Rustlers Roost and Quest 29 Open-Cut Mine Redevelopment

Draft Environmental Impact Statement (EIS)

Section 11 - Holistic Impacts

Prepared pursuant to the Environment Protection Act 2019

October 2021

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Key Project Terms

Term	Definition
Adaptive Management	Systematic process for incrementally improving management practices by learning from the outcomes of past and current practices.
Carbon in Leach	This process uses a dilute alkaline cyanide solution to leach (dissolve) gold from the ore material. Activated carbon removes gold out of dilute cyanide solution by adsorption (sticking). The leaching agent and activated carbon are added together in a slurry of ore and water.
Development Envelope	Defined as the maximum area within which the Project footprint could occur. The development envelope for the Project encompasses 790 ha, inclusive of Rustlers Roost, Quest 29, the accommodation camp and haul road.
Environmental Aspect	An element of the Primary Gold's activities, products or services that can interact with the environment.
Environmental Impact	Change to the environment whether adverse or beneficial, wholly or partially resulting from the Primary Gold's environmental aspects. Environmental impacts can be caused directly or indirectly from a Project activity or cumulatively with other non-Project related activities in a set area.
Environmental Factor	The NT EPA listed environmental objectives to identify environmental matters that have value to the Northern Territory and that need to be protected; and to state the objective to be achieved for each matter. The NT EPA has prepared these environmental objectives and organised these in structured divisions of the environment, called environmental factors.
Existing Disturbance Footprint	Defined as the direct disturbance area from known historical activities associated with the Rustlers Roost, Quest 29, accommodation camp and haul road areas. For Rustlers Roost and Quest 29 this is taken from the existing Mine Management Plans. The existing direct disturbance footprint encompasses 169.4ha within the development envelope.
Heap Leach Pad	Existing areas where historic mining placed ore for processing via a leaching solution to dissolve and capture the mineral. The pads contain the remaining material.
Maximum Vegetation Clearing Extent	The maximum extent of native vegetation clearing proposed for the Project based on mapped vegetation extent layers which account for historic anthropogenic disturbances to the development envelope (e.g. historic mining and pastoral activities). This area constitutes a total of 368.86 ha.
Project	The Project includes the expansion of existing pits, waste rock landforms, water storage dams and internal roads in both the Rustlers Roost and Quest 29 MLs. Two new pits will be constructed at Rustlers Roost and new infrastructure includes an onsite processing plant, a tailings storage facility, a landfill, laydown area, magazine, administration office, accommodation camp and groundwater bores for water supply. The Project is inclusive of an expanded connecting haul road between the non-contiguous extraction areas and an accommodation camp.
Project Area	The Project area is defined as wholly including ML1083 (Rustlers Roost), ML 29783 (Quest 29), ML 29814 (accommodation camp) and the connecting haul road. The entire Project area covers 1,143.25 ha.
Direct Disturbance Footprint	Defined as the direct disturbance area based on the current proposed infrastructure and material placement inclusive of Rustlers Roost, Quest 29, the accommodation camp and haul road. This area covers both historically disturbed and undisturbed areas. The disturbance footprint encompasses 532.84 ha within the Project area.
Significant Impact	A significant impact of an action is an impact of major consequence having regard to: (a) the context and intensity of the impact; and (b) the sensitivity, value and quality of the environment impacted on and the duration, magnitude and geographic extent of the impact.
Study Area	Refers to the area of survey or investigation for a specific study. This area may be beyond the Project area or development envelope.
Tailings Storage Facility	A specially engineered and constructed impoundment into which tailings (residue) from the ore processing plant is deposited for placement in perpetuity. The storage facility is constructed with confining embankments consisting of earthen material (e.g. rock and soil) and capped following closure.
Waste Rock Dump	An engineered and constructed impoundment into which overburden from the mining process is placed for safe storage in perpetuity.

Acronyms, Abbreviations and Units

Abbreviation, Acronym or Unit	Definition
$m	Million dollars
%	Percentage
+ve	Assessment of positive
µS	Microsiemens
4WD	Four-wheel drive
AADT	Average Annual Daily Traffic
AAS	Atomic Absorption Spectrophotometer
AAPA	Aboriginal Areas Protection Authority
AARL	Anglo American Research Laboratory
ABS	Australian Bureau of Statistics
AE	Aquatic Ecosystems
AEP	Annual Exceedance Probability
AFANT	Amateur Fishermen's Association of the Northern Territory
AHD	Australian Height Datum
ALA	Atlas of Living Australia
ALARP	As Low As Reasonably Practicable
AMD	Acid and Metalliferous Drainage
ANC	Acid Neutralising Capacity
ANCOLD	Australian National Committee on Large Dams
ANFO	Ammonium Nitrate
ANZG	Australia and New Zealand Government
ARI	Average Recurrence Interval
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AS	Australian Standard
ASRIS	Australian Soil Resource Information System
ASX	Australian Stock Exchange
AS/NZS	Australian/New Zealand Standards
AUSRIVAS	Australian River Assessment System
BESS	Battery Energy Storage System
BoM	Bureau of Meteorology
BOO	Build-Own-Operate
BOOT	Build-Own-Operate-Transfer
Bq	Becquerel
BUD	Beneficial Use Declaration
CAD	Computer-Aided Design
CAPEX	Capital Expenditure
CCTV	Closed Circuit Television
CE	Community and Economy
CEO	Chief Operating Officer
CH_4	Methane

Abbreviation, Acronym or Unit	Definition
CIL	Carbon in Leach
CO_2	Carbon Dioxide
CO_2-e	Carbon Dioxide Equivalent
COPC	Contaminant of Potential Concern
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSL	Compact Soil Liner
CSM	Conceptual Site Model
C&D	Construction and Demolition
C&I	Commercial and Industrial
DAWE	Department of Agriculture, Water and Environment (Cth) (current)
DEPWS	Department of Environment, Parks and Water Security (NT) (current)
DGV	Default Guideline Value
DIDO	Drive-in Drive-out
DITT	Department of Industry, Tourism and Trade (NT) (current)
DIWA	Directory of Important Wetlands of Australia
DO	Dissolved Oxygen
DotE	Department of the Environment (Cth) (former)
DotEE	Department of the Environment and Energy (Cth) (former)
EC	Electrical Conductivity
EH&S	Environment, Health and Safety
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
EP Act	*Environment Protection Act 2019*
ERA	Energy Resources of Australia
ERP	Emergency Response Plan
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
GDE	Groundwater Dependent Ecosystem
GGAP	Greenhouse Gas Abatement Plan
GHG	Greenhouse Gas
GJ	Gigajoule
GL	Gigalitre (1,000 Megalitres)
GPS	Global Positioning System
GRP	Gross Regional Product
GST	Goods and Services Tax
g/t	Grams Per Tonne
GV	Guideline Value
GWP	Global Warming Potential
ha	Hectare

Abbreviation, Acronym or Unit	Definition
HDPE	High Density Polyethylene
HEC-HMS	Hydrologic Modelling System
HFC	Hydrofluorocarbons
HP	Hydrological Processes
HSE	Health, Safety and Environment
IAP2	International Association for Public Participation
IBC	Intermediate Bulk Container
ID	Identification
IECA	International Erosion Control Association
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Provider
ISO	International Organisation for Standardisation
IWEQ	Inland Water Environmental Quality
JORC	Joint Ore Reserve Committee
kL	Kilolitre
km	Kilometre
km^2	Square Kilometre
kV	Kilovolt
L	Litre
L/s	Litre Per Second
LED	Light Emitting Diode
LiDAR	Light Detection and Ranging
LNG	Liquefied Natural Gas
LOM	Life-of-Mine
LPG	Liquefied Petroleum Gas
M	Million
m	Metre
m^2	Metre squared
m^3	Cubic metre
mAHD	Metres Australian Height Datum
mBGL	Metres Below Ground Level
MCP	Mine Closure Plan
MEDLI	Model for Effluent Disposal Using Land
mg	Milligram
ML	Mining Lease (Granted)
MLA	Mining Lease Application
mm	Millimetre
MMP	Mining Management Plan
MNES	Matter of National Environmental Significance
MP	Management Plan
mRL	Metres Reduced Level
Mt	Million Tonnes

Abbreviation, Acronym or Unit	Definition
Mtpa	Million Tonnes Per Annum
MW	Megawatt
N_2O	Nitrous Oxide
NAF	Non-Acid Forming
NAPP	Net Acid Producing Potential
N/A	Not Applicable
NGER Act	*National Greenhouse Energy Reporting Act 2007*
NLC	Northern Land Council
NMD	Neutral Mine Drainage
NORM	Naturally Occurring Radioactive Material
NOI	Notice of Intent
NO_2	Nitrogen Dioxide
NSESD	National Strategy for Ecologically Sustainable Development
NT	Northern Territory
NTG	Northern Territory Government
NTU	Nephelometric Turbidity Unit
NT Act	*Native Title Act 1993*
NVIS	National Vegetation Information System
OPEX	Operational Expenditure
PAF	Potentially Acid Forming
PASS	Potential Acid Sulfate Soil
PER	Public Environmental Report
PET	Plecoptera, Ephemeroptera and Trichoptera
PFC	Perfluorocarbon
PGO	Primary Gold Limited, a wholly owned subsidiary of Hanking Australia Investment Pty Ltd
PMF	Probable Maximum Flood
PMLU	Post Mining Land Use
PMST	Protected Matter Search Tool
PPL	Perpetual Pastoral Lease
Q	Quarter
RL	Reduced Level
RMP	Risk Management Plan
RO	Reverse Osmosis
ROM	Run of Mine
RRMPL	Rustlers Roost Mining Pty Ltd
RSWL	Reduced Standing Water Level
SA	Statistical Area
SD	Saline Drainage
SDS	Safety Data Sheet
SEP	Stakeholder Engagement Plan
SEIFA	Socio-Economic Indexes for Areas
SF_6	Sulfur Hexafluoride
SGV	Site-Specific Guideline Value

Abbreviation, Acronym or Unit	Definition
SIGNAL	Stream Invertebrate Grade Number – Average Level
SoBS	Site of Botanical Significance
SoCS	Site of Conservation Significance
SSAN	Security Sensitive Ammonium Nitrate
SSC	State Suburb Code
SSTV	Site-Specific Trigger Values
STP	Sewage Treatment Plant
SWGs	Stock Water Drinking Guidelines
SWL	Standing Water Level
t	Tonne
TAMS	Territory Asset Management Services
TARP	Trigger Action Response Plan
TBD	To Be Determined
TE	Terrestrial Ecosystems
TEC	Threatened Ecological Community
TEQ	Terrestrial Environmental Quality
Th	Thorium
TN	Total Nitrogen
ToR	Terms of Reference
TP	Total Phosphorus
TPWC Act	*Territory Parks and Wildlife Conservation Act 1976*
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
TSSC	Threatened Species Scientific Committee
U	Uranium
UC	Uncertain
V	Volt
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
WCD	Water Control District
WDL	Waste Discharge Licence
WMP	Water Management Plan
WONS	Weed of National Significance
WRD	Waste Rock Dump
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Section 11 Holistic Impacts

11.1 Indirect and Cumulative Impact Assessment

The meaning of impact within Section 10 of the EP Act includes *"an event or circumstance that is an indirect consequence of the action and the action is a substantial cause of that event or circumstance"* and *"an impact may be a cumulative impact and may occur over time"* (p. 9). In the assessment of impacts from the Project the NT EPA must consider the likelihood and consequence of significant change to the environment including any potential cumulative impacts associated with other actions that are occurring or proposed to occur in or near the area of the Project.

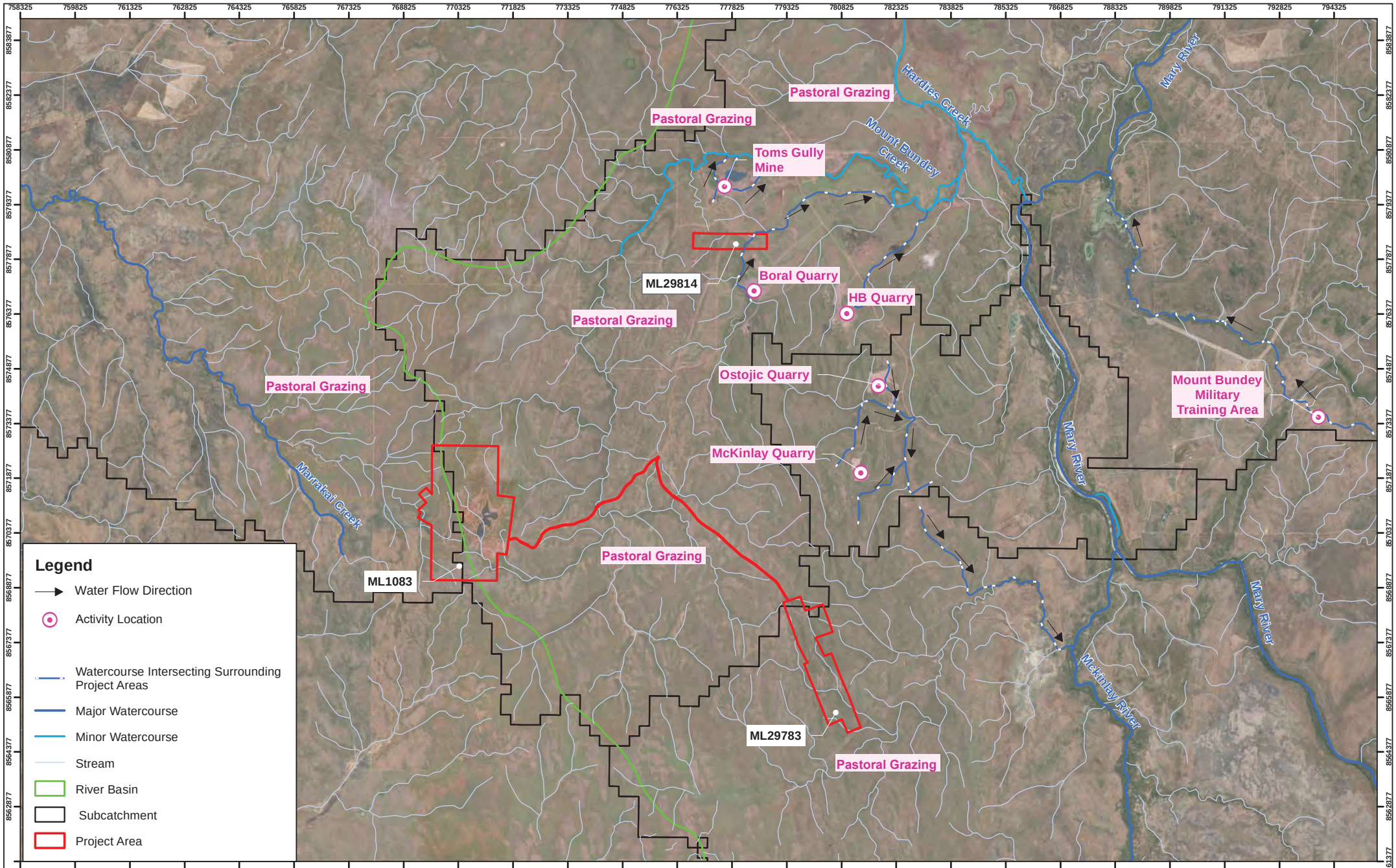
The obligation to consider connections and interactions between environmental factors and impacts holistically (including indirect and cumulative) is raised in the NT EPA guidelines for environmental impact statements (NT EPA 2021a) and specifically within Section 1.4 of the Project ToR. The importance of considering impacts holistically is summarised by Morrison-Saunders and Bailey (2000) that when considering environmental impact assessment *"there is a danger that, by breaking each proposal down into discrete parts and assigning environmental objectives to them, it may not adequately represent overall environmental functions"* (p.270). It is noted that when considering impacts to environmental factors and assigned management measures separately requirements may be meet but when considered cumulatively with other projects or activities and between factors the impacts may be more consequential.

The Draft EIS provides a detailed assessment of the potential environmental impacts associated with the Project and the management strategies for each relevant environmental factor. This section provides information regarding the key themes of Land, Water and People and how these connect and interact both indirectly and cumulatively as relevant to the Project. The Key Environmental Factors are addressed separately in Section 7.1 to Section 7.6, where indirect and cumulative impacts relevant to the factor have been considered. Other environmental factors considered relevant for consideration are addressed in Section 8 and include the marine ecosystem, atmospheric processes and human health.

Figure 11-1 shows the key activities in the locality surrounding the Project. While activities at various spatial scales have been considered in the key environmental factor sections (e.g. Terrestrial Ecosystem considers up to catchment and bioregional scale), for focus, the activities and interactions presented in Figure 11-1 and the associated diagram of connections and interactions (Figure 11-2) are limited to the Mount Bundey locality. The subsequent Table 11-1 provides a summary of the key connections and interactions between the environmental factors identified.

PGO acknowledges the interrelationships between environmental factors require consideration and management to achieve positive environmental outcomes. Given the context of historic mining and extractive industry disturbance within and nearby the Project area, management and mitigation measures have been considered from a holistic impacts perspective. Therefore, the approach applicable to the management of key environmental factors in this Draft EIS is a natural extension of the well-established site practices contemporised to reflect current expectations for environmental outcomes to be achieved.

The connections and interactions between the environmental factors have been identified, and the mitigations proposed in this Draft EIS meet the principles contained in the EP Act and the NT EPA's objectives for individual factors. The predicted outcomes for each interrelationship in relation to the NT EPA's environmental objectives, after the application of the NT EPA's mitigation hierarchy (avoid, minimise, rehabilitate, offset) are summarised in Table 11-1. Where significant residual impacts were identified, offsets have been proposed.



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APPROVED	TK	DATE	25/08/21

Notes:

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Meters

1 cm = 950 meters

GCS GDA 1994 MGA Zone 52

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 11-1

Surrounding Activities with Potential Indirect or Cumulative Impacts

DRG Ref: 1001087-EIS-07-7.28

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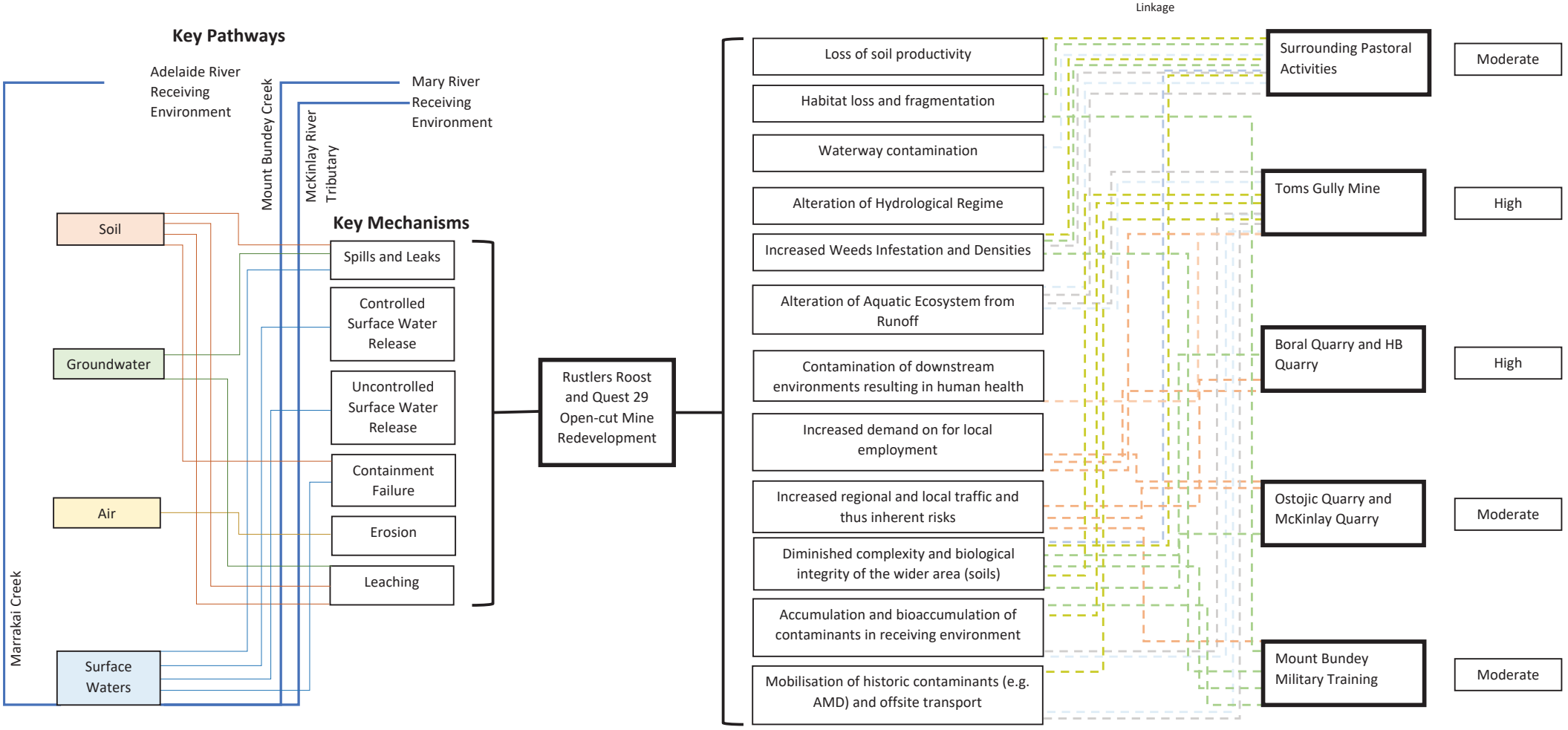
Relevant Factor
Terrestrial Environmental Quality
Terrestrial Ecosystem
Hydrological Processes
Inland Water Environmental Quality
Aquatic Ecosystems
Community and Economy



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Meters

1 cm = 950 meters

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FIGURE 11-2

Potential Indirect and Cumulative Interactions with Surrounding Projects and Activities

DRG Ref: 1001087-EIS-11-11.2

Table 11-1 Summary of Potential Indirect and Cumulative Impacts

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
TEQ-1 TE-1 IWEQ-1 AE-1	Vegetation clearing for the Project	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystems ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Increased disturbance and loss of productivity of soils in the wider Mount Bundey locality coupled with disturbance at Toms Gully Mine 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. ▪ 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. ▪ Elevated sediments in waterways from the Project, nearby major operations (e.g. Toms Gully Mine, quarry operations 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 hydrology, 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).	**Avoid** ▪ Only clearing the practical minimum footprint necessary for the portion of the Project to be implemented; ▪ Clearly mark limits of clearing; ▪ Make use of already disturbed areas where possible; and ▪ Avoid land clearing during the December to March portion of the wet season. **Minimise and Mitigate** ▪ Clearly mark limits of clearing; ▪ Only clearing what is absolutely necessary; ▪ Adherence to Ground Disturbance Procedures; ▪ Implement erosion and sediment controls in accordance with an approved ESCP; and ▪ Have a trained fauna spotter on site during clearing operations.	Disturbing an additional 333.4 ha of land for the Rustlers Roost, 26.16 ha for Quest 29, 7.3 ha for the accommodation camp, and 2 ha for the haul road (total of 368.86 ha). The clearing may result in some localised destabilisation of soils and erosion; however, through implementation of the ESCP, erosion and loss of topsoil is anticipated to be retained within the site with minimal offsite movement of material. Based on the review of the selected Projects at varying spatial scales (Table 7-18) it is estimated that cumulative impacts at the property and catchment scale consist of approximately 592.36 ha of Eucalyptus woodland and fauna habitat[31], approximately 602.36 ha in the region and approximately 904.99 ha in the bioregion. As a comparison, using total extent of mapped Eucalyptus woodland and Eucalyptus open forest in these four extents indicates the cumulative impact will constitute roughly 1.28% of Eucalyptus woodland and Eucalyptus open forest at the property scale, 0.32% at the catchment scale, 0.15% at the region scale and 0.03% at the bioregion scale. Characteristics of soils, including chemical, physical, biological, and aesthetic qualities will be degraded in the vegetation clearing areas. Resulting in less productive soils within the clearing areas; however, this impact is anticipated to be contained within the site disturbance area. Also, the Project commitments include the stripping and retention of topsoils and organic matter for progressive rehabilitation purposes. Therefore, while it is predicted certain areas may be more challenging to rehabilitate with native vegetation of local provenance (e.g. WRDs) this can be overcome through progressive rehabilitation, appropriate planning, management of weeds and fire regime, and limiting access/disturbance of these areas. After the application of mitigation measures, the Project will result in the direct loss of 368.86 ha of native vegetation and subsequently, associated fauna habitat. Although only a single TPWC Act listed species, the Merten's Water Monitor has been recorded in the Project area, the clearing still constitutes potential habitat; however, none of the habitat is considered high quality for listed species and would not support an important population of a listed species, should they occur.
TEQ-14 TE-9	Inability to establish native vegetation by local provenance species with resultant cover comparable to nearby areas	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystem	▪ Increased disturbance and lost productivity of soils in the wider Mount Bundey locality coupled with disturbance at Toms Gully Mine 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. ▪ Potential transportation of contaminated sediments and material throughout the Project area and externally. 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. ▪ 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 PGO is the same proponent for the nearby Toms Gully Mine 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 a regional loss of fauna habitat.	**Avoid** ▪ 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. **Minimise and Mitigate** ▪ Implement active weed control	
TEQ-2 TE-2 IWEQ-2 AE-2	Overtopping, embankment failure or seepage from the new TSF at Rustlers Roost leading to uncontrolled release of tailings	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystems ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. ▪ Potential for bioaccumulation of contaminants in environmental pathways should the same contaminants be released from the Toms Gully Mine or already present in the environment due to historic activities. Potential for NORMS to present downstream ecological and human health risks where waste rock is used as part of the construction material.	**Avoid** ▪ Manage the site water balance to reduce excess build-up of water. ▪ Chemical storage will be located a minimum 30 m from any drainage line or watercourse. ▪ Design, storage and handling of hazardous materials to Australian Standards and regulations.	Strict design requirements have been nominated for the TSF, which will contain Annie's Dam and be utilised for return water. Design criteria will be set in accordance with ANCOLD and therefore the likelihood of failures is considered extremely low. Uncontrolled releases from the spillway into the environment under 'emergency' conditions (e.g. extreme rainfall) is also highly unlikely as the TSF wall is to be built higher than

[31] Note – much of this calculated Eucalyptus woodland disturbance has already occurred with development of the quarries.

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
	material to surrounding environment.		▪ Potential transportation of contaminated sediments and material throughout the Project area and beyond. Biological and human health implications (primary contaminants of concern being cyanide and heavy metals).	▪ 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 is adequate and SDS available. ▪ Standard pre-requirements for contractors (must meet standard requirements and licensing). ▪ Ensure transportation contractors undertake standard pre-departure checks. ▪ Appropriate site access for large vehicles. ▪ All external operators to complete induction that includes transportation safety considerations. **Mitigation and Management** ▪ Development of Monitoring Plan / Operational Manual which includes weekly inspections of the TSF. ▪ Develop and implement programme for the monitoring of groundwater. ▪ Implementation of AMDMP. ▪ Implement of WMP. ▪ The management of tailings from processing activities will be undertaken in alignment with the Department of Industry guideline Leading Practice Sustainable Development Program for the Mining Industry – Tailings Management (Australia Government 2016) (or as amended). ▪ Develop and implement a groundwater monitoring programme to include the monitoring of Ag, As, Al, Cd, Co, Cr, Cu, Fe, Mo, Ni, P, Pb, Se, Ti, U, V and Zn, and nitrate. ▪ Storage and management of cyanide in accordance with the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (Australian Government 2008) (or as amended). ▪ Chemicals and substances will be reviewed and approved prior to coming to site. ▪ A chemical storage register and SDSs will be maintained and made available on site. ▪ Chemical storage areas will be capable to of meeting the volume requirements for each substance. ▪ Display relevant Dangerous Goods information. ▪ Storage in accordance relevant stage requirements (i.e. incompatible materials not store together); and appropriately bunded. ▪ Bunding to have a minimum capacity of 100% of the largest container; or 25% of the capacity of the total volume of the material stored, whichever is larger. ▪ Chemical storage will comply with AS 1940:2004. ▪ Diesel in bunded storage tanks. ▪ Waste oil stored bunded tanks/containers e.g. IBC. ▪ Weekly inspections of storage areas, tanks, containers for leaks or damages. ▪ Spill kits available around the site and procedures and training for the cleaning up of hazardous spills. ▪ Develop Emergency Response Plan and include in inductions. ▪ Implementation of hazardous materials management plan training for emergency response.	the level of the waste and the spillway during each of the operational stages. The risk is only possible when the tailings dam is in the final stage. Based on the hydrology assessment there is a risk under extreme flood scenarios that runoff could result in erosion and scouring that would contribute to the transportation of sediment. However, the risk of transporting sediments from the Project area to the environment at levels that would result in detrimental impacts to ecosystem functioning, is largely limited to extreme rainfall scenarios that exceed the ESCP design criteria. During operation, the implementation of erosion and sediment controls in accordance with the management plans is anticipated to maintain soil and structure stability and limit the release of sediment from the site to acceptable levels. Furthermore, through the closure, rehabilitation and capping of historic mining features currently constituting to erosion (e.g. heap leach pads) it is possible the Project will result in a net reduction in the offsite movement of sediments. Thus, it is considered highly unlikely the Project would introduce contaminants to the receiving environments through sedimentation that would cumulatively increase contaminates to a level that would impact ecosystem functioning, cause a human health risk or impacts either recreation or cultural uses. 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. With appropriate implementation and design and controls, the Project should not contribute to cumulative impacts associated with release of chemicals into the environment. The groundwater model predicted that the cone of depression induced by the proposed groundwater extraction may extend up to 5 km to the north and 3 km to the south of the Rustlers Roost pits and 2 km to the south-west of the Quest 29 pits. The modelling demonstrates that the probability of Marrakai Creek, Mary River and McKinlay River being impacted by the proposed pits is minimal. Further, there is only a minor potential area of overlap in the modelled maximum extents of influence between the Project and Toms Gully Mine. Therefore, the likelihood of cumulative groundwater interactions with Toms Gully is considered low. 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 Pit Lake Water Quality Analysis (Appendix P) indicates good water quality with only two
TEQ-3 TE-3 IWEQ-3 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.	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystems ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential transportation of contaminated sediments and material throughout the Project area and externally. Biological and human health implications (primary contaminants of concern being cyanide and metals). ▪ 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 contaminants in environmental pathways should the same contaminants released from the Toms Gully Mine or already present in the environment due to historic activities.		
TEQ-4 IWEQ-5 AE-5	Embankment failure of Annie's Dam water storage and uncontrolled water and sediment release.	▪ Terrestrial Environmental Quality ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential increase in cumulative concentration of sediments within the Marrakai Creek and Adelaide River 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.		
TEQ-5 IWEQ-6 AE-6	Poor quality runoff or seepage from the historic WRDs and Heap Leaches.	▪ Terrestrial Environmental Quality ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential transportation of contaminants throughout the Project area and externally (AMD, heavy metals, and NORMS). 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 contaminants in environmental pathways should the same contaminants be released from the Toms Gully Mine or already be present in the environment due to historic activities.		
IWEQ-4 AE-4	Embankment failure or seepages from the new WRDs at Rustlers Roost and Quest 29 to surrounding environment.	▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential transportation of contaminants throughout the Project area and external (AMD, metals and NORMS). Biological and human health implications and contamination of downstream environments. ▪ Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. ▪ Potential for bioaccumulation of contaminants in environmental pathways should the same contaminants be released from the Toms Gully Mine or already be present in the environment due to historic activities.		
IWEQ-9	Pit and groundwater dewatering	▪ Inland Water Environmental Quality	▪ Potential transportation of PAF material, with potential to cause contamination, throughout the Project area and externally. This would have the potential to lead to dieback of riparian vegetation.		

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
	exposing PAF and causing AMD.		Indirect biological and human health implications in the immediate location of the placement and areas subject of seepage or runoff. ▪ Decrease in fish populations and species richness resulting in decreased suitability of the environment for aquatic species. ▪ Potential for accumulation of excessive contaminants within sediments and fauna. ▪ 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.		contaminants of potential concern slightly exceeding ecosystem values for iron and ammonium. Therefore, it is predicted that seepage of pit lake water into groundwater is unlikely to contribute significant contaminants that would adversely affect the surrounding environment and cumulatively increase contaminants in groundwater from other uses. In accordance with the Pit Lake Water Quality Analysis (Appendix P) there is potential for species to bioaccumulate heavy metals should they be feeding on animal species that reside or utilise the pit lakes. There could be localised cumulative impacts with any bird species that utilise the nearby Toms Gully Mine and quarry pits. However, there are no known fish species within the pit lakes and macroinvertebrates are expected to be limited. Furthermore, the edge environment surrounding the pits is sub-optimal for bird and animal species and therefore the risk of bioaccumulation, particularly of species that may be utilised by humans, is considered extremely low. Based on the proposed design approach, management and monitoring measures the risk of overtopping, embankment failure or seepage occurring and contributing contaminants to the environment that would result in bioaccumulation is considered low.
IWEQ-10 AE-8	Planned pit over topping or release to surface water features during extreme rainfall and flooding events.	▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential transportation of contaminants throughout the Project area and externally (AMD, heavy metals, and NORMS). Biological and human health implications (primary contaminants of concern being cyanide and metals). ▪ Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation, and fishing. ▪ Contamination of downstream aquatic environments resulting disturbance of ecological integrity and functioning of aquatic ecosystems.		
IWEQ-11 AE-9	Unplanned pit overtopping or release to surface water features during extreme rainfall and flooding events.	▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential transportation of contaminated sediments and material throughout the Project area and externally. Biological and human health implications (primary contaminants of concern being cyanide and metals). ▪ 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. ▪ Contamination of downstream aquatic environments resulting disturbance of ecological integrity and functioning of aquatic ecosystems.		
IWEQ-14 AE-11	Poor handling and management of tailings and waste rock	▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential transportation of contaminated sediments and material throughout the Project area and externally. Biological and human health implications (primary contaminants of concern being cyanide and metals). ▪ 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. ▪ Increased disturbance and lost productivity of surface water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully Mine, nearby quarries, and Mount Bundey Training Area, resulting in cumulatively 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.		
TEQ-7 IWEQ-8	Indiscriminate use of existing waste rock for construction. Storage of waste rock outside of pit footprint for too long.	▪ Terrestrial Environmental Quality ▪ Inland Water Environmental Quality	▪ Potential transportation of leaching material, with potential to cause contamination, throughout the Project area and externally. 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.	**Avoid** ▪ Develop and implement a geochemical block model. ▪ ESCP to prevent mobilisation. ▪ Maximisation of placement within pits. ▪ Testing of waste rock for AMD, heavy metals and NORMS prior to use as on or offsite construction material. **Mitigation and Management** ▪ Tracking of the waste rock and dumping locations. ▪ Implementation of AMDMP and WMP.	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

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
			▪ 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.		a geochemical block model. With appropriate implementation and design and controls, the Project should not contribute to cumulative impacts associated with release of chemicals into the environment. While the lower reaches of Mount Bundey Creek have been subject to AMD a cumulative increase in AMD within the watercourses is unlikely if the site is managed as per the AMDMP (Appendix T) and the closure commitments implemented (e.g. capping the WRDs).
TEQ-8	Failure of process tanks/pipes/ pumps.	▪ Terrestrial Environmental Quality	▪ Potential increase in cumulative concentration of sediments within the Mount Bundey (Mary River) and Marrakai Creek (Adelaide 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.	**Avoid** ▪ Only clearing the practical minimum footprint necessary for the portion of the Project to be implemented ▪ 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 December to March portion of the wet season. ▪ 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 (Australian Government 2016) ▪ Design TSF to contain a range of design storm and rainfall sequences events up to and greater than the required design criteria ▪ 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 ▪ Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams ▪ Continued use of drainage controls and bunds ▪ Construction of abandonment bunds around the processing plant **Mitigation and Management** ▪ 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 ▪ Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams ▪ Adherence to Ground Disturbance Procedures ▪ Implement erosion and sediment controls in accordance with an ESCP ▪ Implementation of Biodiversity Management Plan ▪ Implementation of AMDMP and WMP ▪ 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 ▪ Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams ▪ Daily monitoring of waste rock handling and tailings disposal	The Project will maintain hazardous chemicals onsite. There are established guidelines associated with the storage and handling of hazardous chemicals in Australia and the proponent has committed to operating in accordance with these guidelines. Furthermore, the Project design incorporates significant bunding around the process plant and a sump. Therefore, the risk of stored or transport hazardous chemical release from the site contributing cumulatively to contamination in the surrounding environment is low. While the risk of small scale leaks and spills during operation is an inherent risk in any mining operation, release of these chemicals to the environment during such a scenario can be prevented though employment of appropriate standard operating procedures, training and provision of spill kits. All these measures are proposed for the Project and therefore the risk of release to the environment is low. It is predicted the design, implementation of standard operating procedures and implementation of the environmental management system will sufficiently prevent chemical releases and any incident would be sufficiently minor to be contained and treated with spill kits and through appropriate landfilling of contaminated material.
TEQ-9 IWEQ-12	Erosion of site infrastructure leading to sedimentation	▪ Terrestrial Environmental Quality ▪ Inland Water Environmental Quality	▪ Contribution to exposed ground in the Project area and general locality. Diminished complexity and biological integrity of Project area and soils. Potential indirect structural stability issues. ▪ Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminants of concern being cyanide and metals). ▪ Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing.		
TEQ-13 TE-8 IWEQ-16 AE-12	Unfinished/ unsuccessful rehabilitation of Project due to inadequate funds or natural disaster (e.g. cyclone).	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystem ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential transportation of contaminated sediments and material throughout the Project area and beyond. Biological and human health implications (primary contaminant of concern being cyanide). ▪ Given PGO is the same proponent for the nearby Toms Gully Mine 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 impact to the local and surrounding environment. ▪ 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.		
IWEQ-24 AE-20 CE-4	Major mechanical failure of processing plant	▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems ▪ Community and Economy	▪ Potential transportation of contaminated sediments and material throughout the Project area and externally. Biological and human health implications (primary contaminants of concern being cyanide and metals). ▪ 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 PMLU cannot be achieved due to significant environmental incidents resulting in widespread ongoing contamination of water features.		

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
				▪ Tailings and Waste Rock will be managed in accordance with the Tailings Management Plan and Operational Manual (including inspections) ▪ Infrastructure design to withstand extreme events ▪ Improve site drainage controls ▪ Clearing and Topsoil Procedures Implementation ▪ Corporate commitment to EMS implementation via policy ▪ Environmental Management System and various management plans (e.g. EMP, WMP, MMP) ▪ All personnel will be trained in the appropriate management practices and protocols as is applicable to their position ▪ Regular maintenance and inspections of plant	
TEQ-1 TE-5 IWEQ-13 AE-10	Release of hazardous chemicals or materials during storage and handling onsite.	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystems	▪ 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 externally. Potential for bioaccumulation of contaminants within surrounding environment. Biological and human health implications (primary contaminants of concern being cyanide and metals). ▪ Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation, and fishing.	**Avoid** ▪ 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* ▪ Chemical and hydrocarbon storage and processing within containment bunding ▪ Pipelines, pumps, and tanks selected for appropriate capacity ▪ Pumps operated in accordance with supplier specification and operating manuals ▪ Drainage to processing plant area sump to prevent contaminant export ▪ Maintenance of relevant infrastructure as per manufacture scheduled recommendations ▪ Weekly inspections of storage areas, tanks and containers for structural integrity and leaks ▪ Cyanide management and storage will be aligned to the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (Australian Government 2008) ▪ Chemical storage will be located a minimum 30 m from any drainage line or watercourse. ▪ Standard pre-requirements for contractors for transport on site (must meet standard requirements and licencing) ▪ Appropriate site access for large vehicles. ▪ All external operators to complete induction that includes transportation safety considerations **Mitigation and Management** ▪ Develop Emergency Response Plan and include in inductions ▪ 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 ▪ Emergency Management and Response Plan, spill response for transport incidents on site ▪ Implementation of WMP ▪ Implementation of Biodiversity Management Plan ▪ Implement erosion and sediment controls in accordance with an ESCP	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 cumulative impacts associated with release of chemicals into the environment. The Project will maintain hazardous chemicals onsite. However, there are established guidelines associated with the storage and handling of hazardous chemicals in Australia and PGO has committed to operating in accordance with these guidelines. Furthermore, the Project design incorporates significant bunding around the process plant and a sump. Therefore, the risk of stored or transport hazardous chemical release from the site contributing cumulatively to contamination in the surrounding environment is low. While the risk of small scale leaks and spills during operation is an inherent risk in any mining operation, release of these chemicals to the environment during such a scenario can be prevented though employment of appropriate standard operating procedures, training and provision of spill kits. All these measures are proposed for the Project and therefore the risk of release to the environment is low. It is predicted the design, implementation of standard operating procedures and implementation of the environmental management system will sufficiently prevent chemical releases and any incident would be sufficiently minor to be contained and treated with spill kits and through appropriate landfilling the contaminated material.
TEQ-11 TE-6 AE-10	Release of hazardous chemicals or materials during transportation to site.	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystem ▪ Aquatic Ecosystems			
TEQ-12 TE-7 IWEQ-15	Production of domestic waste and storage of the waste onsite	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystem ▪ Inland Water Environmental Quality	▪ 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. ▪ Potential for cumulative pest fauna increases in the Mount Bundey locality where nearby operators also produce waste onsite. ▪ 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 accumulation of contaminants within sediments and fauna.		
TEQ-20 IWEQ-23 AE-19	Inappropriate liquid and solid waste disposal.	▪ Terrestrial Environmental Quality ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ 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. ▪ 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 sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts.		
TE-4	Poor water quality released from site	▪ Terrestrial Ecosystem	▪ Decrease in fish populations and species richness resulting in decreased suitability of the environment for aquatic species and terrestrial species that may utilise the watercourses (e.g. birds).		

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
IWEQ-7 AE-7	during wet season (stormwater).	▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential for bioaccumulation of contaminants within sediments and fauna (e.g. heavy metals). ▪ 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.	▪ Cyanide management and storage will be aligned to the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (Australian Government 2008). ▪ Compliance with the WDL ▪ Manage disposal of wastes in accordance with the Project EMP (including bunded waste oil bins)	
TEQ-15 TE-10 IWEQ-18 AE-15	Lack of rehabilitation materials leads to inadequate tailings closure and poor-quality site rehabilitation.	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystem ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Increased disturbance and lost productivity of soils and water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully Mine and the nearby Mount Bundey Training Area. Resulting in reduced local capacity of soils and water features to perform ecological functions and a cumulative increase in erosion contributing to dust and waterway sedimentation. ▪ Reduced area of vegetation in the general Mount Bundy locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.	**Avoid** ▪ Clearing and ground disturbance will only take place within areas of the mining footprint; ▪ Areas will not be clear areas unless they are approved for direct mining or supporting infrastructure and activities; ▪ Early planning and financial provision for closure works; and ▪ Financial provisioning for closure implementation. ▪ Corporate commitment to EMS implementation via policy; ▪ The EMS will align with AS 14001; and ▪ Environmental Management System will include management plans and procedures (EMP, WMP, MMP etc.). **Mitigation and Management** ▪ Implementation of detailed Mine Closure Plan; ▪ Final closure design to account for rehabilitation potential; ▪ Infrastructure design to withstand extreme events; ▪ Ongoing management of levels in water infrastructure; ▪ Improve site drainage controls; ▪ Rehabilitation trials to determine effective methods; ▪ Planning and allocation of appropriate rehabilitation media (topsoil and organic matter); ▪ Establishment of a fire regime that promotes native vegetation; ▪ Implement active weed control and prevention during construction, operation and closure; ▪ Monitoring of areas that have been rehabilitated and closed from further mining and associated activities; ▪ Calculation of material requirements and identification of extraction areas; ▪ Prepare and implement Clearing and Topsoil Management Procedure; ▪ Prepare and implement Ground Disturbance Management Plan/Procedure; ▪ Recover topsoil from TSF, WRD and processing plant footprints; ▪ Appropriate handling storage of topsoil and rehab material during construction and operation; ▪ Implementation of Mine Closure; ▪ 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; and ▪ All personnel will be trained in the appropriate management practices as is relevant to their position	Based on the review of the selected Projects at varying spatial scales (Table 7-18) it is estimated that cumulative impacts at the property and catchment scale consist of approximately 592.36 ha of Eucalyptus woodland and fauna habitat[32], approximately 602.36 ha in the region and approximately 904.99 ha in the bioregion. As a comparison, using total extent of mapped Eucalyptus woodland and Eucalyptus open forest in these four extents indicates the cumulative impact will constitute roughly 1.28% of Eucalyptus woodland and Eucalyptus open forest at the property scale, 0.32% at the catchment scale, 0.15% at the region scale and 0.03% at the bioregion scale. Characteristics of soils, including chemical, physical, biological, and aesthetic qualities will be degraded in the vegetation clearing areas. Resulting in less productive soils within the clearing areas; however, this impact is anticipated to be contained within the site disturbance area. Also, the Project commitments include the stripping and retention of topsoils and organic matter for progressive rehabilitation purposes. Therefore, while it is predicted certain areas may experience difficulty with establishing native vegetation of local provenance (e.g. WRDs) this can be overcome through progressive rehabilitation, appropriate planning, management of weeds and the fire regime, and limiting access/disturbance of these areas. During operations, rehabilitation will be undertaken on the decommissioned heap leach facilities using suitable available oxide waste material. The proposed surface WRD at Quest 29 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. The predicted outcome of this approach is an end stable and safe post-closure landform that does not contribute to ongoing cumulative impacts in the surrounding environment.
TEQ-16 TE-11 IWEQ-19 AE-16 CE-1	Inappropriate management of the decommissioned site, post closure landform.	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystem ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems ▪ Community and Economy	▪ Increased disturbance and lost productivity of soils and water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully Mine and the nearby Mount Bundey Training Area. ▪ Reduced area of vegetation in the general Mount Bundy locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity. ▪ Increased disturbance of water features in the wider Mount Bundey locality coupled with disturbance at Toms Gully Mine and nearby quarries and the 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 and impacting the downstream receptors and use of the downstream environment by the community (e.g. recreational fishing and cultural activities).		
TEQ-17 TE-12 IWEQ-20 AE-17	Ineffective operational implementation of site environmental management system, plans and procedures.	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystem ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Decreased likelihood of achieving rehabilitation goals and closure requirements following decommissioning. Agreed PMLU cannot be achieved due to significant environment incidents resulting in widespread ongoing degradation of soils. ▪ Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rehabilitation goals and closure requirements following decommissioning. ▪ Given PGO is the same proponent for the nearby Toms Gully Mine 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 impacting the local and surrounding environment. ▪ Potential increase in cumulative concentration of contaminated sediments within the downstream watercourse because of any sediment discharged. Increased downstream depositions and siltation impacts leading to decreased aquatic ecological functionality.		

[32] Note – much of this calculated Eucalyptus woodland disturbance has already occurred with development of the quarries.

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
TEQ-18 TE-13 IWEQ-21	Use of Project machinery, equipment, vehicles, and activities causing fire through sparks or heat ignition source.	▪ Terrestrial Environmental Quality ▪ Terrestrial Ecosystems ▪ Inland Water Environmental Quality	▪ Potential increase in cumulative concentration of sediments within the downstream watercourse as a result of any sediment discharged. Increased downstream depositions and siltation impacts. ▪ Indirect loss of nutrients from topsoil dispersal and reduced viability of soils to re-establish 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. ▪ Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminants of concern being cyanide and metals). ▪ Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing.	**Avoid** ▪ Liaise with Bushfires NT regarding regional (and site) fire break. ▪ Project to establish designated smoking areas. ▪ Vehicles not to park in vegetation areas (to prevent hot engines causing bush fire). **Mitigation and Management** ▪ PGO to implement appropriate fire regime within the Project tenements in consultation with leaseholder and in accordance with best management practices (to be informed by guidance material on regimes to support best ecological outcomes). ▪ Establish and implement 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. ▪ Develop Fire Management Plan (or inclusion in ERP above). ▪ Vehicles, plant and machinery to be switched off when not in use. ▪ Implementation of Project EMP (incorporating fire and dust management measures).	Bushfires commonly occur in the dry season within the region. Should fires be started due to Project activities (other than controlled burns) they could impact onsite fauna and flora and easily spread offsite. This could couple with fire regimes triggered or associated with nearby projects and activities (e.g. Mount Bundey Military Training Area). However, through the appropriate implementation of the proposed avoidance, management and mitigation measures the predicted outcome for the area will be implementation of a fire regime that is more suited to ecosystem functioning and maintenance of surrounding habitats.
TEQ-19 TE-14 IWEQ-22	Dust generation from Project activities such as vehicular movements and earthworks.	▪ Terrestrial Environmental Quality ▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Potential cumulative dust lift-off and deposition in the wider area in conjunction with Toms Gully Mine, 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. ▪ Indirect impact of reduced ability for successful revegetation due to loss of topsoils which may lead to further erosion.	**Avoid** ▪ Areas identified to assist in mining operations will be cleared progressively to minimise impact of local fauna and creation of dust. ▪ Site planning to consider only the necessary clearing of areas and avoid clearing on significantly windy days. ▪ 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 maintaining all equipment in accordance with manufacturers specifications. ▪ Where possible, choose the ""Buy Quiet"" option for the purchase of equipment. ▪ Vehicles, plant and machinery to be switched off when not in use. ▪ Lighting to be switch off when not in use at administration, crib and work areas. **Mitigation and Management** ▪ Development and implementation of Dust Management Plan. ▪ Develop and implement an ESCP. ▪ ESCP controls implemented where ground cracking identified. ▪ Employees will carry out visual monitoring and individual assessment of dust emissions prior to undertaking tasks or attending work areas. ▪ Biodiversity Management Plan to incorporate dust mitigation and artificial lighting mitigation measures. ▪ Comply with approved vegetation clearance. ▪ Ground Disturbance Permit procedure to be adhered to. ▪ Monitoring of area surrounding high vibration activities for ground instability. ▪ Noise management and controls to be addressed in Project EMP.	While there is potential for cumulative contribution to airborne particulates with surrounding activities, this is only likely to occur during severe weather events. Such circumstances are unlikely to result in detrimental impacts to ecological or human receptors in the area. Furthermore, any impacts to fauna through noise and artificial light are predicted to be localised and result in temporary behavioural changes (e.g. avoidance of areas) and will not result in long-term impacts.
TE-15	Noise and vibration emissions from construction and operational activities (e.g. vehicle movements and blasting).	▪ Terrestrial Ecosystem	▪ Potential increase in cumulative impact on fauna in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area.		
TE-18	Artificial light emissions from construction and/or operation of the mine site.	▪ Terrestrial Ecosystem	▪ Potential increase in cumulative impact on fauna in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area. ▪ An artificial increase in lighting can also influence the abundance and behaviour of predators.		
CE-2	Emissions from clearing, dust, noise, artificial light associated with construction and/or operation of the mine site.	▪ Community and Economy	▪ Potential cumulative impact from the abovementioned risks in the wider area in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area.		

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
				▪ Develop and implement Noise and Vibration Management Plan. ▪ Operations in line with noise regulations. ▪ Use of low voltage/wattage light bulbs where possible.	
TE-16 AE-18	Construction and operational activities (incl. vegetation clearing) result in introduction of new weeds and spread of existing weeds into new areas.	▪ Terrestrial Ecosystem ▪ Aquatic Ecosystems	▪ Increased weed species in the area negatively affecting rehabilitation potential and contributing to rehabilitation failure. Failure to establish appropriate capping and native vegetation. ▪ There is a risk that PMLU may not be achieved due to unsuccessful rehabilitation process (e.g. vegetation establishment, 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.	**Avoid** ▪ Annual weed mapping (by June each year) to understand nature of the spread of weeds and plan weed control activities accordingly. ▪ Weed inspections completed regularly and prior to commencement of development activities to inform weed management and detection. ▪ 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. **Mitigation and Management** ▪ Develop and implement a Weed and Pest Management Plan for the Project that specifically addresses the following: ▪ Reduction and management of the local cane toad population – to reduce the threat to listed monitor species in the area; ▪ Active management of invasive grass species (particularly Gamba Grass) within the Project area – to reduce the risk of inappropriate fires; ▪ Reduction and management of feral predators in the local area particularly cats which are known to predate on Pale Field-rats, Red-cheeked Dunnarts and Partridge Pigeon. ▪ Conduct seasonal weed control activities in consultation with local landholder (in and surrounding the Project boundary) in accordance with the site Weed and Pest Management Plan (grazing control as option). ▪ Implementation of the biodiversity management actions within the Project-wide EMP. ▪ Weed hygiene procedures - including inspection and wash down of all vehicles and machinery entering site. ▪ Compliance with ground disturbance and clearing procedures. ▪ Ensure all employees are aware of the Declared weeds and WoNS during inductions.	The declared weed species, Hyptis was the most abundant weed within the Project area. Hyptis was recorded in high densities in the southern section of the Quest 29 Project area. Scattered Perennial Mission Grass and Gamba Grass were also observed, mostly within Quest 29 and along roadsides. Other weed species included Spinyhead sida (EcOz 2020a). Introduce weeds and pest animals are a key threatening process to native and listed threatened species in the region. Weed species also contribute to fire regimes and intensities that are adverse to ecosystem functioning. The Project presents opportunities to gain a better understanding of the terrestrial ecological values that are in the area; and will be able to contribute to the management of introduced and feral species, including weed management, and the control of wild dogs, pigs and cats. Based on the proposed avoidance, mitigation and management measures it is predicated proactive management will reduce pest fauna and flora within and surrounding the Project. With implementation of the proposed measures there is unlikely to be an adverse cumulative impact to the area. The Project commitments include the stripping and retention of topsoils and organic matter for progressive rehabilitation purposes. Therefore, while it is predicted certain areas may experience difficulty with establishing native vegetation of local provenance (e.g. WRDs) this can be overcome through progressive rehabilitation, appropriate planning, management of weeds and the fire regime, and limiting access/disturbance of these areas.
TE-17	Increased density of weed infestations.	▪ Terrestrial Ecosystem	▪ Increased weed species in the area negatively affecting rehabilitation potential and contributing to rehabilitation failure. Failure to establish appropriate capping and native vegetation. ▪ There is a risk that PMLU may not be achieved due to unsuccessful rehabilitation process (e.g. vegetation establishment, 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.		
IWEQ-17 AE-14	Pit lake becomes a groundwater source.	▪ Inland Water Environmental Quality ▪ Aquatic Ecosystems	▪ Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. ▪ Potential for bioaccumulation of contaminants in environmental pathways should the same contaminants be released from the Toms Gully Mine or already be present in the environment due to historic activities.	**Mitigation and Management** ▪ 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.	At Rustlers Roost, the behaviour of the pit lake is not clearly defined as a sink and may be behaving as a through flow with the lake receiving groundwater from the western side and recharging the aquifer on the eastern side. Groundwater level data at Quest 29 indicates that the Zamu pit lake may act as a through flow lake receiving groundwater from the northern side and losing to groundwater on the southern side. The Taipan pit is likely to be leaking to the groundwater aquifer at least on the north-east side of the pit. The pit lake may possibly be working also as a through flow lake as the higher ground elevation on the southern side may suggest higher groundwater level on this side. The South Koolpin pit likely experiences infiltration on the southern end of the pit and higher ground surface elevation on the other sides of the pit also suggest likely groundwater seepage to the pit. The North Koolpin pit lake is likely losing to groundwater. However, the location of the pit along a ridge indicates that groundwater along the ridge may

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
					be flowing toward the pit. The BHS pit lake level is standing above the monitoring groundwater level of adjacent bores suggesting that the pit lake is standing above surrounding groundwater level, hence recharging the aquifer. 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 Pit Lake Water Quality Analysis (Appendix P) indicates good water quality with only two contaminants of potential concern slightly exceeding ecosystem values for iron and ammonium. Therefore, it is predicted that seepage of pit lake water into groundwater is unlikely to contribute significant contaminants that would adversely affect the surrounding environment or cumulatively increase contaminants in groundwater from other uses.
CE-6	Skilled labour shortages	▪ Community and Economy	▪ Potential cumulative skilled labour shortage impact in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area.	**Avoid** ▪ Prioritise employment from the local area and region (aimed at directing positive economic impacts locally); ▪ Ongoing Project updates and information to the public detailing recruitment (aimed at avoiding missed community expectations); ▪ PGO to provide training and development to local residents for placement (aimed at maximising local benefit); ▪ Maintain existing access controls; ▪ Combine freight transports and limit vehicle movements for all Project phases; ▪ Provide worker education and company policy expectations through induction material to include traffic safety requirements (e.g. no commuting after long shifts, adherence to road rules etc.); ▪ Transport of hazardous goods is in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission Australia 2018) and the following mitigation measures: – Ensure supply of hazardous goods is by recognised and approved suppliers – Ensure transport of Hazards goods is as per directions of the SDS. ▪ Develop and maintain a positive organisation culture that benefits all employees; ▪ Develop a roster that will be sustainable for the majority of employees; ▪ Regularly update stakeholders regarding Project status; ▪ Work with local training providers to develop local training programs to provide unskilled people with opportunities to gain employment; ▪ Actively work with the Northern Territory Government on placement of redundant mining industry personnel (e.g. from the Ranger Uranium Mine and Union Reef Mine closures); ▪ Adoption of recruitment policies that allow for appropriate notice periods to be served for new employees; ▪ Accommodate workers in a purpose-built camp for those personnel travelling in to work on the Project; and	The Project presents economic and community opportunities at a scale that is not problematic for services, existing infrastructure or social fabric and are expected to have on balance an overall positive socio-economic impact. Risks to the community from transport related interactions, altered water quality (affecting downstream recreational and cultural uses) and the risk of unexpected closure resulting in legacy issues that affect the community will remain. However, both the likelihood and consequence of such risks are considered to be sufficiently low through the application of controls applied in accordance with the environmental decision-making framework. The environmental objective identified in the ToR (NT EPA 2021b) for community and economy risk was to enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians. The Project provides an opportunity to enable further mining increment to generate local economic opportunities with minimal environmental risk and creates the opportunity to manage the unrehabilitated historic disturbance area, waste rock and water management according to international best practice for mine closure such that the ToR objective for this factor is able to be met. Any cumulative impact associated with surrounding Projects is largely expected to be positive (e.g. increased local employment).
CE-7	Additional highway commuter traffic and associated road safety concerns.	▪ Community and Economy	▪ Potential cumulative traffic impact in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area.		
CE-8	Influx of workers to the local community seeking housing	▪ Community and Economy	▪ Potential cumulative economic and social impact to local community in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area.		
CE-9	Influx of workers to the local community in general	▪ Community and Economy	▪ Potential cumulative economic and social impact to local community in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area.		
CE-10	Increased demand for local services and supplies	▪ Community and Economy	▪ Potential cumulative economic and social impact to local community in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area.		
CE-11	Disturbance of sites/objects of heritage significance heritage items or places and sacred sites.	▪ Community and Economy	▪ Potential cumulative disturbance to cultural heritage in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area. Also, potential cumulative impact due to previous activities onsite.		

Risk No.	Source of Impact	Relevant Factor(s)	Potential Impacts and Connection or Interaction Pathways	Measures to Prevent and Address Residual Impacts	Predicted Outcome
				▪ Develop and implement a procurement policy that prioritises local and Northern Territory procurement. **Mitigation and Management** ▪ Establish a complaints and feedback register; ▪ Acquire any additional services on commercial terms; ▪ Provide in-house first aid treatment to staff (aimed at avoiding the need to utilise external services for minor health issues); ▪ Establish a complaints and feedback register; ▪ Undertake ongoing stakeholder engagement in accordance with the SEP; and ▪ Develop programs to assist local businesses retain workers where it is identified the Project is directly impacting labour availability and implement more stringent controls, where required to limit access to operations to reduce access concerns to sensitive environmental and cultural areas.	

11.2 Consideration of Project Against Legislated Principles and Duties

In accordance with the guideline for preparing an EIS (NT EPA 2021a) the Draft EIS must outline how the Project meets the requirements of Section 42(b) and Section 43 of the EP Act. These sections set out the purpose of the environmental impact assessment process and the general environmental duty of proponents. While each of the principles and obligations have been addressed throughout the Draft EIS sections and actions relating to stakeholder engagement, this section provides a concluding summary to provide a clear linkage.

11.2.1 Ecologically Sustainable Development

The Project has been considered against the principles of Ecologically Sustainable Development (ESD) as set out in Part 1 Division 1 of the EP Act and in accordance with the NT EPA guidance for preparing an EIS (NT EPA 2021a). ESD as defined in the EP Act as '*development that improves the total quality of human life, both now and in the future in a way that: (a) maintains the ecological processes on which all life depends; and (b) recognises the need for development to be equitable between current and future generations*.' The core objectives and principles of ESD established in the EP Act are consistent with those of the National Strategy for Ecologically Sustainable Development (NSESD) (ESD Steering Committee 1992).

The principles of ESD defined in the EP Act (s18) are:

- *Decision-making principle*

  (1) Decision-making processes should effectively integrate both long-term and short-term environmental and equitable considerations.

  (2) Decision-making processes should provide for community involvement in relation to decisions and actions that affect the community.

- *Precautionary principle*

  (1) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

  (2) Decision-making should be guided by:

    (a) A careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and

    (b) An assessment of the risk-weighted consequences of various options

- *Principle of evidence-based decision-making*

  Decisions should be based on the best available evidence in the circumstances that is relevant and reliable.

- *Principle of intergenerational and intragenerational equity*

  The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of present and future generations.

- *Principle of sustainable use*

Natural resources should be used in a manner that is sustainable, prudent, rational, wise and appropriate.

- *Principle of conservation of biological diversity and ecological integrity*

  Biological diversity and ecological integrity should be conserved and maintained.

- *Principle of improved valuation, pricing and incentive mechanisms*

  (1) Environmental factors should be included in the valuation of assets and services.

  (2) Persons who generate pollution and waste should bear the cost of containment, avoidance and abatement.

  (3) Users of goods and services should pay prices based on the full life cycle costs of providing the goods and services, including costs relating to the use of natural resources and the ultimate disposal of wastes.

  (4) Established environmental goals should be pursued in the most cost-effective way by establishing incentive structures, including market mechanisms, which enable persons best placed to maximise benefits or minimise costs to develop solutions and responses to environmental problems

As required under the EP Act the principles of ESD have been considered in the Project planning and design. A description of how the Project is aligned with these principles is provided in Table 1-9. Details of the key management actions proposed, or already applied in the Project planning and design, so the Project aligns with these principles are provided.

Table 11-2 Guiding Principles of Ecologically Sustainable Development Addressed

Principle	Relevant Key Management Actions	Demonstration of Alignment
Decision-making principle	• Stakeholder Engagement Strategy • Flora and fauna studies • Implementation of Biodiversity Management Plan • Mine Closure Plan	As part of the planning and design PGO has considered short-term and long-term economic, environmental, social and equitable issues and have included the community in the decision-making processes. PGO developed a Stakeholder Engagement Strategy to include community involvement into the planning and environmental impact assessment process (refer to section 3.2). Various stakeholders were directly contacted to seek input on the Project. Other stakeholders including the general public were given information and an avenue for contact regarding the Project (refer to section 7.6.1.2). Stakeholders including pastoral lease holders will be consulted regarding the post mine life land use and closure objectives. While the Project is designed for a 10 year operational life, the Project documentation considers post-closure use of the area (refer to the draft Mine Closure Plan in Appendix J). In the short-term the Project aims to stabilise historic mining impacted landforms and ensure the site does not pose a risk to the surrounding environment, while at the same time accessing valuable gold resources which result in economic benefits at all spatial scales throughout the Northern Territory. In the long-term the objective of mine completion is to prevent or minimise adverse environmental, physical, social and economic impacts, and to create a stable landform suitable for ongoing pastoral land use (refer to Appendix J).
Precautionary principle	• Risk Assessment • Alternative assessment	A risk assessment has been developed for the Project which carefully identifies and evaluates associated environmental risks (refer to Section 6 – Risk Assessment of Environmental Factors). Notably, risks vary across the Project stages. For example the risk of impacts from

Principle	Relevant Key Management Actions	Demonstration of Alignment
		vegetation clearing are highest during the construction stage. 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 (i.e. consideration of a worst-case precautionary approach). For each of the six environmental factors that the NT EPA identified as at risk to significant Project related impacts, mitigation and management strategies have been proposed aligning with information collected in site-specific scientific studies. This has been extended to other environmental factors, on a precautionary approach identified during the course of the EIS preparation. Uncertainties and assumptions have been identified alongside potential environmental impacts. This allows PGO to address these uncertainties as best they can and ensure appropriate frameworks are implemented. An alternative assessment was undertaken to assess various Project related options for social, economic and environmental advantages and disadvantages (refer to section 4.15 – Alternative Assessment). Power alternatives including solar energy will be considered as a source for Rustlers Roost following a feasibility study. PGO proposed a pit backfilling arrangement at Quest 29 in preference to establishing a larger or multiple WRD as disturbance and runoff is minimised and better environmental outcomes are achieved. The original TSF option has been adapted with consideration of environmental, engineering and economic factors. Two haul roads were considered, the options having conflicting distance and environmental impacts. PGO has considered updating the existing road in preference to building a new one to have the least environmental damage and be the most cost effective.
Principle of evidence-based decision-making	• Flora and fauna studies • Water and geochemical studies • TSF location option study	Decisions during the planning and assessment of the Project have been made with the consideration of relevant information obtained from a variety of sources and professionals in appropriate fields. In all cases where a known source of direct field verified data is available, this has been used in preference of desktop data. Flora and fauna field surveys were undertaken in Project planning to gather baseline data and identify potential occurrences and habitat for threatened species. Water and geochemical baseline studies have also been undertaken. The results of these studies ensure accurate and relevant environmental knowledge of the Project site is available for the design of effective management, monitoring and closure strategies. A TSF location option study was undertaken, and the selected location was chosen for a combination of factors including its minimised transport distance, portion of historically disturbed land and economic potential.
Principle of intergenerational and intragenerational equity	• Rehabilitation frameworks • Progressive rehabilitation during mining to enable more established areas upon closure • Implementation of post closure monitoring programs	PGO is committed to ensuring the Project will not adversely impact on future generations and instead maintain a productive environment and provide opportunities for future generations. The mine will be operational for approximately 10 years. At the completion of operation, the mine site will be decommissioned, closed and rehabilitated under an approved MCP. The land use post closure and closure objectives will be drafted in consultation with pastoral lease holders and other stakeholders. Mine surfaces will be rehabilitated, reshaped and revegetated, infrastructure removed from site and the pits left to form pit lakes. A

Principle	Relevant Key Management Actions	Demonstration of Alignment
		monitoring programme will be implemented as part of the MCP ensuring adequate environmental rehabilitation is achieved. The implementation of the management measures presented in the Draft EIS and actions proposed in the draft MCP should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
Principle of sustainable use	• Recycling of wastes where possible • Internal water reuse processes (see WMP) • Relocation of accommodation camp • Use of mine waste material for TSF construction	PGO is committed to using natural resources in a sustainable way. The WMP has been drafted with careful consideration of the wet and dry seasons and relevant natural water bodies in the vicinity of the mine. Internal runoff and process water from the plant will be captured and reused. Measures will be taken to ensure water use occurs in a sustainable and appropriate manner. Site-specific groundwater modelling will be used and a WMP and a Trigger Action Response Plan will be implemented. The significant variation for the Project included relocation of the accommodation camp to a site which allows direct connection to the mains electricity grid. This enabled the Project to forgo the use of diesel generators for the primary supply and is considered an improvement in resource use. Furthermore, PGO is investigating opportunities to connect the Project to an existing gas pipeline to further reduce diesel usage for transportation of gas. The Project also proposes to utilise historic and newly created waste earthen and rock material for construction of the TSF embankments.
Principle of conservation of biological diversity and ecological integrity	• Implementation of Biodiversity Management Plan • Make use of already disturbed areas where possible • Limit construction and clearing to times of the year when fauna are least vulnerable • Implementation of ecologically safe wastewater discharge procedures • Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines • Groundwater / surface water quality monitoring	The Project is located on historically disturbed areas and the environmental impact assessment has considered areas of conservation significance in the region. The Project has been designed with consideration and commitment to ensuring the protection and conservation of biological diversity and integrity. PGO is committed to avoid the disturbance of threatened flora species where possible. Targeted surveys have been completed within the Project area and no threatened flora species have been identified. Caution will be taken to maintain sufficiently low contamination levels when releasing water from the mine site. Discharge water will undergo suitable sediment removal processes and be released to ensure appropriately required mixing and dilution factors to prevent adverse impact on aquatic ecology.
Principle of improved valuation, pricing and incentive mechanisms	• Contribution to NT Government legacy mines levy	The Project will contribute a significant amount (tens of thousands of dollars per year) into the Northern Territory Governments legacy mines annual levy over the 10-year operational mine life. The revenue from this levy is used to address the impacts of historical mining activities as well as ensuring future mining related activities are regulated to minimise environmental damage (see section 7.6.2.2 – Economy).

11.2.2 Waste Management Hierarchy

In the design and planning of the Project the waste management hierarchy has been applied to actions which have the potential to significantly impact the environment in accordance with NT EPA guidance for preparing an EIS (NT EPA 2021a). The waste management hierarchy is set out in section 27 of EP Act as a formal method for ensuring minimal waste generation.

The waste management hierarchy as described in the EP Act (s27) is as follows:

(1) In designing, implementing and managing an action, all reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.

(2) For subsection (1), waste should be managed in accordance with the following hierarchy of approaches in order of priority:

(a) avoidance of the production of waste;

(b) minimisation of the production of waste;

(c) re-use of waste;

(d) recycling of waste;

(e) recovery of energy and other resources from waste;

(f) treatment of waste to reduce potentially adverse impacts;

(g) disposal of waste in an environmentally sound manner.

The generation of the production of waste during both construction and operation phases of the mine is unavoidable however PGO has committed to minimising waste where possible and recycling, reusing and treating waste appropriately.

In the construction phase, generated waste will be recycled where possible in preference onsite landfill. This will be managed through the establishment of a waste segregation area. All topsoil stripped during this stage will be stored and reused for rehabilitation activities.

The generation of waste rock is an obvious unavoidable waste production, however PGO has put careful consideration into drafting suitable waste management strategies ensuring waste rock is disposed of in way which minimises environmental disturbance. An alternatives assessment was carried out to explore and inform the best way to manage the disposal of waste rock. In accordance with relevant NT EPA guidance, backfilling is proposed as the preferred waste rock disposal method at Quest 29 in part due to its better environmental outcomes when compared with other disposal options including establishing a larger WRD. At the Rustlers Roost site several alternatives to WRDs were considered and although none considered feasible PGO will seek to backfill where possible.

In the case of wastewater, PGO has drafted a WMP which acts to reuse and recycle water. Dewatering of groundwater and surface water will be required continuously throughout operations and a portion of this water will be reused alongside stormwater in the processing plant and for dust suppression. When wastewater discharge is required, sediment basins and flocculants will be used to remove sediments and discharge will be conducted in an environmentally sound manner in regard to discharge quality, time and volumes. The existing pits onsite will require dewatering prior to mining commencement generating the need to discharge ‘clean’ water from site. This will be done during wet seasons ensuring environmental disturbance is minimised.

Sewage waste associated with the accommodation camp cannot be avoided or minimised but will be appropriately treated at a suitable treatment plant and on-site sewage waste will be treated and managed through wastewater systems in accordance with regulatory requirements.

11.2.3 Ecosystem-Based Management

PGO has considered ecosystem-based management when planning and assessing actions which may have significant environmental ramifications. As defined in the EP Act ecosystem-based management is '*management that recognises all interactions in an ecosystem, including ecological and human interactions.*' PGO have adapted this style of management into the decision-making process of relevant environmental decisions.

PGO have invested in various geochemical, groundwater, surface water, flora and fauna studies specific to the Project site in the lead up to mining construction and operation. These studies have provided valuable data sets on the relevant ecosystems within and extending beyond the Project site ensuring environmental decisions are made based on relevant scientific data. Groundwater and surface water studies will be used to generate a set of Site Specific Trigger Values ensuring discharge water quality is suitable for aquatic ecosystems. Environmental monitoring will continue to be conducted during and after the operational lifetime of the mine allowing decision makers to take an adaptive approach to management ensuring management strategies and frameworks can be improved to reflect the best available scientific data.

PGO have undertaken a thorough environmental risk assessment to address and manage potential environmental impacts. This process of identifying and mitigating environmental risks was informed by the site-specific ecological surveys and explored not only direct impacts but indirect and cumulative impacts which could potentiate from external and internal ecosystem interactions.

11.2.4 Impacts of a Changing Climate

PGO acknowledges the current climate is changing on a local and global scale largely as a result of anthropogenic greenhouse gas emissions and that international, national and state level targets have been pledged. A greenhouse gas emission assessment was undertaken to assess the emission amounts from various project facilities through the mine life. As the mine is only operational for a relatively small spatial and temporal scale it is unlikely that Project related emissions will have any measurable impact beyond the immediate air quality of the site.

11.2.5 General Duty of Proponents

The EP Act establishes seven general duties of proponents with regard to the environmental impact assessment process. These duties and how they have been addressed for the Project are detailed in Table 11-3.

Table 11-3 General Duty of Proponents Addressed

Duty	How Addressed
To provide communities that may be affected by a proposed action with information and opportunities for consultation to assist each community's understanding of the proposed action and its potential impacts and benefits.	PGO have developed a Stakeholder Engagement Strategy to ensure a two-way trusting relationship between PGO and relevant stakeholders. This framework aims to inform and engage stakeholders and provide avenues for consultation and discussion. Engagement with key relevant stakeholders has been undertaken as part of this EIS, with feedback considered. PGO is supportive of the process of consultation provided through the EIS public comment period.

Duty	How Addressed
To consult with affected communities, including Aboriginal communities, in a culturally appropriate manner.	PGO commits to informing, consulting and involving local communities in relevant decisions and collaborating and empowering Traditional Owners and Aboriginal groups through advice seeking discussions and direct decision involvement where appropriate. As part of the Stakeholder Engagement Strategy PGO is committed to ongoing communication, one-on-one meetings and employment partnerships with Traditional Owners and Indigenous groups ensuring they are engaged in a way where they are respected, listened to and with recognition that they are an important part of environmental decision-making processes.
To seek and document community knowledge and understanding (including scientific and traditional knowledge and understanding) of the natural and cultural values of areas that may be impacted by the proposed action.	PGO has undertaken a survey with the AAPA regarding sacred sites and identified no sacred sites within the Project area. PGO has also consulted with the NT Government Heritage Branch who have not raised concerns for potential heritage sites within the Project area. PGO understands the cultural importance of these sites and in the event of a potential heritage site discovery, mine work will cease and the NT Government Heritage Branch will be contacted. PGO is committed to ongoing communication with the local community and providing avenues for input and feedback as well as seeking knowledge from Traditional Owners and indigenous communities through the facilitation of relevant discussions.
To address Aboriginal values and the rights and interests of Aboriginal communities in relation to areas that may be impacted by the proposed action.	PGO recognises and understands the importance of Aboriginal community participation in the environmental decision-making process and respects their values and customs. PGO is committed to ongoing consultation and collaboration with Traditional Owners and indigenous communities and has put ample effort into ensuring the Project Construction and Operation do not affect any sacred or heritage sites.
To consider the principles of ecologically sustainable development in the design of the proposed action.	Project actions which possess the potential to generate significant environmental risks have been considered against the relevant principles of ESD. Decisions have been made on consideration of multiple options, based on relevant and scientific information and with the consultation of relevant personnel. PGO is committed to maintaining environmental integrity and ensuring development is sustainable and with mitigated impact on ecological health and diversity.
To apply the environmental decision-making hierarchy in the design of the proposed action.	The assessment has sought to achieve residual risks that are ALARP through application of the environmental decision-making hierarchy (to avoid or mitigate potentially significant environmental impacts) and implementation of an adaptive management approach in accordance with current NT EPA guidelines and industry standards (e.g. AS/ISO 31000 risk management series).
To consider the waste management hierarchy in the design of the proposed action.	In the drafting of waste management strategies PGO has considered the waste management hierarchy and implemented appropriate minimising, reusing, recycling and treatment techniques.