic will reduce the risk of heavy traffic and accidents and therefore moderate residual risk is expected.
CE-8	Influx of workers to the local community seeking housing	**Direct -** Increase in demand for accommodation, and reduction in affordability of rental housing leading to rent escalation and housing price inflation. Negative impact on housing availability. Impact on local community. **Indirect and Cumulative** - Potential cumulative economic and social impact to local community in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area.	Construction, Operation, Decommissioning and Closure	The majority of workforce will be working roster arrangements consisting of either 2 weeks on 1 week off (2:1) or 8 days on 6 days off (8:6) or 14 days on 7 days (14:7). They will reside in the new accommodation camp during their 'on' roster and commute back home for their time off. The roster will be based on 12 hour days, 2 shifts (day/night) and a 3-crew panel.	D	2	21	Low	> Recruit locally from within existing labour pool. > Provision of a Project specific accommodation camp.	D	1	24	Low	C3	High certainty. Based on data. Administrative Controls.
CE-9	Influx of workers to the local community in general	**Direct** - Decline in community health, safety and wellbeing. Increase in incidences of anti- social behaviour. Impacts on vulnerable groups such as women and Indigenous groups. Negative impact on community cohesion and inclusion. **Indirect and Cumulative** - Potential cumulative economic and social impact to local community in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area.	Construction, Operation, Decommissioning and Closure	The Project is approximately 100 km from Darwin and thus shortages of skilled labour is not expected to be significant. Personnel drawn from the surrounding district will continue to live in their own homes when not rostered. No impacts on local community values, lifestyle and amenity are expected. The recommencement of mining operations will require the employment of approximately 210 people during operation. 100 people will be required for the construction stage. Construction material will be sourced locally where possible.	D	2	21	Low	> Recruit locally from a demographic where mining is already significant proportion of industry of employment. > Establish a complaints and feedback register. > Establish clear mechanisms for ongoing stakeholder engagement.	D	1	24	Low	C2	Moderate. Similar conditions. Administrative Controls.
CE-10	Increased demand for local services and supplies	**Direct** - Positive impact on local business and local economy with the injection of capital from the Project. Increased local employment rate. **Indirect and Cumulative** - Potential cumulative economic and social impact to local community in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area.	Construction, Operation, Decommissioning and Closure	Where required services are not in place at the Project, local services providers will be used. Construction material will be sourced locally where possible.	D	2	21	Low	> Acquire any additional services on commercial terms. > Local services providers will be used where required.	E	2	23	Low	C2	Moderate certainty. Similar conditions. Administrative Controls.
CE-11	Disturbance of sites/objects of heritage significance heritage items or places and sacred sites.	**Direct** - Damage, destruction or removal of heritage item, place or sacred site. **Indirect and Cumulative** - Potential cumulative disturbance to cultural heritage in conjunction with Toms Gully, nearby quarries and the Mount Bundey Training Area. Also, potential cumulative impact due to previous activities onsite.	Construction, Operation, Decommissioning and Closure	Historically there have been a number of Aboriginal Area Protection Authority (AAPA) Certificates issued over the Project area. Most recently, PGO was issued an Authority Certificate in 2016, for the purpose of exploration activities and ongoing maintenance of the Rustlers Roost and Quest 29 mines (C2016/168). No recorded or registered sacred sites were identified. Prior to the commencement of the proposed action, PGO will seek a new Authority Certificate. An archaeological survey was undertaken at Rustlers Roost, and recorded four sites of prehistoric materials, which included background scatters. No archaeological surveys have been undertaken on the Q29 mining leases; however, an AAPA authorisation has been lodged with the entire Project area. Correspondence with the NTG Heritage Branch in August 2020 determined that no nominated, provisional or declared heritage places were registered as a result of the above archaeological investigation. A number of the sites recorded were removed or disturbed as part of previous development and expansion of the mine. Heritage Branch did not express any heritage or archaeological concern within the proposal area, due to level of disturbance, proximity of the Arnhem Highway and previous archaeological investigation undertaken. In the event that potential archaeological sites are discovered, all works in the immediate area should cease and the Heritage Branch will be contacted for comment.	D	2	21	Low	> Survey over the Project area with the AAPA regarding Aboriginal Sacred Sites. > Undertake consultation with the NTG Heritage Branch with regards to potential heritage sites in the area. > Project EMP. > Adherence to ground disturbance/clearing procedures. > In the event that potential archaeological sites are discovered, all works in the immediate area should cease and the Heritage Branch will be contacted for comment.	E	2	23	Low	C3	High certainty. Based on database searches, and AAPA certificate.