# PAJINGO GOLD MINE

## EA Amendment
## Sewage Treatment Plant, Borrow Pits and Post Mining Land Uses

**Prepared for:**

NQM Gold 2 Pty Ltd
Level 3, 66 Kings Park Road
West Perth
WA 6005
Australia

SLR Ref: 626.30122.00000-R01
Version No: -v1.0
March 2023

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# BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with NQM Gold 2 Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

# DOCUMENT CONTROL

| Reference | Date | Prepared | Checked | Authorised |
|---|---|---|---|---|
| 626.30122.00000 | 30 March 2023 | M. Carr & J. Caneiro | H.Gardner | H. Gardner |

# DOCUMENT REFERENCES

## TABLES



## FIGURES



## APPENDICES

# 1 Introduction

The Pajingo Gold Mine (Pajingo) is owned by NQM Gold 2 Pty Ltd (NQM) and operated and managed by Minjar Gold Pty Ltd.

The Pajingo Mine is situated approximately 53 kilometres (km) SSE of Charters Towers in Queensland, Australia (**Figure 1-1**). Access to Pajingo is via the sealed north-south highway connecting Charters Towers and Clermont, (Gregory Development Highway). A sealed access road extends 22 km east of the highway to the site of the Administration Office and Carbon In Pulp (CIP) Mill. Access to the Vera portal and Mine Office is via a sealed company road some 5 km to the south-east of the Mill. This road is used by ore haulage trucks to move ore from Vera to the Mill.

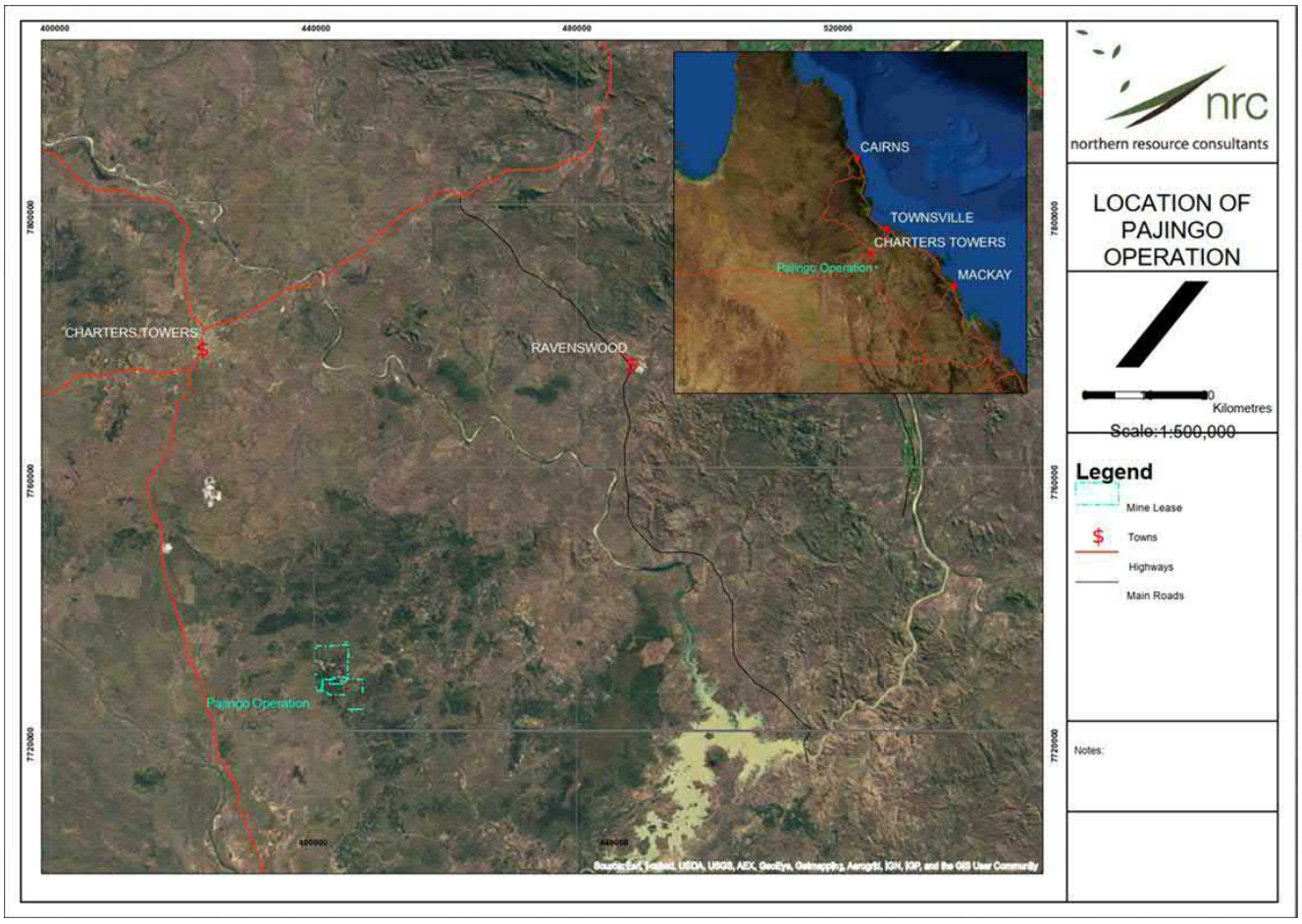


**Figure 1-1 General site location.**

Pajingo consists of four mining leases which the details presented in **Table 1**.

**Table 1 Mining Lease Details**

| Tenure | Area (ha) | Activities/Processes |
|---|---|---|
| ML10215 "Vera" | 230 | Vera Nancy open cut and underground operations, Orchid, Janine East, Venue and VNU open cuts, exploration activities, waste disposal, mine dewatering dams and explosive storage |
| ML10246 "Vera South" | 1,255 | Development of Vera and other ore bodies through underground mining techniques, exploration activities including costeaning, drilling and field sampling. Lynne Moonlight ROM and boxcut location and Starlight B pit. |
| ML1575 "Janet Darling" | 2,716 | Scott Lode TSF and Janet A TSF, Cindy open cut and underground operations, and Anne, Sue, Janine North, Janine Northwest, Cindy surface pits, Exploration activities, CIP/CIL processing plant, waste disposal, tailings containment and explosive storage. |
| ML10370 "Moonlight" | 2,055 | Access tracks, exploration and Lynne Underground mining area. |

The mining methods utilised at Pajingo Mine throughout the life of the mine include underground and open cut mining. Underground ore is produced via a portal at Vera, which leads, by underground decline, to adjacent ore sources. Underground mining methodology uses avoca, narrow vein and longhole open stoping. This system is proven and well understood in Australia and provides for a low-risk method for the scale of mining, ground conditions and ore body geometry.

Open cut mining has employed a conventional drill and blast with hydraulic excavator, dig and truck haul operation using nominally 80 t - 100 t excavator and 40 t – 50 t, dump trucks for waste and ore transport to waste dumps, run of mine (ROM) stockpiles and Processing Plant.

Ancillary surface activities include:

- Clearing of vegetation from new areas;
- Topsoil stripping, stockpiling and stockpile maintenance;
- Dust control as required;
- Construction and maintenance of roads within the pits and access to dump locations;
- Ongoing maintenance of waste dump tip edges and mining faces;
- Exploration drilling, costeaning and field sampling; and
- Progressive rehabilitation activities.

The post-mine land use for Pajingo consists of self-sustaining low intensity grazing, fauna habitat, open woodland, water storage areas ,and non-use mine areas. Rehabilitation records include seed mixes, seeding rates, soil amelioration details, contractor details, costs and photographs (before and after). These records are periodically reviewed and inform subsequent rehabilitation campaigns.

## 1.1 Ownership and Current Operations

The Pajingo Mine ore deposit was discovered by Battle Mountain Gold (BMA) in 1983. BMA held the tenements until 1991 when it became a joint venture with Newmont Mining. In 2002, the operation became 100 % owned by Newmont Mining. North Queensland Metals (NQM) took ownership in 2008 in a joint venture with Heemskirk. Conquest mining took 100% ownership of Pajingo Mine in 2010. In November 2011, Evolution Mining took 100 % ownership of Pajingo Mine, with NQM Gold 2 Pty Ltd (NQM) taking 100 % in September 2016 and has continued to hold the tenement.

## 1.2 Purpose

The purpose of this report is to accompany the *Application to amend an environmental authority* submitted by NQM. This report contains the supporting information required by the *Environmental Protection Act 1994* (EP Act) and the approved form.

# 2 Legislative Requirements

The EP Act states the requirements for an environmental authority amendment application. The requirements have been addressed in this report as outlined (Table 2).

**Table 2 Legislative Requirements and Response**

| Requirement | Response |
|---|---|
| Section 226 of the EP Act: | |
| a) Be made to the administering authority; | The amendment application has been submitted to the Department of Environment and Science (DES) (the administering authority). |
| b) Be in the approved form; | The approved form "Application to amend an environmental authority" (ESR/2015/1733). |
| c) Be accompanied by the fee prescribed by regulation; | A fee of $355.30 has been provided with the amendment application as prescribed in Part 2, Schedule 15 of the EP Regulation. |
| d) Describe the proposed amendment; | See Section 2.2 and Section 4 |
| e) Describe the land that will be affected by the proposed amendment; and | See Section 3 and Section 5 |
| f) Include any other document relating to the application prescribed by regulation. | Section 41AA of the Environmental Protection Regulation 2019 may apply to this decision. This information has been included in Section 6. |
| Section 226A of the EP Act: | |
| a) Describe any development permits in effect under the Planning Act for carrying out the relevant activity for the authority; | There are no development permits required for the carrying out of the proposed activity. |
| b) State whether each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity; | The relevant environmental authority was approved under a site-specific application as the activities do not comply with the eligibility criteria for mining lease activities. |
| c) If the application states that each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity-include a declaration that the statement is correct; | The activities do not comply with the eligibility criteria. |
| d) State whether the application seeks to change a condition identified in the authority as a standard condition; | The relevant environmental authority was approved under a site-specific application and therefore all conditions are site specific and not standard. |
| e) If the application relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit-state whether the applicant seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit; | The application does not relate to a new relevant resource tenure. |
| f) Include an assessment of the likely impact of the proposed amendment on the environmental values, including- | See Section 5 |
| i. A description of the environmental values likely to be affected by the proposed amendment; | See Section 5 |

| Requirement | Response |
|---|---|
| ii. Details of emissions or releases likely to be generated by the proposed amendment; | See Section 5 |
| iii. A description of the risk and likely magnitude of impacts on the environmental values; | See Section 5 |
| iv. Details of the management practices proposed to be implemented to prevent or minimise adverse impacts; | See Section 5 |
| v. If a PRCP schedule does not apply for each relevant activity-details of how the land the subject of the application will be rehabilitated after each relevant activity ends; | See Section 5 |
| g) Include a description of the proposed measures for minimising and managing waste generated by amendments to the relevant activity; and | See Section 5 |
| h) Include details of any site management plan or environmental protection order that relates to the land the subject of the application. | A site management plan or environmental protection order does not relate to the land subject of the application. |

The application does not relate to a PRCP schedule, CSG activity or Underground Water Rights and therefore section 226B, 227 and 227AA of the EP Act do not apply to this application.

## 2.1 Application Form

This amendment has been submitted with the Application Form *Application to amend an environmental authority* (ESR/2015/1773). Responses to relevant sections of the form can be found in this document (**Table 3**).

**Table 3 Application Form Requirements and Response**

| Form Section | Response |
|---|---|
| Section 11 – Amend Conditions | Section 7 |
| Section 13 – Describe the proposed amendment | Section 2.2 and Section 4 |
| Section 14 – Describe the land affected | Section 3 and Section 5 |
| Section 22 – Environmental Values | Section 3 |

## 2.2 Proposed Amendment

This application includes multiple amendments as outlined below:

1. The addition of two new Sewage Treatment Plants and a subsequent change in the approved threshold for Environmentally Relevant Activity (ERA) 63.

2. The inclusion of a Rehabilitation Outcomes table in the Land Schedule of the EA.

3. Additional areas of disturbance including 4 new borrow pits, an increase in exploration disturbance area and updates to other ancillary disturbance areas in Table A1 of the EA.

4. Changes to Conditions C10 and C11 of the EA.

### 2.2.1 Amendment 1

The installation of two new Sewage Treatment Plants (STP) to replace the existing unit. The current system is struggling to meet the current EA trigger limits for treated effluent and therefore this new system will be better equipped, and it's expected that treated effluent will be able to comply with the EA limits.

The proposed upgrades to the STPs will have the following capacities:

- 10KL/d for the Mill (Processing Area), a flow for approximately 50 Equivalent Persons (EP)
- 25KL/d for the Vera (Mining Area) buildings, a flow of approximately 150 EP.

These capacities include an allowance for wet weather inflows; however, rainfall dependent infiltration rates are predicted to be minimal given small catchment areas. The proposed STPs intend to use treatment by a submerged membrane bioreactor which is expected to meet parameters established within the EA and significantly improve upon the existing sewage treatment quality and performance.

The current approved EA authorises the undertaking of *ERA 63 – Sewage Treatment 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (a-ii) 21 to 100EP Otherwise.* Given the proposed combined EP capacity of 200 EP, NQR propose to amend the EA to authorise ERA 63 1 (b(ii)), which authorises total design peak capacities of more than 100 but not more than 1,500EP.

### 2.2.2 Amendment 2

This application proposes to amend Schedule G: Land and Rehabilitation to include the Post-Mining Land Use (PMLU) and rehabilitation requirements for different domains into the EA in a table format. The purpose of this amendment is to clarify the PMLUs for all land in the EA with the intention of using the EA as a Land Outcome Document (LOD) for the development of the Pajingo Mine Progressive Rehabilitation and Closure Plan (PRCP).

During the Pajingo PRCP pre-lodgement meeting, the Department of Environment and Science (DES) acknowledged that the 2014 version of the FLURP was considered to be a LOD. It was noted that the 2018 version was not considered a LOD as it had not been provided to the administering authority under a condition of the EA. Both the 2018 FLURP (**Appendix A**) and the 2014 FLURP (**Appendix B**) have been included.

This amendment is proposing to adjust the names of the PMLU from the FLURP and include in the EA to better align with the on-ground rehabilitation outcomes at Pajingo mine. Additional information to support the selection of criteria and delivery of rehabilitation will be submitted with the PRCP.

#### 2.2.2.1 Open Cut Pits

The intended final land use for certain open cut pits (Nancy pit, Nancy North Pit, Cindy Pit, Janine East Pit, Orchid Pit, Sue Pit, Janine North pit, Janine Extension pit, Vera pit) at Pajingo Mine is a Non-use Management Area (NuMA) acting as impacted water storage. In order to achieve this land use, it is vital that potential environmental harm to the receiving environment risked by the water stored in the pit is minimised. The safety risk of a water body of this nature also needs to be managed, so the water body poses minimal risk to people, wildlife and stock.

The intended final land use for the remaining open cut pits not listed above (Venue pit, VNU pit, Janine North-West pit, Anne pits, Starlight B pit) is a Grassland (fauna habitat). The Janine North-West pit and the VNU pit have already previously been backfilled which is a better land outcome than an impacted water storage (FLURP 2014). In order to achieve the final land use, it is vital to establish a cover system that is safe, structurally stable and limits/reduces oxygen ingress. It also should serve to support native habitat.

#### 2.2.2.2 Waste Rock Dumps

The proposed post mining land use for the waste rock dumps (Cindy NAF, Venue NAF, Anne Temp WRD) are for open woodland with and the possibility of light intensity cattle grazing where the steepness of the slopes allows it. The steepness of the slopes on the finished landform must be conducive to a geotechnically stable structure, with erosion and sediment control landscaping that ensure erosion rates will not interfere with the achievement of final land use.

The proposed post mining land use for the waste rock dumps (Vera WRD, Scott Lode WRD) is for a grassland (fauna habitat). In order to achieve the final land use, it is vital to establish a cover system that is safe, structurally stable and limits/reduces oxygen ingress. It also should serve to support native habitat.

#### 2.2.2.3 Tailings Storage Facility

The proposed post mining land use for a TSF is for a grassland (fauna habitat). The steepness of the embankment slopes on the finished landform must be conducive to a geotechnically stable structure, with erosion and sediment control features that ensure erosion rates will not interfere with the achievement of final land use.

All hazardous material content of the final landform must be managed appropriately to ensure that any runoff of precipitation or seepage from the tailings storage facility poses no harm to the receiving environment or to environmental values.

#### 2.2.2.4 Ancillary Infrastructure and Mining Areas

The intended final land use for Ancillary Infrastructure and Mining areas (Admin areas, workshops, Irrigation area – Vera, Irrigation area – Mill, Site Landfill, Processing Landfill, Vera Landfill, Mill, Haul roads, borrow pits (proposed), Infrastructure areas, Access tracks, Exploration, Janet A/K PAF WRD, Venue PAF footprint, Vent fans, Powerline, Seismic) at Pajingo Mine is open woodland/light intensity grazing. In order to achieve this land use, it is vital that all areas are rehabilitated, with erosion managed and runoff water of a quality that does not present a risk of environmental harm.

If infrastructure are to remain, these should be done so under written agreement with the landholder and should be left in an appropriate condition.

#### 2.2.2.5 ROM areas

The intended final land use for ROM areas (Vera ROM, Janet A ROM, Mill ROM, Lynne Box cut ROM) at Pajingo Mine is open woodland/light intensity grazing. In order to achieve this land use, it is vital that all areas are rehabilitated, with erosion managed and runoff water of a quality that does not present a risk of environmental harm.

#### 2.2.2.6 Water Management Infrastructure and Dams

The intended final land use for water management infrastructure and dams at Pajingo Mine are open woodland/low intensity cattle grazing unless the dams are retained under a written landholder agreement.

For dams set to be retained, it is vital that the water in the dams poses no harm to the receiving environment. The safety risk of a water body of this nature also needs to be managed, so the water body poses minimal risk to people, wildlife and stock.

### 2.2.3 Amendment 3

This EA Amendment proposes an update to Table A1 Authorised Disturbance to include 4 new borrow pits and to expand the exploration disturbance footprint:

- Additional exploration footprint;
- TSF Potential Borrow 1;
- TSF Potential Borrow 2;
- SLP Potential Borrow 1; and
- Venue Potential Borrow.

This EA Amendment also proposes additional disturbance areas as listed below:

- Raw Water dam;
- Lynne ROM dam; and
- Topsoil Stockpiles.

### 2.2.4 Amendment 4

This proposes to modify the wording of condition C10 and C11 due to the upcoming Progressive Rehabilitation and Closure Plan.

# 3 General Environmental Values

Environmental values of the PJO leases have been historically assessed and were most recently updated to support an EA amendment in 2018 (Minjar Gold, 2018a). General environmental values as they apply to proposed activities the subject of this amendment is summarised in this section and values more specific to proposed amendment matters are included in subsequent sections as applicable.

## 3.1 Climate

PJO is located in the dry tropics of North Queensland and has a dry savannah climate. Rainfall is characterized by short, intense rainfall events that occur primarily in the wet season, from November to April. Approximately 80 % of annual rainfall occurs during the wet season. The mean average rainfall at Trafalgar Station (BOM Station 34010) (Table 4) is 643.9 mm and median rainfall is 606.4 mm (BOM, 2023). Annual rainfall is highly variable, with the lowest annual rainfall of only 205.9 mm falling in 1923 and the highest annual rainfall of 1410.4 mm falling in 1958. Average maximum and minimum temperatures range from 25° to 34 °C in summer and 11 to 23 °C in winter (Minjar Gold, 2018b) (Figure 3-2).

**Evaporation is consistent throughout the year, as to be expected in the dry tropics environment, with higher levels during the warmer summer months. Annual pan evaporation is 2,209 mm (Minjar Gold, 2018b) (**

Table 5).

It is important to note that the maximum annual rainfall is more than double the average annual rainfall, meaning that extreme isolated events may occur in some years, and that the majority of the time between wet seasons is relatively dry with very little rainfall occurring.

These extreme events are likely the product of depressions, cyclonic events or other extreme meteorological conditions.

**Table 4 Bureau of Meteorology (BOM) stations in and around the Pajingo Mine Site (Minjar Gold, 2018b)**

| BOM Station No. | Station Name | Latitude | Longitude | First year of data | Distance from Pajingo Mine |
|---|---|---|---|---|---|
| 34010 | Trafalgar Station | -20.4328 | 146.0131 | 1910 | 45 km |

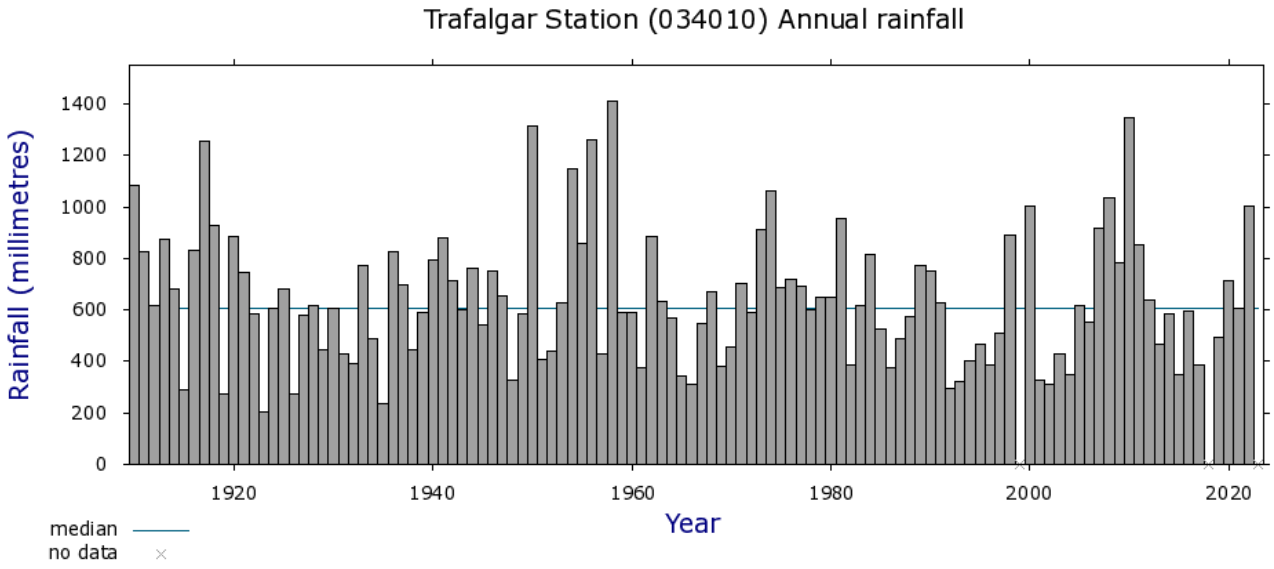


**Figure 3-1 Annual rainfall (mm) at Trafalgar Station (BOM, 2023)**

**Table 5 Average pan evaporation (mm)**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Evaporation (mm) | 234 | 185 | 185 | 147 | 139 | 145 | 144 | 139 | 178 | 220 | 234 | 250 | 2209 |

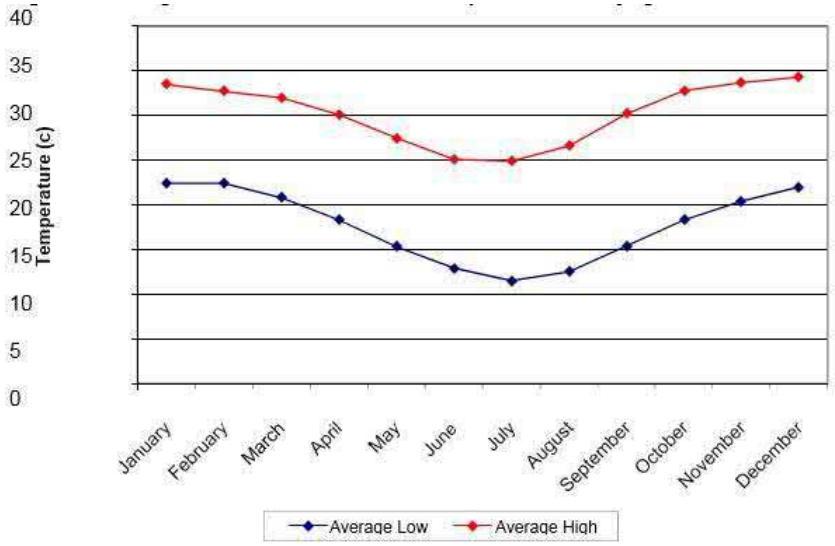


**Figure 3-2 Average maximum and minimum temperatures at Pajingo (Minjar Gold, 2018b)**

## 3.2 Landscape and Vegetation

PJO Geology consists of Permian volcanics and Permian-Triassic sediments of the Bowen and Galilee Basins, Carboniferous and Devonian sediments and volcanics of the Drummond Basin and coastal blocks, Cambrian and Ordovician rocks of the Anakie inlier and associated Tertiary deposits (Minjar Gold, 2018b).

RGS Environmental Pty Ltd undertook a geochemical assessment of waste rock materials likely to be generated by three proposed open pits at PJO in December 2017. The assessment concluded that "the overwhelming majority of the oxide waste rock materials are classified as NAF-Barren and are essentially devoid of sulfur. The oxide samples represent materials with a very low risk of acid generation and a high factor of safety with respect to potential AMD" (RGS, 2017). Waste rock materials classified as PAF are limited to some of the fresh rock at Janine East pit and some of the transitional and fresh rock at Janine Northwest pit (RGS, 2017). Ongoing waste characterisation is undertaken in accordance with the Waste Rock Management Plan (Minjar Gold, 2018).

The site Sediment & Erosion Control Plan discusses in detail the soil types on site and variability in profiles. Topsoils within the operational areas of PJO occur at a depth between 0 - 300 mm where rock cover at surface is common due to escarpments and outcropping of country rock in the immediate area.

PJO is located in the Brigalow Belt North bioregion in which vegetation generally consisting of open acacia forests on dissected slopes and hills and eucalypt woodlands on the plains (Landline, 2020). Woodlands also include Ironbark (*Ecalyptus* (*E*.) *melanophloia*, *E. crebra*), Poplar Box (*E. populnea*), Brown's Box, (*E. brownii*), Brigalow (*Acacia harpophylla*), Blackwood (*A. argyrodendron*) and Gidgee (*A. cambagei*) (Landline, 2020). The country supports low intensity beef cattle production (Landline, 2020).

Multiple localised drainage features incise the landscape with all being highly ephemeral and only flowing during and immediately following significant rainfall events, these are further described below (**Section 3.4**).

## 3.3 Vegetation, Fauna and Matters of State Environmental Significance (MSES)

### 3.3.1 Vegetation Communities and other protected flora

Regional Ecosystem (RE) communities have been historically verified during the flora and fauna surveys undertaken at PJO, including in 2012, 2017 and 2018. These surveys verified that no species present were consistent with RE 11.3.25. The most notable regional ecosystem present on the PJO mining lease was RE 11.11.15 (*E. crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics – No concern at present). The vegetation communities were mapped and described for this proposed amendment using the RE Description Database and ground truthing of the primary areas impacted by the proposed changes associated with the amendment was undertaken (Landline, 2020). The Queensland Government RE mapping for the PJO site is shown (**Figure 3-3**). RE assemblages associated with each proposed change area are discussed further below.

A desktop search was conducted on 28 March 2023 using the Queensland Government's WildNet Online Search Platform (see **Appendix C**). Three (3) species were identified as having the potential to occur based on species distribution modelling in pre-cleared habitat.

| Scientific Name | Common Name | Nature Conservation Act Status | Environmental Protection & Biodiversity Act Status |
|---|---|---|---|
| *Cycas couttsiana* | None | V | None |
| *Mardenia brevifolia* | None | V | V |
| *Eucalyptus raveretiana* | Black ironbox | C | V |
| *Livistona lanuginose* | None | V | V |
| *Dichanthium setosum* | None | C | V |

Furthermore, there was a single record of the *Santalum lanceolatum* within the study area in June 2016. This species is classified as Special Least Concern under the NC Act (see **Appendix C**).

### 3.3.2 Fauna

To date, no threatened or endangered fauna species have been observed on the PJO project site, either in historic studies including 2012, during both survey periods in the 2017 field studies or 2018 (Minjar Gold, 2018b) or in the 2020 survey (Landline, 2020). Historic fauna studies have determined low fauna density within the immediate area surrounding the PJO mine site in general (Minjar Gold, 2018b) and this was supported by the findings of the 2020 survey (Landline, 2020). As a result, it is unlikely that fauna would be directly impacted by the proposed changes addressed by this amendment.

A desktop search was conducted on 28 March 2023 using the Queensland Government's WildNet Online Search Platform (see **Appendix C**). Three (3) species were identified as having the potential to occur based on species distribution modelling in pre-cleared habitat.

**Table 6 Threatened Fauna list**

| Scientific Name | Common Name | Nature Conservation Act Status | Environmental Protection & Biodiversity Act Status |
|---|---|---|---|
| *Rostratula australis* | Australian painted snipe | V | E |
| *Geophaps scripta scripta* | Squatter pigeon (southern species) | V | V |
| *Peophila cinta cincta* | Black-throated finch (white-runped subspecies) | E | E |

### 3.3.3 MSES

MSES reports were generated for the project area Queensland Department of Environment and Science (DES) (2023) (provided in **Appendix D**).

The results of the MSES search showed areas of Regulated Vegetation (Category R) and Regulated Vegetation intersecting a watercourse. The areas were included as a focus of the 2020 survey (Landline, 2020). However, the proposed disturbance areas have been designed as to not impact on any MSES (see **Figure 3-4**).

Landline (2020) states: *"There is no evidence of the MSES Regulated Vegetation, Category R in those areas or in any of the drainage lines throughout the mining leases inspected. The drainage features are not watercourses as initially mapped by government and an application for Watercourse Determination has been submitted to DNRMNE for the area adjoining the ROM and TSF1. These drainage features match areas reviewed by an authorized officer of DNRM on 13 September 2017, who confirmed them not to be watercourses under the definitions of the Water Act 2000."*

The findings of the Department of Natural Resources Mines and Energy (DNRME) authorised officer Roger Timms from October 2017 stated:

> *"I determined that the drainage features, which are tributaries of Four Mile Creek, within Lot 3237 on SP191769 (Pallamana Holdings) are not watercourses as defined by the Act for the following reasons:*
>
> *The features flowing through the proposed work areas of the Cindy Extension, Nancy North and Anne Open Pit are ephemeral drainage features. Due to no water was present for any period of time after a rainfall event and a lack of riverine vegetation being observed in the provided site photographs; the areas are considered to meet the definition of a 'drainage feature' and is therefore not considered a 'watercourse' as relevant to the Water Act 2000."*

A response to a Watercourse Determination application for Lot 489/SP133401 was received from Alison Bowen, Natural Resource Officer, which confirmed the feature within this lot is not considered a watercourse under the *Water Act 2000* (DNRME, 2020).

# PAJINGO GOLD MINE

## EA AMENDMENT

## FIGURE 3-3
## STATE MAPPED REGIONAL ECOSYSTEMS

440000 441000 442000 443000 444000 445000

7731000 7730000 7729000 7728000 7727000

TSF Borrow Pit 1
TSF Borrow Pit 2
Raw Water Dam
SLP Borrow Pit
Venue Borrow Pit
Lynne ROM Dam
ML 1575
ML 10215
ML 10246

11.11.15
11.11.15/11.7.3
11.3.10/11.7.3/11.5.9
10.5.5/10.5.4
11.11.15/11.11.2
11.11.15/11.11.12/11.11.2
11.7.3/11.5.9
11.12.1
11.3.25
11.11.15/11.11.12
11.11.15/11.11.2

- Vegetation Management Watercourse
- Borrow Pit
- Dam
- Mining Lease

**State Mapped Regional Ecosystem**

- Category A or B area that is least concern
- Non-remnant
- Category C or R area that is least concern
- Water

0 100 200 Metres

| | |
|---|---|
| Coordinate System: | GDA2020 MGA Zone 55 |
| Scale: | 1:15,000 at A3 |
| Project Number: | 626.30122 |
| Date: | 30-Mar-2023 |
| Drawn by: | LC |

SLR

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441000
442000
443000
444000
445000
7731000
7730000
7729000
7728000
7727000

TSF Borrow Pit 1
TSF Borrow Pit 2
Raw Water Dam
SLP Borrow Pit
ML 1575
Venue Borrow Pit
ML 10215
ML 10246
Lynne ROM Dam

**PAJINGO GOLD MINE**

**EA AMENDMENT**

**FIGURE 3-4**
**MATTER OF STATE ENVIRONMENTAL SIGNIFICANCE**

- Borrow Pit
- Dam
- Mining Lease

**MSES Regulated Vegetation**

- Defined Watercourse
- Category R GBR Riverine

0 100 200 Metres

| | |
|---|---|
| Coordinate System: | GDA2020 MGA Zone 55 |
| Scale: | 1:15,000 at A3 |
| Project Number: | 626.30122 |
| Date: | 30-Mar-2023 |
| Drawn by: | LC |

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## 3.4 Sensitive Receptors

There are three sensitive receptors within 10 km of PJO. The closest is Doongara Station which is 5 km southeast of the activities and is owned by NQM. The closest sensitive receptors not owned by NQM are Slogan Downs (approximately 7 km southwest) and Pallamana (approximately 9.5 km east) (**Figure 3-5**).

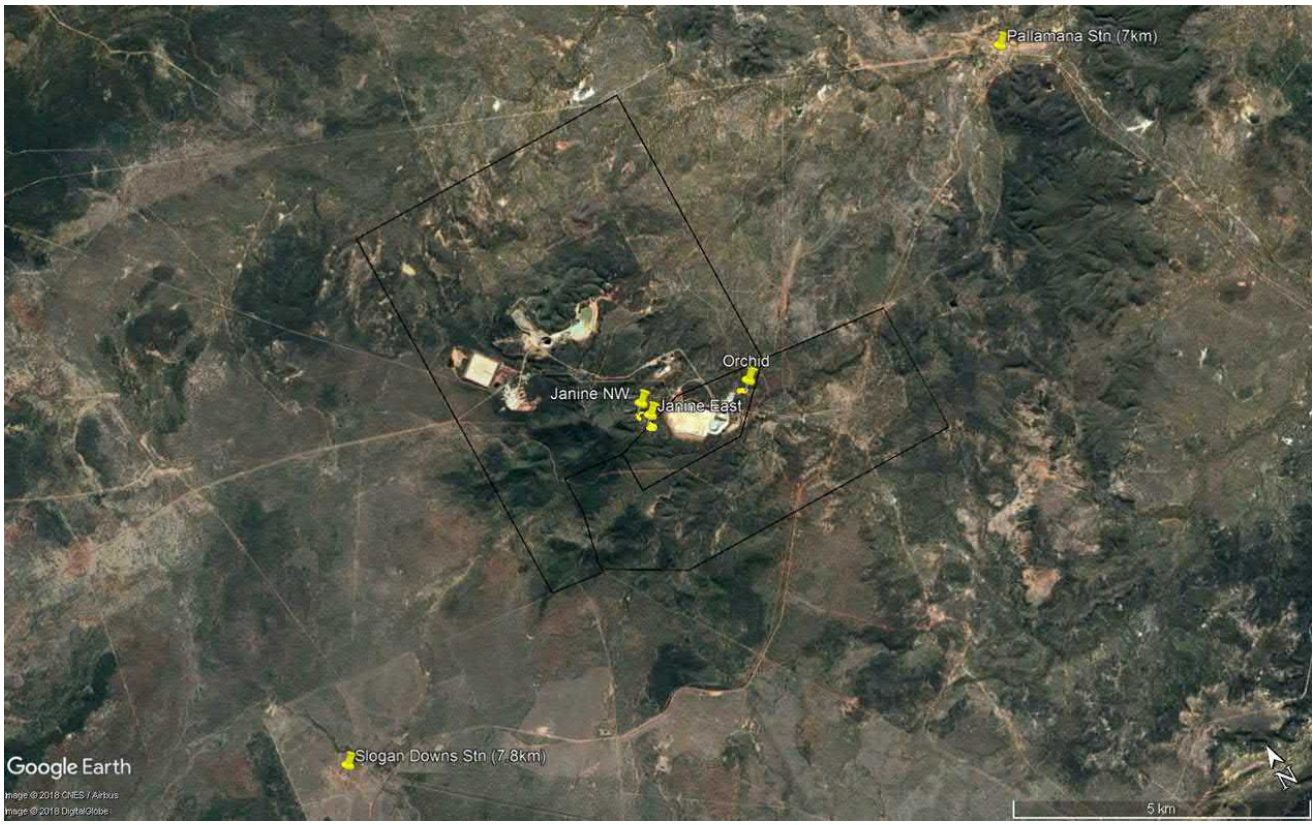


**Figure 3-5 Sensitive receptors**

## 3.5 Topography and Surface Water

Topography in the PJO project area ranges from flat to gently undulating on the alluvial plains, to very steep, dissected hills and scarps (**Figure 3-6**). The pits are generally located in the steep dissected hill areas (Minjar Gold, 2018b).

The ephemeral drainage features on site are part of the Moly Darling Creek catchment to the north and east and the Starlight Creek Catchment to the south. All flows from major infrastructure on-site drain to the Molly Darling Creek. Molly Darling and Starlight Creeks flow to the Rollston River which is located approximately 15 km to the east of the mine site (**Figure 3-6**). The Rollston River in turn flows to the Cape River immediately upstream of its confluence with the Burdekin Falls Dam 70 km downstream from site. The western parts of the MLs drain to Victoria Creek which flows to the Campaspe River, these western areas are not currently impacted by operations.

The area draining to Molly Darling Creek is subdivided into two catchments on-site, the northern and eastern sub-catchments. The northern sub-catchment drains the areas surrounding:

- TSF1;
- Administration area;
- Seepage Dam; and
- Madigan's Dam.

This eastern sub-catchment drains areas surrounding:

- Scott Lode Dam
- A Lode Dam;
- Sam's Dam;
- Nancy Dam;
- Venue Pit
- Orchid Pit;
- VNU Pit; and
- Vera Pit.

## Figure 3-6 Site and Surrounding Area Drainage Features

## 3.6 Soils and Land Use

Seven soil groups have been described in the PJO area**,** comprising:

- **Shallow rocky soils**: Exhibit a slightly acidic to neutral pH and have mainly coarse textures, generally contain gravel or rock fragments derived from quartz sandstone, acid volcanics or tuffaceous rocks. They also occur on the laterite escarpments, where the characteristic vegetation is lancewood (*Acacia shirleyi*) or narrow-leaved ironbark (*Eucalyptus crebra*).
- **Uniform coarse-textured soils**: Comprise uniform sands or weakly gradational loamy sands and occur as slopewash or as outwash fan deposits derived from erosion of the Tertiary land surface. The soil is slightly to moderately acidic and gravelly lenses are common within the profile where they occur on the alluvial flats.
- **Moderately Shallow to Deep Gravelly Coarse to Medium-Textured Soils**: Consists of loamy sand to sandy loam textures, occasional clay loam to light clay textures. They include sub-angular rock fragments and soil reaction is generally slightly acidic to neutral.
- **Sandy red and Yellow Earths**: Formed from coarse to medium- textured alluvial or outwash deposits from the Tertiary land surface and sandstone ranges. Soil reaction is very slightly acidic to neutral throughout the soil profiles, which is gradational and exhibit red and yellow colours.
- **Loamy Red and Yellow Earths**: Occur on more or less intact surfaces of the Tertiary laterite formations whilst the loamy yellow variants are more commonly associated with the Lower Carboniferous sandstone lithology. They are generally fairly deep soils and soil reaction may range from strongly acid at the surface, becoming progressively less acidic at depth.
- **Texture Contrast (Duplex) Soils**: Occur on footslopes and outwash slopes surrounding the Tertiary laterite escarpment and sandstone/volcanics of the range area. Preliminary chemical analyses indicate that in some areas total soluble salts and chloride may be relatively high at shallow depths and high levels of exchangeable sodium and or magnesium may be present within the profile.
- **Uniform Fine-Textured Grey and Brown Clay Soils, including Cracking Clay Soils**: Small occurrences of heavy-textured clays and cracking clay soils are present in the south-eastern sector of the PJO project area (adjacent to the Doongara homestead). These soils exhibit strongly alkaline pH values with exchangeable sodium and salinity increasing with depth (500-600 mm).

## 3.7 Hydrogeology

The below is based on the findings of C&R Consulting (2012). The site hydrology has also been reviewed by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) (2018) who supported these conclusions.

Relevant data reproduced as follows:

- Limited groundwater investigations have been conducted external to the PJO TSF1 and Scott Lode Pit TSF. Limited hydrological information is available within the Vera-Nancy area;
- Limited hydrological and geochemical variation between bores across the area suggest multiple groundwater systems controlled by Tertiary sediments and variability in weathering depth for minor shallow waters, and fault-controlled conduits in the deeper systems;

- Naturally poor water chemistry and low flow conditions in the immediate PJO area preclude (routine use of) groundwater resources; including poor quality groundwater used intermittently by the Doongara homestead (1.8 km southeast of Vera Pit and reported as generally poor quality and aggressive water) to the far southwest of the Vera-Nancy fault system;
- The Britannia Bore field, 15 km north, supplied the PJO operation for 20 years until exhausted in 2006; and
- There appear to be negligible impacts to environmental values outside operational areas that are due to the reduction of groundwater levels (AGE, 2018). In close proximity to open pits there is significant drawdown (e.g. VEN09, adjacent to Venue Pit, is a dry bore at a depth of 140 m). However, the groundwater levels from bores such as MB20 and MB7, that are approximately 2 km from the open pits, have stable groundwater levels.

Dr. John Broughton (NRA, 2018) summarised *"aquifer potential in the Tertiary Sediments is limited, and the primary groundwater reserves are contained within fractured bedrock (sandstone and volcanics). The primary porosity of these bedrock units is very low to negligible and aquifer potential is dependent on structural features (fracture zones and faults). The groundwater system in the basement rocks is likely compartmentalised with smaller aquifers of limited size. A contiguous regional aquifer system has not been identified in the study area.*

*RLA (2015) supports the earlier work of RGC (2004), identifying that the calculated hydraulic conductivity values around the Pajingo mine site are very low. RGC (2006) concluded that the hydraulic conductivity of the Tertiary Sediments was marginally higher than that for bedrock units. As a consequence of the overall low hydraulic conductivity of the aquifer sequences at Pajingo, groundwater movement (vertically and horizontally) is slow overall although it is expected to be slightly higher in the Tertiary Sediments."*

Minjar Gold (2018a) states - "*The final void depths of the Janine North, Janine Extension Sue and Starlight pits are estimated to be above the groundwater level with the pre-development groundwater level in the Vera Pit area at approximately RL265 m to RL270 m. No groundwater has been encountered in the current open pit floors Note: Orchid Pit has completed mining with no water encountered. Current groundwater levels are well below these depths with limited moisture or groundwaters encountered during exploration drilling of the proposed resources."*

The proposed activities are not expected to result in an increase to the previously addressed existing exercise of underground water rights under Section 126A(2)(a) of the EP Act.

## 3.8 Supporting Infrastructure

**Water Supply** - PJO mine has a number of mine-affected catchment dams around the site that supply process water for use in the ore processing operations. Water from the Burdekin River is piped to PJO and provides supplemental water as required under appropriate *Water Act 2000* licencing.

**Electricity** - The PJO site is served by grid power with backup generators maintained on site.

**Accommodation** – Staff reside in the nearby Charters Towers area and commute to site by bus.

**Mine Waste Management** - A Waste Management Plan for the management of general and regulated wastes generated by the project has been developed for PJO (attached). This plan includes control strategies such as transporting water to storage process ponds and covering waste regularly to reduce wind dispersal and vermin. Putrescible waste is regularly trucked by a waste contractor to the Charters Towers township landfill.

**Water Management**

Wastewater generated through mining activities will include mine water, process water, stormwater, sediment-laden runoff from disturbed areas and sewerage effluent.

Mine water will be contained in storage facilities for reuse in mining and processing operations. Discharge to surrounding watercourses will only occur in extreme weather events with flow dilution occurring as required by the site EA.

Sewage Treatment Plants (STP) (typical Fuji Clean system) are located at the Vera office/workshops area and administration/processing areas. The system is designed to service the maximum expected workforce and produce Class A effluent (Water quality guidelines for recycled water schemes [DEWS, 2008]).

Stormwater management will target the diversion of clean water towards natural drainage features and away from areas disturbed by operational activities to minimise capture of clean runoff. Uncontaminated site water (i.e. water runoff from bare earth surfaces) is to be directed to natural drainage features following treatment via appropriate erosion and sediment control measures. Stormwater contaminated by mining operations is to be captured, contained and reused where possible with limited controlled release undertaken in accordance with EA requirements.

The overall objective for site water management is to minimise catchment areas where mine contaminated water is generated, maximising the containment of any potentially contaminated water at its source and optimising reuse of such water for dust suppression, processing or mining.

## 3.9 Community

The project is in an isolated area, with the Doongara homestead, located two kilometres east of the Vera Pit located on ML10215, being the closest resident. This property is owned by NQM Gold. The closest rural community is Charters Towers, with a population of approximately 12,000 residents. Charters Towers is 55km from the mine site.

The Doongara homestead (1.91km from operational areas) and Slogan homestead (8.11km) are considered sensitive locations for potential air quality and noise impacts. Since start of operations in 1987, however, there have been no air, noise or dust complaints made by nearby residences. Hence, minor to no impacts on the surrounding community are associated with the construction or operations of the pits.

As there are only a number of residences surrounding the mine lease area, potential benefits for the community would be small scale. Benefits already associated with the mine for nearby residences have included paved roads. While the benefits to Charters Towers have included increased revenues spent in the area, more employment opportunities, new development to accommodate workers and more extensive government services for expanding recreational and cultural facilities. Community donations and assistance programs have been rolled out throughout the operations existence.

## 3.10 Cultural Heritage

An archaeological assessment of the site was completed in 1986 as part of the Pajingo Baseline Environmental Survey undertaken by Hollingsworth Consultants. The majority of mine related activities are located in areas of low archaeological sensitivity. Two sites of significance have been identified on the Tertiary laterites, which include settlement evidence and artefact scatters. Neither site is threatened by current developments. Excessive scatters of stone artefacts are located on the creek flats of the Quaternary sediments, which are outside the boundaries of the Vera ML and are not threatened by current developments.

Throughout the Pajingo Mine Operations Leases and Exploration Permits, a stringent management procedure is undertaken to ensure any cultural heritage within the site is identified and preserved. This procedure involves both the management of sites identified as having cultural value and identifying additional sites of cultural significance.

Prior to the commencement of exploration in the exploration or clearing of mining areas, the Pajingo site employs traditional owners of the land, representing the Kudjala people and Birri people to ground truth the area and determine the location of sites of cultural significance. To date no sites of cultural significance have been identified close to mining areas and unlikely to be impacted.

# 4 Proposed Amendment Description

## 4.1 Amendment 1 - Sewage Treatment Plants

The current STPs are unable to produce an effluent discharge quality that can achieve compliance with the site's Environmental Authority (EA). Wastewater specialists from AGNR Consulting were commissioned in 2021 to investigate the current STPs and from this investigation it was determined that the design capacity is inadequate, and the system loading is excessive. Therefore, very little can be done to improve the efficiency of the system, making compliance with the EA conditions difficult. Water Treatment Services have designed two new STPs with greater capacity. Two new larger systems will be installed at Mill and Vera within an existing disturbance footprint. The upgrade of the two STPs will trigger an increase in threshold for the currently authorised ERA 63 1(a-ii).

## 4.2 Amendment 2 - Inclusion of Land Outcomes

Pajingo is operated under Environmental Authority EPML00879413 (effective of 8th July 2022). This application proposes to amend Schedule G – Land and Rehabilitation to update the closure land outcomes included in the EA. The purpose of this amendment is to clarify the PMLU for the entire Pajingo Mine site in order to use the EA as a LOD for the development of a PRCP for the Pajingo Mine.

SLR has undertaken a review of all existing PMLUs for the site. The proposed land outcomes in this amendment are mostly aligned the review outcomes and provide an outcome for areas that have not previously been addressed.

## 4.3 Amendment 3 - Update of Authorised Disturbance Table and New Borrow Pits

A review of Table A1 – Authorised Disturbance against existing site disturbance has shown that the following existing disturbance areas are not included:

- Raw Water Dam;
- Lynne ROM Dam; and
- Topsoil Stockpile.

Figure 4 (Location of Authorized disturbance) of EPML00879413 identifies location of Topsoil Stockpile footprint. However, Table A1 of Authorized disturbance has no allowance for Topsoil Stockpiles. Addition of Topsoil Stockpiles to Table A1 is considered to be an Administrative EA Amendment.

There is also an increase in some existing areas, including:

- Exploration Areas.

The following borrow pits have been proposed to be added to the authorised disturbance on the EA:

- TSF Potential Borrow 1 (14.36 ha);
- TSF Potential Borrow 2 (24.14 ha);
- SLP Potential Borrow 1 (12.07 ha); and
- Venue Potential Borrow (21.92 ha).

These borrow pits will be used for rehabilitation activities and may not all be required.

## 4.4 Amendment 4 - Removal of Conditions

This amendment proposes the modification of Conditions C10 and C11.

Condition C10 states *'All waste rock characterised as potentially acid forming from Janet A pit, within K dump, within Anne pits and within Scott Lode waste rock dump must be returned to Scott Lode Pit, Janet A Pit, and Venue/VNU pit by December 2024.'*.

This condition is to be modified to read '*All waste rock characterised as potentially acid forming from Janet A pit, within K dump, within Anne pits and within Scott Lode waste rock dump must be returned to Scott Lode Pit, Janet A pit and Venue/VNU pit by December 2024 or rehabilitated via an alternate methodology, providing for equivalent or improved environmental outcomes, justified and approved in a PRCP*'.

Condition C11 states '*All waste rock characterised as potentially acid forming from Nancy, Nancy North, Janine East, Janine Northwest, Orchid, Venue/ VNU pits, Lynne underground workings, Janine North, Janine Extension, Starlight B and Sue pits must be returned to Venue/VNU pit at the completion of the mining of these pits*'.

This condition is to be modified to read '*All waste rock characterised as potentially acid forming from Nancy, Nancy North, Janine East, Janine Northwest, Orchid, Venue/ VNU pits, Lynne underground workings, Janine North, Janine Extension, Starlight B and Sue pits must be returned to Venue/VNU pit at the completion of the mining of these pits or rehabilitated via an alternative methodology, providing for equivalent or improved environmental outcomes, justified an approved in a PRCP'*.

# 5 Impact Assessment

## 5.1 Sewage Treatment Plants

The two new STP systems will be located on existing disturbance footprints at Mill and Vera. The new Mill STP will be located on the laydown yard (adjacent to the Raw Water Stockpile), Northeast of the Processing Area laydown yard (**Figure 5-1**). A pipeline will transfer the Class A effluent to TSF2. This location has been chosen due to its proximity to the Mill shower and toilet infrastructure, eliminating the need for a transfer station.

The new Vera STP will be located immediately behind the Vera change house area and before the existing Vera STP (**Figure 5-2**). This location has been chosen due to the lack of suitable other options and will require additional earthworks and changes to the traffic management practices in the area, particularly for the exploration and geology departments. The Class A effluent will be transferred via a pipeline to Nancy Dam.

Currently, the STP effluent is released to A-Lode Dam. The new STPs will produce Class A effluent water quality. For water management and reuse purposes, the effluent from the new Mill STP will report to TSF2 and the effluent from the new Vera STP will report to Nancy Dam.

### Figure 5-1 New Mill STP Location

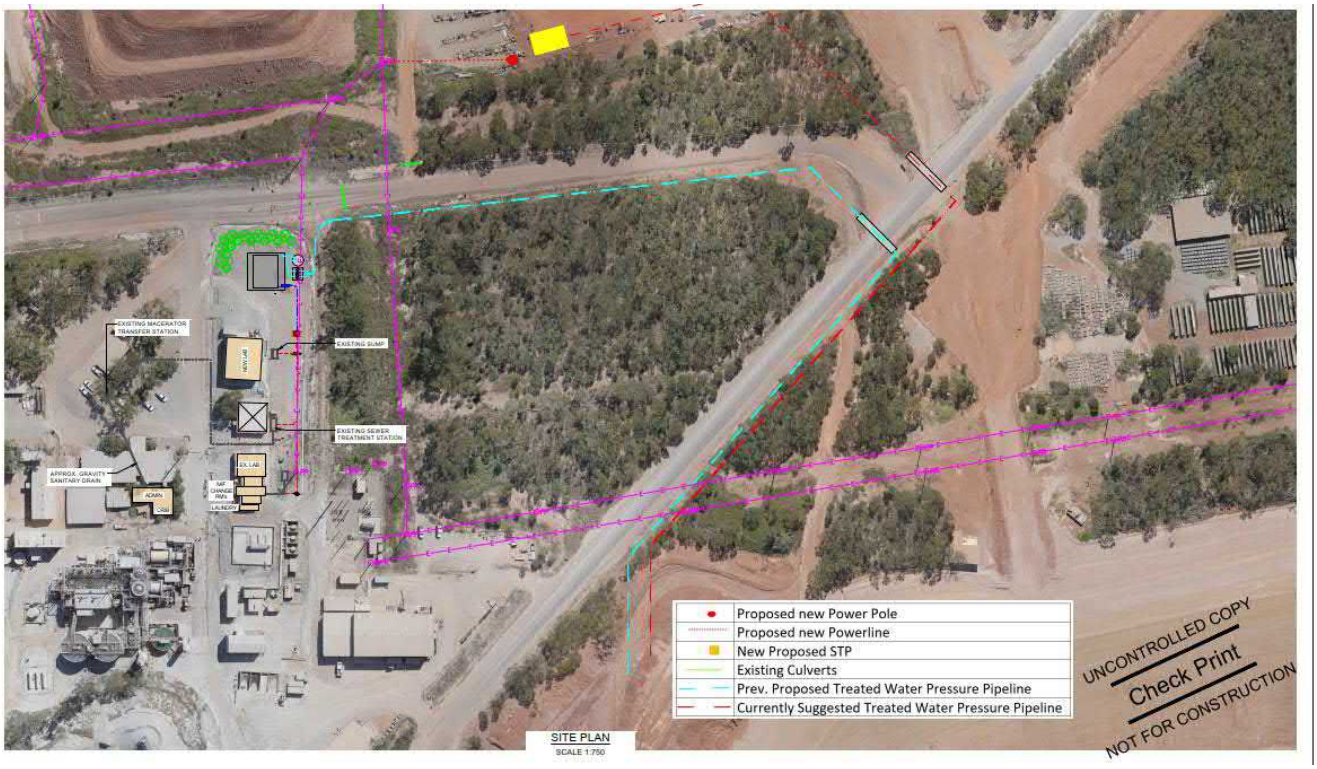

**Figure 5-2 New Vera STP Location**


## Air and noise & vibration

There are three sensitive receptors within 10 km of PJO. The closest sensitive receptor, Doongara Station, is 5.3 km southeast of PJO and is owned by NQM. The two sensitive receptors not owned by NQM are Slogan Downs (approximately 6.8 km southwest) and Pallamana (approximately 9.7 km east). Since start of operations in 1987, there have been no noise or dust complaints made by nearby residences.

The proposed amendment is not anticipated to cause any additional environmental impact to air and noise values.

## Water and Wetlands

There are no wetlands or drainage lines proximate to the new STP locations. The proposed STP replacement are not likely to cumulatively increase the potential for environmental harm. Furthermore, the new STPs will utilise modern technology and materials, further reducing the likelihood for uncontrolled spills or releases.

## Groundwater

Groundwater will not be impacted by the proposed amendment as the new STP's are proposed to be constructed on existing disturbance footprint. As above, the new STPs will be constructed with modern materials, reducing the likelihood for uncontrolled spills or releases.

### Land

Both the Mill and Vera STPs, as well as their associated pipelines are contained entirely within authorised disturbance footprints. As a result, no vegetation clearing, soil disturbance, or impacts to fauna or their habitats are anticipated to occur.

### Land Use

The STP are proposed to be constructed on areas classified as “Mining” in Queensland Globe (2023). The pipelines are proposed to be on areas classified as “Other minimal use” in Queensland Globe (2023). The proposed amendments to the EA will not cause any potential environmental harm to the current land use.

### Waste

A pipeline will transfer the Class A effluent from the Mill STP to TSF2 and from the Vera STP to Nancy dam. Any other waste generated during construction of the new STP will be managed in accordance with the Waste Management Plan (PJO-ENV-EMP-2010).

## 5.1.1 Emissions and Releases

Effluent from the STPs will comply with the water quality release limits stated in Table C1 of the EA. The application of effluent to irrigation areas will be carried out in a way that doesn’t result in any surface ponding or any run-off or over spray of effluent. Therefore, any releases from the new STPs will comply with the existing conditions.

While there are no proposed release from the STPs, potential overtopping, and effluent release due to equipment malfunction poses a risk of environmental harm to the receiving environment. However, any releases from the Vera plant would flow towards the mine infrastructure, and eventually into the open pits. The Mill plant is proposed on land with minimal slope, given the nearest watercourse is located approximately 300m to the northeast, it is not likely that any release would impact on the watercourse.

For water management and reuse purposes, treated Class A effluent will be released to the TSF2 and Nancy dam. The reason for the new STPs is to ensure compliance with the contaminant release limits. The current system is struggling to meet these limits and has resulted in some exceedances which has been reported to the Department. The new systems are expected to be able to easily comply with the EA requirements.

Noise and air emissions will be similar to those currently approved within the EA.

## 5.1.2 Risk and Impact

The new STPs will be located within existing disturbance areas and therefore cause no additional impacts to land. The proposed amendments to the EA will not cause any risk or impact to the groundwater resources at Pajingo Mine.

While uncontrolled release are a possibility from the STPs, the potential for material environmental harm are limited given the gentle land gradients and significant distances to watercourses.

### 5.1.3 Management and Mitigation measures

#### Air and noise & vibration

Beyond the continued implementation of standard operating procedures and management plants, no further management or mitigation measures are proposed.

#### Water and Wetlands

Minor earthen containment bunds will be constructed around the perimeter of the STPs. These bunds will capture and store any uncontrolled releases until such time that NQM can action a clean-up protocol. NQM will ensure all STP operating procedures are followed by staff, and additionally, regular inspections and maintenance will be undertaken on the SPTs (frequency to be decided upon by site environmental manager).

#### Groundwater

No further management or mitigation measures are proposed.

#### Land

No further management or mitigation measures are proposed.

### 5.1.4 Rehabilitation

The rehabilitation of the Sewage Treatment Plants would include:

- Electrical and Mechanical disconnection of tanks and pump sets;
- Pipelines will be flushed, cut and removed;
- Demolish, dispose and remove tanks and equipment; and
- Topsoil application, rip and seed land with pasture seed.

## 5.2 Material Borrow Pits

Four new Borrow Pits (**Figure 5-3**) are proposed to be added to the authorized disturbance: TSF Borrow 1 (14.7 ha), TSF Borrow 2 (24.2 ha), SLP Borrow (12.1 ha) and Venue Borrow (22 ha). The Borrow Pits are identified as sources of potential capping material to Voids/Waste Rock Dump at mine closure with testing of the samples largely focussed on low permeability materials and topsoil sources (O'Kane 2020). The development of these material borrow pits will be wholly for the supply of materials to be used in rehabilitation activities.

The depth of each borrow pit is expected to vary based on material requirements. However, the final depths will be subject to the groundwater level within each borrow pit footprint, these depths have been further discussed below in the groundwater section.

The borrow pit footprints will be cleared of vegetation and stripped of topsoil. Topsoil will be stockpiled outside the operational area for later reuse in rehabilitation activities. Any deleterious material will be removed and directed to selected waste rock dumps prior to the base rock being blasted and excavated as required.

## Air and Acoustics

There are three sensitive receptors within 10 km of PJO. The closest sensitive receptor, Doongara Station, is 5.3 km southeast of PJO and is owned by NQM Gold 2 Pty Ltd. The two sensitive receptors not owned by NQM Gold 2 Pty Ltd are Slogan Downs (approximately 6.8 km southwest) and Pallamana (approximately 9.7 km east). Since start of operations in 1987, there have been no noise or dust complaints made by nearby residences.

The proposed amendment is not anticipated to cause any additional environmental impact to air and noise values.

## Water and Wetlands

The location of drainage lines and wetlands proximate to the Pajingo Mine site are shown in **Figure 5-3**. No MSES will be impacted from the proposed borrow pit footprints. The borrow pits have been designed as to not require any clearing within.

## Groundwater

### TSF Borrow 1

There are no groundwater bores located within the footprint of the proposed TSF Borrow 1, however, three bores are located the east of the footprint, and another four bores to the southwest of the footprint.

| Bore Name | Distance to footprint | Depth to groundwater[1] | Notes |
|---|---|---|---|
| 13S | 80m east | 7.92 | - |
| 13D | 80m east | 25.14 | - |
| 13M | 80m east | 18.69 | - |
| 12S | 130m southeast | 1 | - |
| 12D | 130m southeast | 25.14 | - |
| 12M | 130m southeast | 13.77 | - |
| RN 186851 | 120m south | 7 | SWL from bore log at time of drilling |

1 Shown as the average of all SWL measurements, presented in metres below top of casing.

### TSF Borrow 2

There are three bores located within the proposed TSF Borrow 2 footprint, one bore to the east of the footprint and one further bore to the south.

| Bore Name | Distance to footprint | Depth to groundwater[1] | Notes |
|---|---|---|---|
| 12S | Within | 1 | - |
| 12D | Within | 25.14 | - |
| 12M | Within | 13.77 | - |
| RN 186851 | 30m east | 7 | SWL from bore log at time of drilling |
| MB24 | 160m southeast | 18.43 | - |

1 Shown as the average of all SWL measurements, presented in metres below top of casing.

### SLP Borrow

There are no registered or private bores identified within the footprint of the proposed SLP Borrow, the nearest bore is situated to the northwest.

| Bore Name | Distance to footprint | Depth to groundwater[1] | Notes |
|---|---|---|---|
| RN 166183 | 830m northwest | 83 | SWL from bore log at time of drilling |

1 Shown as the average of all SWL measurements, presented in metres below top of casing.

**Venue Borrow**

While there are no registered or private bores within the footprint of the Venue Borrow, there are three bores within proximity – to the north, northeast, and southwest.

| Bore Name | Distance to footprint | Depth to groundwater[1] | Notes |
|---|---|---|---|
| Jan 10 | 90m north | Dry | - |
| VEN09 | 630m east | 128 | SWL assumed from perforated case depth |
| TNMBO4 | 330m southwest | 56.42 | - |

1 Shown as the average of all SWL measurements, presented in metres below top of casing.

## Land

The regional ecosystems within the Borrow Pit areas were identified as 11.11.2, 11.11.15, 11.11.12, 11.7.3, 11.5.9, 10.5.5a and 10.5.4a descriptions of these REs are shown in **Table 8**.

The material borrow footprints have been designed so that no MSES are impacted by disturbance. This includes siting the borrow pits at least 5m from any watercourses (as defined under the VM Act) so as to avoid any significant residual impacts (pursuant to the *Significant Residual Impact Guideline,* DES 2014). Furthermore, there are no mapped areas of essential habitat, protected plants trigger mapping, or Category A regulated vegetation. A report demonstrating the lack of MSES within the project area has been provided in **Appendix D**.

### Table 7 Regional Ecosystems

| Regional Ecosystems | Description | Vegetation Management Act Class | Biodiversity Status | Structural Category |
|---|---|---|---|---|
| 11.11.2 | Acacia shirleyi or A. catenulate woodland top open forest on old sedimentary rocks with varying degrees of metamorphism and folding. | Least Concern | No concern at present | Sparse |
| 11.11.15 | Eucalyptus crebra woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics. | Least Concern | No concern at present | Sparse |
| 11.11.12 | Eucalyptus persistens +/- Corymbia lamprophylla low open woodland. Corymbia lamprophylla may dominate localised areas. Occurs on low hills and undulating rises formed from moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. | Least concern | No concern at present | Very sparse |

| Regional Ecosystems | Description | Vegetation Management Act Class | Biodiversity Status | Structural Category |
|---|---|---|---|---|
| 11.7.3 | Eucalyptus persistens low open woodland often with a Triodia mitchellii ground layer. Other scattered eucalypts such as Corymbia leichhardtii or Eucalyptus melanophloia may also occur. Understorey species are usually very sparse. Occurs on the stripped margins of ranges and plateaus. Soils are usually shallow loamy red earths overlying a hard pan. (BVG1M: 19d) | Least concern | No concern at present | Very sparse |
| 11.5.9 | Eucalyptus crebra and/or Eucalyptus melanophloia woodland. Other tree species that may be present and locally dominant include Corymbia citriodora or C. clarksoniana sometimes in association with C. intermedia, C. dallachiana, C. lamprophylla, E. tenuipes, E. exserta, E. cloeziana, E. acmenoides. The mid layer ranges from absent to a sparse to dense shrubland typically dominated by Acacia spp. (such as A. excelsa, A. leiocalyx), Petalostigma pubescens, Lysicarpus angustifolius, Alphitonia excelsa and occasionally Melaleuca nervosa. Occurs on Cainozoic sandplains formed on plateaus and broad crests of hills and ranges. Soils are generally deep red earths. (BVG1M: 18b)<br><br>Vegetation communities in this regional ecosystem include:<br>11.5.9a: Eucalyptus melanophloia woodland. Not a Wetland (BVG1M: 17b)<br>11.5.9b: Eucalyptus crebra, E. tenuipes, Lysicarpus angustifolius +/- Corymbia spp. woodland. Not a Wetland (BVG1M: 18b)<br>11.5.9c: Eucalyptus crebra +/- Corymbia intermedia +/- E. moluccana +/- C. dallachiana woodland. Not a Wetland (BVG1M: 18b)<br>11.5.9d: Corymbia citriodora and/or E. crebra woodland. Not a Wetland (BVG1M: 10a) | Least concern | No concern at present | Sparse |
| 10.5.5a | Eucalyptus melanophloia woodland occasionally with Corymbia dallachiana. Eucalyptus populnea and Corymbia plena may also occur. The shrub layer is usually dominated by Carissa lanceolata and Acacia spp. and commonly includes Petalostigma pubescens and Denhamia cunninghamii. The ground layer is dominated by Triodia pungens and/or tussock grasses including Aristida spp., Bothriochloa ewartiana, Eriachne mucronata, Eragrostis lacunaria and Heteropogon | Least concern | No concern at present | Very sparse |

| Regional Ecosystems | Description | Vegetation Management Act Class | Biodiversity Status | Structural Category |
|---|---|---|---|---|
| | contortus. Occurs on broad sandy outwash plains. Not a Wetland (BVG1M: 17b) | | | |
| 10.5.4a | Eucalyptus crebra usually dominates often with Corymbia dallachiana in the very sparse canopy. Denhamia cunninghamii and Carissa lanceolata are often in the very sparse shrub layer. Chrysopogon fallax and Heteropogon contortus often dominate the very spare to spare ground layer. Occurs on sandplain. Not a Wetland (BVG1M: 18) | Least concern | No concern at present | Sparse |

## Land Use

The area surrounding Pajingo Mine is classified as "Other minimal use" in Queensland Globe (2023). The proposed amendments to the EA will not cause any potential environmental harm to the current land use.

## Waste

Any waste produced through the proposed activities will be managed in accordance with the Waste Management Plan. The Waste Management Plan employs the best practice waste management hierarchy to ensure that waste generation is minimised during the construction, operational, and decommissioning phase of the project. The site environment manager will ensure that all staff and contractors are fully aware and trained in how to implement the Waste Management Plan.

440000
441000
442000
443000
444000
445000
7731000
7730000
7729000
7728000
7727000

TSF Borrow Pit 1
TSF Borrow Pit 2
Raw Water Dam
SLP Borrow Pit
ML 1575
Venue Borrow Pit
ML 10215
ML 10246
Lynne ROM Dam

**PAJINGO GOLD MINE**

**EA AMENDMENT**

**FIGURE 5-3**
**MATTER OF STATE ENVIRONMENTAL SIGNIFICANCE**

- Borrow Pit
- Dam
- Mining Lease

**MSES Regulated Vegetation**

- Defined Watercourse
- Category R GBR Riverine

0 100 200 Metres

| | |
|---|---|
| Coordinate System: | GDA2020 MGA Zone 55 |
| Scale: | 1:15,000 at A3 |
| Project Number: | 626.30122 |
| Date: | 30-Mar-2023 |
| Drawn by: | LC |

SLR

H:\Projects-SLR\626-MKY\626.30122.00000 Pajingo Gold Mine EA Amendment (Borrow\06 SLR Data\01 CADGIS\GIS\SLR62630122_PajingoGoldMine_EAAmendment_MSES_20230330.mxd

### 5.2.1 Emissions and Releases

The construction phase of the proposed borrow pits poses a risk of emissions and releases which may results in environmental harm, the following impacts have been identified.

- Hydrocarbon releases from plant and machinery during the construction and operational phases.
- Noise and air emissions resulting from the use of plant and machinery during the construction and operational phases, this includes additional dust generated during clearing and earthworks.

### 5.2.2 Risk and Impact

There will be no significant impacts from air. During construction of the borrow pits, dust suppression will be utilised as per the standard site dust management procedures where required. Condition B1 in the EA will continue to apply to the proposed activities. See **section 3.4** for sensitive receptors.

The proposed activities do not pose a material risk to cause noise nuisances at any sensitive receptors. The noise limits in Table D1 of the EA will continue to apply to the proposed activities. No further controls measures are required. See **section 3.4** for sensitive receptors.

Machinery and plant will be regularly serviced, in line with the manufacturer's recommendations. Furthermore, any external plant or machinery operators will be informed of the requirement to ensure that their equipment is also regularly serviced.

Any waste produced through the proposed activities will be managed in accordance with the Waste Management Plan which employs the waste hierarchy to ensure a reduction in waste generation.

The excavation of the material borrow pits poses a potential risk to groundwater values, while it is not likely that any water quality impacts would occur, there stands the potential for dewatering into the material borrow voids, resulting in a decrease in aquifers water levels. Based on the groundwater levels identified at the proposed material borrow footprints above, it is unlikely that the depth of material extraction will impact on groundwater in the SLP and Venue borrows, which have groundwater levels of >50m in each. The groundwater levels in the TSF Borrow pits are closer to the ground level, with TSF Borrow 1 and TSF Borrow 2 water depths ranging from 1m bTOC to 25m bTOC. However, it is likely that the water level in bore 12S (1m bTOC) is due to surface infiltration and does not represent permanent groundwater.

### 5.2.3 Management and Mitigation measures

The following management and mitigation measures are proposed for the borrow pits:

- The PJO disturbance permit system – this is an internal application to disturb which is reviewed and approved by the NQM environmental team;
- The value of topsoils within the footprint areas as a rehabilitation resourced will be assessed before clearing activities commence in accordance with the Topsoil and Overburden Management Plan (TOMP) (Minjar Gold, 2016). Reusable topsoil will be recovered and stockpiled in accordance with the TOMP;
- Sediment runoff and erosion will be managed in accordance with the Stormwater, Sediment and Erosion Control Plan (SSECP) (Minjar Gold, 2015b);
- Dust suppression by water cart or other will be implemented for all soils disturbance works;

- Clear definition of clearing footprint through mapping and flagging of boundaries in field, ensuring that no clearing occurs within 5m of any watercourses (as identified in the VM Act);
- Rehabilitation of the borrow pit areas;
- Weed management in accordance with the PJO Weed Management Plan (Minjar Gold, 2015a); and
- Material extraction will occur laterally prior to extracting from depth as to minimise potential impacts to groundwater. Furthermore, extraction will be halted when saturated substrate material is encountered and an assessment undertaken to determine if groundwater impacts would occur if further extraction were to proceed.

### 5.2.4 Rehabilitation

Borrow pits on site will be rehabilitated as below:

- Made safe to people – pushed back to lessen slope;
- Source, load, place and spread growth media; and
- Revegetated as soon as practicable after borrow.

## 5.3 Dams

Two existing Dams are proposed to be added to Table A1: Authorised disturbance.

The Lynne ROM dam is an unlined rainwater dam adjacent to the workshop that collects runoff (**Figure 5-4**). This water is returned to the holding tanks at the box-cut for use underground at Lynne or pumped back to Vera Dam. The addition of Lynne ROM dam (0.164 ha) is an administrative change required as it was included in an EA Amendment Application for Lynne Box-cut in October 2018.

The current Table A1 Authorized disturbance allows for Lynne ROM footprint and Lynne Powerline Stage 1 & 2 only. The Lynne ROM dam is already constructed and operated within the existing Lynne ROM footprint. It is proposed to segregate the Lynne ROM dam from the Lynne ROM footprint and represent it as a separate disturbance item in the authorised disturbance table.

Raw Water Dam (1.016 ha) is lined with a polyliner and is located to the South of the TSF1 area, the purpose of which is to contain water that has been pumped from Charter Towers, via the Mt Leyshon pipeline (**Figure 5-5**). This storage provides an emergency water supply for the process operation. Given the dam is existing and has been operated safety for at least 12 years, this amendment is considered wholly administrative.

445000

7727000

ML 10246

Lynne ROM Dam

# PAJINGO GOLD MINE

## EA AMENDMENT

## FIGURE 5-4
## LYNNE ROM DAM

Dam

Mining Lease

0 25 50 Metres

| | |
|---|---|
| Coordinate System: | GDA2020 MGA Zone 55 |
| Scale: | 1:2,500 at A3 |
| Project Number: | 626.30122 |
| Date: | 30-Mar-2023 |
| Drawn by: | LC |

SLR

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440000

441000

7731000

7730000

TSF Borrow Pit 1

TSF Borrow Pit 2

ML 1575

Raw Water Dam

# PAJINGO GOLD MINE

## EA AMENDMENT

**FIGURE 5-5**
**RAW WATER DAM**

- Borrow Pit
- Dam
- Mining Lease

0 50 100 Metres

| | |
|---|---|
| Coordinate System: | GDA2020 MGA Zone 55 |
| Scale: | 1:5,000 at A3 |
| Project Number: | 626.30122 |
| Date: | 30-Mar-2023 |
| Drawn by: | LC |

SLR

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### Groundwater

Both of the proposed water dams have been previously constructed and have operated for at least four years. Through best practice construction techniques (utilising clay and HDPE plastic lining), there have not been any groundwater impacts (quality or quantity) noted within proximity to the dams.

### Land

The regional ecosystems within the Raw water dam and Lynne ROM dam were identified, descriptions of these REs are shown in **Table 8**. However, there will be no further impacts to any environmental values as these structures are already constructed.

**Table 8 Regional Ecosystems**

| Regional Ecosystems | Description | Vegetation Management Act Class | Biodiversity Status |
|---|---|---|---|
| 10.5.5a | Eucalyptus melanophloia woodland occasionally with Corymbia dallachiana. Eucalyptus populnea and Corymbia plena may also occur. The shrub layer is usually dominated by Carissa lanceolata and Acacia spp. and commonly includes Petalostigma pubescens and Denhamia cunninghamii. The ground layer is dominated by Triodia pungens and/or tussock grasses including Aristida spp., Bothriochloa ewartiana, Eriachne mucronata, Eragrostis lacunaria and Heteropogon contortus. Occurs on broad sandy outwash plains. Not a Wetland (BVG1M: 17b) | Least Concern | No concern at present |
| 10.5.4a | Eucalyptus crebra usually dominates often with Corymbia dallachiana in the very sparse canopy. Denhamia cunninghamii and Carissa lanceolata are often in the very sparse shrub layer. Chrysopogon fallax and Heteropogon contortus often dominate the very spare to spare ground layer. Occurs on sandplain. Not a Wetland (BVG1M: 18b) | Least Concern | No concern at present |
| 11.3.8 | Acacia argyrodendron woodland to low woodland. A secondary tree or shrub layer is usually absent although there can be scattered shrubs including Eremophila mitchellii, Lysiphyllum carronii and Atalaya hemiglauca. The ground layer is usually very sparse with Sporobolus actinocladus, Astrebla spp. and Iseilema vaginiflorum frequently present or dominant. Other graminoids usually present include Oxychloris scariosa, Enteropogon acicularis, Sporobolus spp., Dactyloctenium radulans, Brachyachne convergens and Chloris pectinata. Forbs commonly present include Trianthema triquetra, Portulaca filifolia and Evolvulus alsinoides. Occurs on Cainozoic alluvial plains. (BVG1M: 26a) | Least Concern | Of concern |

| Regional Ecosystems | Description | Vegetation Management Act Class | Biodiversity Status |
|---|---|---|---|
| 11.7.3 | Eucalyptus persistens low open woodland often with a Triodia mitchellii ground layer. Other scattered eucalypts such as Corymbia leichhardtii or Eucalyptus melanophloia may also occur. Understorey species are usually very sparse. Occurs on the stripped margins of ranges and plateaus. Soils are usually shallow loamy red earths overlying a hard pan. (BVG1M: 19d) | Least Concern | No concern at present |
| 11.5.9 | Eucalyptus crebra and/or Eucalyptus melanophloia woodland. Other tree species that may be present and locally dominant include Corymbia citriodora or C. clarksoniana sometimes in association with C. intermedia, C. dallachiana, C. lamprophylla, E. tenuipes, E. exserta, E. cloeziana, E. acmenoides. The mid layer ranges from absent to a sparse to dense shrubland typically dominated by Acacia spp. (such as A. excelsa, A. leiocalyx), Petalostigma pubescens, Lysicarpus angustifolius, Alphitonia excelsa and occasionally Melaleuca nervosa. Occurs on Cainozoic sandplains formed on plateaus and broad crests of hills and ranges. Soils are generally deep red earths. (BVG1M: 18b) | Least Concern | No concern at present |

**Land Use**

The area surrounding Lynne area is classified as “grazing native vegetation” in Queensland Globe (2023). The area around the Raw water dam is classified as “Mining” in Queensland Globe (2023). The proposed amendments to the EA will not cause any potential environmental harm to the current land use.

### 5.3.1 Emissions and Releases

All dams have previously been approved and inclusion in Table A1 is only considered administrative in nature. No additional release points than those currently in Table E1 of EPML00879413 are proposed. Any releases undertaken will be monitored for quality characteristics specified in Table E3 of EPML00879413.

### 5.3.2 Risk and Impact

Risk and impact for all dams have already been assessed and the EA Amendment is just considered administrative. Historical imagery obtained from Google Earth in 2014 shows that the Raw Water dam) was already constructed. The Lynne ROM dam was included in an EA Amendment application in 2018 for the Lynne Processing area but has not been reflected in the contemporary EA.

### 5.3.3 Management and Mitigation Practices

The following management and mitigation measures are proposed for the dams:

- The release of contaminants to waters will only be undertaken at authorised release points as specified in Table E1 (Contaminant release points) and monitored for quality characteristics specified in Table E3 (Contaminant Release Limit and Trigger Levels).
- Regular inspections and maintenance activities of dams will be carried out by authorised personnel.

### 5.3.4 Rehabilitation

The dams will be rehabilitated as below:

- Pump water from dam to nearest TSF;
- Removal and disposal of sludge and liner (if applicable);
- Earthworks (push in dam walls); and
- Topsoil, rip and seed (pasture).

Dams will be rehabilitated unless they are proposed to be retained via a landholder agreement. If retained, water from dams will be pumped to nearest TSF, sludge removed and disposed in void as to make the structure safe and stable.

## 5.4 Exploration Areas

The EA Amendment proposes an additional exploration disturbance footprint of 18.15 ha as land clearing will be required for both drill pads and access tracks (see Minjar plan on extending exploration activities to identify potential open cut or underground resources. Exploration activities will be undertaken as per Condition A15 of EPML00879413. Exploration disturbance areas are proposed within the approved mining leases and exploration permit – minerals with a maximum drill pad size of 1,000m2. Numerous flora and fauna studies have been undertaken over the Pajingo site (2001 -2003, 2007, 2011, 2012 and 2017) and no threatened or endangered fauna species have been observed. As a result, it is unlikely that fauna species will be impacted by the proposed exploration activities. All access tracks apart from those used by landholders for monitoring purposes will be rehabilitated.

#### Air and Noise

Noise impacts from the operation are unlikely to impact any sensitive receptor. There are no sensitive receptors with the nearest residence being the Pallamana Station 7 kilometres east Northeast (Doongarra is only 2km but owned by Minjar).

#### Water and Wetlands

No drilling will take place within the defining banks of any watercourses or drainage features. Clean water will be diverted around drill pads with the construction of temporary earthen bunds. Run-off from the pad or rehabilitation area will be contained to encourage infiltration and dropping of sediments within the disturbance area.

#### Land

NQM will ensure that all internal pre-clearing procedures are followed, this will include a pre-clearing desktop assessment to ensure that clearing areas are not within any MSES or other sensitive environmental values. NQM will ensure all clearing permits are completed and retained as evidence. Furthermore, proposed drill pads and tracks will be pre-marked to ensure that no unplanned clearing occurs.

#### Land Use

The proposed exploration areas have been classified as “Grazing native vegetation” in Queensland Globe (2023). The proposed amendments to the EA will not cause any potential environmental harm to the current land use.

### Waste

Exploration work such as soil sampling, drilling and investigative techniques such as geo-sensing generate some waste including maintenance by products and waste containers that will need to be disposed. All site waste will be managed in accordance with the Waste Management Plan (PJO-ENV-EMP-2010).

### 5.4.1 Emissions and Releases

There will be temporary noise and dust emissions during the clearing, drilling and subsequent rehabilitation operations. These are unlikely to affect the surrounding area. Further, there are no sensitive receptors with the nearest residence being Pallamana Station 7kms East Northeast.

Run-off water quality maybe impacted by fine sediment during major storm events through overtopping or erosion. Pajingo has limited groundwater regionally, but sumps are constructed where hole depths may intersect groundwater (if any). As part of the rehabilitation works, sumps will be backfilled with cuttings and material excavated at the end of the drilling program. Layout of the drill pads with bunding and inspection by field staff to ensure construction and rehabilitation criteria are being met will be in accordance with SWI PJO-GEO-FOR-6002 Exploration Rehabilitation Checklist. The aim will be to slow contained waters during short duration storm events.

### 5.4.2 Risk and Impact

Exploration works across the project area has been undertaken for over 30 years. The region is already heavily disturbed through prior exploration activity or grazing. Thus, the new area is unlikely to have any significant impact on environmental values. Exploration field components will be scheduled outside the main wet season to reduce risk of erosion and track deterioration. Erosion and Sediment control techniques and mitigation measures will be applied as per the Stormwater and Sediment Erosion Control Plan (PJO-ENV-EMP-2015).

### 5.4.3 Management and Mitigation Measures

Following management and mitigation measures will be applied:

- All exploration activities carried out on the mining leases will comply with each of the standard conditions contained in the most recent version of the administering authority's Eligibility criteria and Standard Conditions for Exploration and Mineral Development Projects (ESR/2016/1985).

### 5.4.4 Rehabilitation

Exploration land disturbance works will be undertaken as per the site permit/procedure (PJO-GEO-PRO-6000 F-01 Exploration Land Disturbance Permit & Checklist_2). Exploration Rehabilitation works will be undertaken as per the Final Land Use Rehabilitation Plan and the Exploration Rehabilitation Checklist (PJO-GEO-FOR-6002). Where practicable, progressive rehabilitation of disturbed areas will be undertaken as per the Code of Environmental Compliance for Exploration and Mineral Development Projects (ESR/2016/1985).

## 5.5 Topsoil Stockpiles

Topsoil Stockpiles are proposed to be added to Table A1: Authorized disturbance. It is noted that the location of Topsoil Stockpiles is already approved previously (Figure 4: Location of Authorised disturbance of EPML00879413). However, no allowance has been made for Topsoil Stockpiles in Table A1: Authorised disturbance.

### Air and Noise

All Topsoil stockpiles have been previously approved and constructed. The amendment is just considered administrative and will not result in additional environmental impact to air and noise values.

### Water and Wetlands

Topsoil stockpiles are not located within any drainage line or wetland areas. No MSES were identified within Topsoil Stockpile footprints.

### Land

The regional ecosystems within the Topsoil stockpile footprint were identified, descriptions of these REs are shown in (**Table 9**). However, given the stockpile is already constructed, there will be no further clearing or disturbance.

**Table 9 Regional ecosystems located within Topsoil Stockpile footprint**

| Regional Ecosystems | Description | Vegetation Management Act Class | Biodiversity Status |
|---|---|---|---|
| 11.11.15 | Eucalyptus crebra +/- Corymbia erythrophloia +/- E. populnea +/- E. melanophloia +/- C. tessellaris +/- C. clarksoniana woodland to open woodland often with a shrubby layer. Eucalyptus exserta and E. platyphylla present in central coastal part of bioregion. Occurs on undulating rises and low hills, often with distinct strike pattern formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics and Permian sediments. (BVG1M: 13c) | Least concern | No concern at present |
| 11.11.12 | Eucalyptus persistens +/- Corymbia lamprophylla low open woodland. Corymbia lamprophylla may dominate localised areas. Occurs on low hills and undulating rises formed from moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. (BVG1M: 19d) | Least concern | No concern at present |
| 11.11.2 | Acacia shirleyi or A. catenulata woodland to open forest. Eucalypt species may be present as emergent trees including Eucalyptus crebra and Corymbia citriodora. Occurs on hills and ranges formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. (BVG1M: 24a) | Least concern | No concern at present |
| 11.3.25 | Eucalyptus tereticornis or E. camaldulensis woodland to open forest. Other tree species, including Casuarina cunninghamiana, E. coolabah, Melaleuca bracteata, Melaleuca viminalis, Livistona spp. (in north), Melaleuca spp. and Angophora floribunda, may occur. An tall shrub layer may occur, including Acacia salicina, A. stenophylla and Lysiphyllum carronii. Low shrubs are present, but rarely form a conspicuous layer. The ground layer is open to sparse and dominated by perennial grasses, sedges or forbs. Occurs on fringing levees and banks of major rivers and drainage lines of | Least concern | Of concern |

| Regional Ecosystems | Description | Vegetation Management Act Class | Biodiversity Status |
|---|---|---|---|
| | alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast. These are usually moderately deep to deep, soft or firm, acid, neutral or alkaline brown sands, loams or black cracking or non-cracking clays, and may be sodic at depth (Burgess 2003). (BVG1M: 16a) | | |
| 10.5.5a | Eucalyptus melanophloia woodland occasionally with Corymbia dallachiana. Eucalyptus populnea and Corymbia plena may also occur. The shrub layer is usually dominated by Carissa lanceolata and Acacia spp. and commonly includes Petalostigma pubescens and Denhamia cunninghamii. The ground layer is dominated by Triodia pungens and/or tussock grasses including Aristida spp., Bothriochloa ewartiana, Eriachne mucronata, Eragrostis lacunaria and Heteropogon contortus. Occurs on broad sandy outwash plains. Not a Wetland (BVG1M: 17b) | Least Concern | No concern at present |
| 10.5.4a | Eucalyptus crebra usually dominates often with Corymbia dallachiana in the very sparse canopy. Denhamia cunninghamii and Carissa lanceolata are often in the very sparse shrub layer. Chrysopogon fallax and Heteropogon contortus often dominate the very spare to spare ground layer. Occurs on sandplain. Not a Wetland (BVG1M: 18b) | Least Concern | No concern at present |

#### Land Use

Topsoil stockpiles are currently constructed on land classified as “Other minimal use” or “Grazing native vegetation” in Queensland Globe (March 2023). The proposed amendments to the EA will not cause any potential environmental harm to the current land use.

### 5.5.1 Emissions and Releases

The emissions and releases have already been assessed and the EA Amendment is just considered administrative.

### 5.5.2 Risk and Impact

Risk and impact for Topsoil Stockpiles have already been assessed and the EA Amendment is just considered administrative.

### 5.5.3 Management and Mitigation Measures

Topsoil stripping and management will be handled in accordance with the Topsoil and Overburden Management Plan (PJO_ENV_EMP_2014). In order to retain the soil characteristics favourable for plant growth, the following measures are applied:

- The surface of the completed stockpiles will be left in a “rough” condition to promote water infiltration and minimise erosion prior to vegetation establishment;

- The surface will be left in a paddock dump fashion or ripped to adequate depth cross slope to minimise runoff;
- Topsoil stockpiles are constructed to have a maximum height of 2 m and width of 5 m in order to limit the potential for anaerobic conditions to develop within the soil profile;
- Topsoil stockpiles to have an embankment grade of approximately 1V:4H (to limit the potential for erosion of the outer pile surface);
- Stockpiles will have sediment control measures installed as required as per the Stormwater, Sediment and Erosion Control Plan (PJO-ENV-EMP-2015). This would involve where practicable placement of the stockpiles within the catchment of a sediment control dam or use of sediment barriers;
- Topsoil stockpiles will be revegetated with an appropriate seed mix and fertiliser. In order to minimise weed infestation, maintain soil organic matter levels, soil structure and microbial activity and maximise the vegetative cover of the stockpile; and
- Soil rejuvenation practices will be undertaken if required prior to respreading as part of rehabilitation works.

Further the following stockpile maintenance procedures will be conducted where on-going monitoring indicates the need:

- Top dress with fertiliser;
- Seed resewing; and
- Weed control

### 5.5.4 Rehabilitation

The rehabilitation of the Topsoil Stockpiles would include:

- Topsoil application (up to 150mm), rip, seed and fertilise land with pasture seed.

# 6 Reef Discharge Standards

DES must consider section 41AA of the EP Regulation when making an environmental management decision for activities with a potential to discharge nitrogen or fine sediment in the Great Barrier Reef catchment waters.[1] Furthermore, the Department must refuse to grant the application if the authority considers that:

a) The relevant activity will, or may have a residual impact[2]; and

b) Remains, or is likely to remain in the water despite mitigation measures for the relevant activity.

Triggering an assessment of the project against section 41AA requires that **each** of the following trigger criteria be satisfied—

[1] See Reef Discharge standards for industrial activities (ESR/2021/5627), Department of Environment and Science.
[2] 'A **residual impact** of a relevant activity is the presence of fine sediment, or dissolved inorganic nitrogen, in Great Barrier Reef catchment waters, or waters mentioned in subsection (1)(b), that—
(a) was released to the water because of the relevant activity; and
(b) remains, or is likely to remain, in the water despite mitigation measures for the relevant activity.'

### Table 10 Reef Regulation trigger criteria

| Criteria | Triggered by | Assessment of trigger |
|---|---|---|
| Application types | • A site-specific EA application under Chapter 5 of the EP Act<br>• A major amendment application under Chapter 5 of the EP Act<br>• A decision on a draft transitional environmental program (TEP) under section 338(1)(a) of the EP Act. See the Transitional Environmental Program guideline (ESR/2016/22776) for further information. | **Triggered**<br>The application will likely be a major amendment application. |
| Activity type | Resource and prescribed ERAs except for the following ERAs as described in Schedule 2 of the EP Regulation:<br>• ERA 16 – Extractive and screening activities to the extent the activity is dredging in the coastal waters of the State (as defined in section 41AA) this includes any ancillary activity associated with ERA 16 that is dredging in coastal water of the State such as ERA 50, and<br>• ERA 13A – Commercial cropping and horticulture in the Great Barrier Reef catchment. | **Triggered**<br>The application involved a resource ERA. |
| Release location | The release is to the GBR catchment waters (as per section 75 of the *Environmental Protection Act 1994*. | **Not Triggered**<br>The proposed activity is within the Burdekin Region Basin as shown on the Great Barrier Reef catchment and river basins.[3] |
| Release type | An application proposing a point source release to GBR catchment waters.<br>• Release is from a point source as the end of pipe and/or,<br>• Release source is wastewater from the relevant activity, except stormwater containing sediment only and/or,<br>• Release event is planned/controlled. | **Not Triggered**<br>The proposed activity will not result in any mine affected water being released from the site. All mine-affected waters are captured and stored on-site. |
| Contaminant type | An application proposing to discharge wastewater from a point source release that contains Dissolved Inorganic Nitrogen/fine sediment. | **Not Triggered**<br>The proposed activity will not result in any affected water release from the site. All mine-affected waters are captured and stored on-site. |

The Project is proposed to occur within the Great Barrier Reef Catchment. However as there are no planned/controlled releases proposed, the Project will not trigger the application of the Reef Discharge.

In addition, NQM have a robust receiving environment monitoring program which sufficiently monitors for any impacts to surface water values.

[3] Department of Environment and Science, Great Barrier Reef Catchment and River Basins, 2018.

# 7 Amend/Remove EA Conditions

1) Increase the ERA 63(1(a-ii)) threshold to ERA 63(1(b-ii)).

2) Amend Condition C15 as follows:

   *"Sewage effluent may only be released to the following locations:*

   *a) Within the nominated irrigation area identified in Table A1 or the TSF2 or Nancy Dam; or*

   *b) Other land for the purpose of dust suppression and/or firefighting; or*

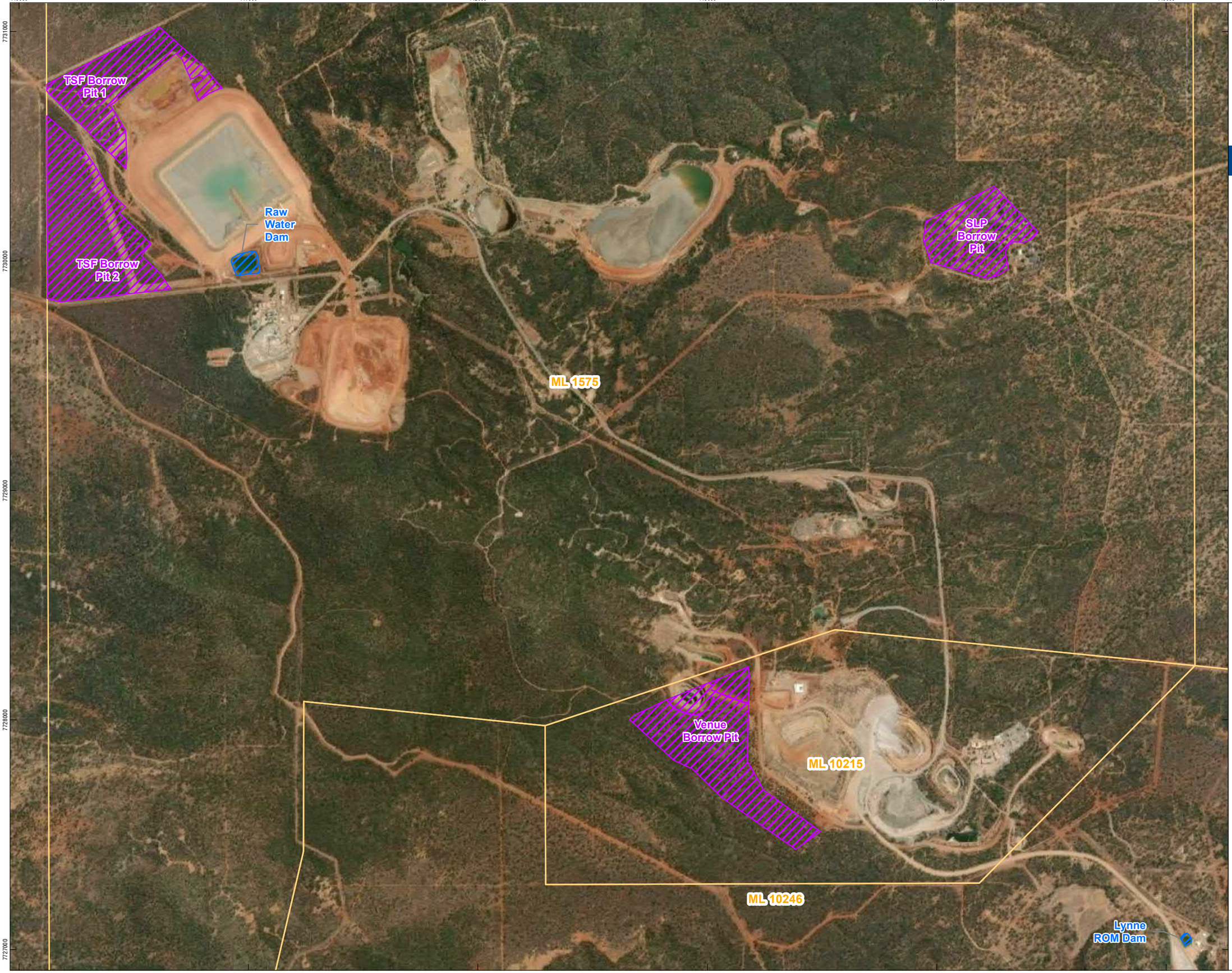
   *c) Reused as part of the mining activities"*

3) Tables A1 – Authorised disturbance in the EA requires amendment to include the following outlined in **Table 11.**

**Table 11 Additional Inputs for Table A1 in the Amended EA**

| Mine Domain | Mine Feature Name | Location (MGA94, Zone 55) | | Maximum disturbance area (ha) |
|---|---|---|---|---|
| | | Central Peg Coordinates | | |
| Dams | Raw Water Dam | 440987 | 7729989 | 1.016 |
| Dams | Lynne ROM Dam | 445086 | 7727045 | 0.164 |
| Voids | TSF potential Borrow 1 | 440426 | 7730794 | 14.7 |
| Voids | TSF potential Borrow 2 | 440285 | 7730171 | 24.2 |
| Voids | SLP potential Borrow 1 | 444158 | 7730108 | 12.1 |
| Voids | Venue Potential Borrow | 443056 | 7727874 | 22 |
| Exploration | Pajingo Site | Various | Various | 37.65 |
| Mining Area | Topsoil Stockpiles | Various | Various | 5.21 |

4) Addition of 'Figure 5' in Schedule J – Maps presenting proposed Material Borrow Areas, Lynne ROM Dam, and the Raw Water Dam as presented below in **Figure 7-1**.




**PAJINGO GOLD MINE**

**EA AMENDMENT**

**FIGURE 5**
**AUTHORISED DISTURBANCE**

- Borrow Pit
- Dam
- Mining Lease

0 100 200 Metres

| | |
|---|---|
| Coordinate System: | GDA2020 MGA Zone 55 |
| Scale: | 1:15,000 at A3 |
| Project Number: | 626.30122 |
| Date: | 30-Mar-2023 |
| Drawn by: | LC |

SLR

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5) Add Table 12 in Schedule G -Land and Rehabilitation

**Table 12 Post Mining Land uses to be included within the EA**

| Mine Domain | Final Land Outcome | Objectives | Mine Feature Name |
|---|---|---|---|
| Open Cut Pits | • Non-use Management Areas (impacted water storage) | • Promote hydrological and hydrogeological stability of water contained in the open voids.<br>• Minimise potential interactions of mine-affected waters from the open voids with the receiving environment.<br>• Safe and structurally stable | • Nancy Pit<br>• Nancy North Pit<br>• Cindy Pit<br>• Janine East Pit<br>• Orchid Pit<br>• Sue Pit<br>• Janine North Pit<br>• Janine Extension Pit<br>• Vera Pit |
| Open Cut Pits (backfilled) | Grassland (fauna habitat) | • Establish a suitable cover system to limit/reduce oxygen ingress.<br>• Limit grazing on cover system.<br>• Vegetated with native and pastural grass species.<br>• Safe and structurally stable.<br>• Supports native fauna habitat. | • Venue Pit<br>• VNU Pit<br>• Janine Northwest Pit<br>• Anne Pits<br>• Starlight B Pit |
| Waste Rock Dumps (PAF) | Grassland (fauna habitat) | • Establish a suitable cover system to limit/reduce oxygen ingress.<br>• Limit grazing on cover system.<br>• Vegetated with native and pastural grass species.<br>• Safe and structurally stable.<br>• Supports native fauna habitat. | • Vera WRD<br>• Scott Lode WRD |
| Waste Rock Dumps (NAF) | Open Woodland / Light Grazing | • Vegetated with mostly native tree and grass species.<br>• Safe and structurally stable.<br>• Non-polluting.<br>• Supports light/intermittent grazing. | • Anne Temp WRD<br>• Venue NAF WRD<br>• Cindy WRD |
| Run of Mine (ROM) | Open Woodland / Light Grazing | • Vegetated with mostly native tree and grass species.<br>• No contaminated material present post closure.<br>• Safe and structurally stable.<br>• Supports light/intermittent grazing. | • Vera ROM<br>• Janet A ROM<br>• Mill ROM<br>• Lynne Boxcut ROM |

| Mine Domain | Final Land Outcome | Objectives | Mine Feature Name |
|---|---|---|---|
| Tailings storage facility (TSF) | Grassland and rocky habitat (fauna habitat) | • Establish a suitable cover system to limit/reduce oxygen ingress.<br>• Limit grazing on cover system.<br>• Vegetated with native and pastural grass species.<br>• Safe and structurally stable.<br>• Supports native fauna habitat. | • TSF 1<br>• Scott Lode In-Pit TSF<br>• TSF2<br>• Janet A Pit |
| Ancillary Infrastructure and Mining Areas | Open Woodland / Light Grazing | • All infrastructure is removed unless there is a landholder statement for retainment.<br>• All disturbance is to be rehabilitated unless there is a landholder statement for retainment.<br>• Vegetated with mostly native tree and grass species.<br>• Safe and structurally stable.<br>• Supports light/intermittent grazing. | • Admin areas, workshops and stores<br>• Irrigation Area – Vera<br>• Irrigation Area – Mill<br>• Site Landfill<br>• Processing Landfill<br>• Vera Landfill<br>• Mill<br>• Haul Roads<br>• Borrow Pits<br>• Infrastructure Areas<br>• Access Tracks<br>• Exploration<br>• Janet A/K PAF WRD<br>• Venue PAF Footprint<br>• Vent fans<br>• Powerlines<br>• Seismic |
| Water Management Infrastructure and Dams | Open Woodland / Light Grazing | • All dams will be rehabilitated unless there is a landholder statement for retaining water storages.<br>• Any retained water storages will meet stock water requirements.<br>• Vegetated with mostly native tree and grass species.<br>• Safe and structurally stable.<br>• Supports light/intermittent grazing. | • Stormwater Dam<br>• Madigan's Dam<br>• A Lode Dam<br>• Sam's Dam<br>• SL WRD Sump<br>• Nancy Dam<br>• Vera Dam<br>• Sumps<br>• Raw Water Dam<br>• Lynne ROM Dam<br>• Mine Water Dam (Lynne)<br>• Stormwater Dam (Processing area) |

6) Remove Condition G2 of EPML00879413 as the FLURP will be replaced by Table 5 to be included in Schedule G.

7) Remove Condition G3 of EPML00879413 as schedule for rehabilitation will be outlined in the PRCP.

8) Modify Condition C10 and C11 as follows:

**Condition C10** *All waste rock characterised as potentially acid forming from Janet A pit, within K dump, within Anne pits and within Scott Lode waste rock dump must be returned to Scott Lode Pit, Janet A pit and Venue/VNU pit by December 2024 or rehabilitated via an alternate methodology, providing for equivalent or improved environmental outcomes, justified and approved in a PRCP.*

**Condition C11** All waste rock characterised as potentially acid forming from Nancy, Nancy North, Janine East, Janine Northwest, Orchid, Venue/ VNU pits, Lynne underground workings, Janine North, Janine Extension, Starlight B and Sue pits must be returned to Venue/VNU pit at the completion of the mining of these pits or rehabilitated via an alternative methodology, providing for equivalent or improved environmental outcomes, justified an approved in a PRCP.

# 8 Amendment Classification

There are two different types of classifications for amendment application; major or minor amendment. An amendment application is considered a major amendment when it is not a minor amendment. The definition of minor amendment is outlined in **Table 13** along with a response for this amendment.

The addition of four borrow pits, post mining land uses, updated Table A1 and additional table for PMLU is considered a major amendment.

**Table 13 Major Amendment criteria**

| Major amendment (threshold) criteria | Proposed Amendment |
|---|---|
| Is not a change to a condition identified in the authority as a standard condition. | **Not triggered**<br>There are no standard conditions as the EA was approved under a site-specific application. |
| Does not significantly increase the level of environmental harm caused by the relevant activity. | **Not likely triggered**<br>The impact assessment has identified that there will not be a significant increase to the level of environmental harm, or potential environmental harm |
| Does not change any rehabilitation objectives stated in the authority in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the authority. | **Not triggered**<br>The proposed amendment does not |
| Does not significantly increase the scale or intensity of the relevant activity. | **Not likely triggered**<br>The proposed amendments does not significantly increase the scale or intensity of the activity – instead, the amendments provide for a range of ancillary support (STP, material borrow pits) to facilitate the ongoing operation and future rehabilitation efforts. |
| Does not relate to a new relevant resource tenure for the authority that is- | n/a |

| Major amendment (threshold) criteria | Proposed Amendment |
|---|---|
| a) a new mining lease;<br>b) a new petroleum lease;<br>c) a new geothermal lease under the Geothermal Energy Act; or<br>d) a new GHG injection and storage lease under the GHG storage Act. | |
| Involves an addition to the surface area for the relevant activity of no more than 10 % of the existing area. | **Triggered**<br>The proposed amendments will result in the additional disturbance of ~97.5ha of land, this equates to an increase of 24% to the existing approved disturbance area. |
| For an environmental authority for a petroleum activity-<br>a) involves constructing a new pipeline that does not exceed 150 km<br>b) involves extending an existing pipeline so that the extension does not exceed 10 % of the existing length of the pipeline. | n/a |
| If the amendment relates to a new relevant resource tenure for the authority that is an exploration permit of GHG permit – seeks, in the amendment application under section 224, an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it related to the permit. | n/a |

# 9 References

AGE Consultants, *Pajingo Gold Mine Lynne Hydrogeology* (Technical Report, 2018).

C & R Consulting, *Pajingo Gold Mine Revised Environmental Plan Investigations* (Surface Water Balance and Hydrology, February 2012).

Minjar Gold, *Environmental Authority EPML00879413 Pajingo Project* (Amendment Application, October 2018).

Minjar Gold, *Waste Rock Management Plan*, (2018).

NRA, *Pajingo – Revised Groundwater Quality Assessment approach* (Technical Report, 2018).

O'Kane & ATC Williams, *Pajingo TSF Erosion Assessment* (Technical Assessment, 2020).

RGS, *Pajingo Gold Mine: Proposed Open Pit Development* (Geochemical Assessment of Waste Rock Materials, 2017).

# Appendix A:

## 2018 FLURP

**Pajingo Mine**

April 2014

prepared for NQM Gold 2 Pty Ltd by

Northern Resource Consultants

Updated December 2017

(by Minjar Gold)

# Limitations of this Report

Client: NQM Gold 2 Pty Ltd – Pajingo Operation Prepared by

Northern Resource Consultants (NRC)

This disclaimer brings the limitations of the investigations to the attention of the reader.

The information in this report is for the exclusive use of NQM Gold 2 Pty Ltd. NQM Gold 2 Pty Ltd is the only intended beneficiary of our work.

We cannot be held liable for third party reliance on this document. The information within this report could be different if the information upon which it is based is determined to be inaccurate or incomplete.

The results of work carried out by others may have been used in the preparation of this report. These results have been used in good faith, and we are not responsible for their accuracy.

This report has been formulated in the context of published guidelines, field observations, discussions with site personnel, and results of laboratory analyses.

NRC's opinions in this document are subject to modification if additional information is obtained through further investigation, observations or analysis. They relate solely and exclusively to environmental management matters, and are based on the technical and practical experience of environmental scientists.

They are not presented as legal advice, nor do they represent decisions from the regulatory agencies charged with the administration of the relevant Acts.

Any advice, opinions or recommendations contained in this document should be read and relied upon only in the context of the document as a whole and are considered current as of the date of this document.



Report updated December 2017 in line with 2017 Open Pit Proposals for EA amendment by John Foley (Senior Environmental Advisor

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# Executive Summary

This Final Land Use and Rehabilitation Plan has been prepared for NQM Gold 2 Pty Ltd, a wholly owned subsidiary of Minjar Gold. This plan is designed to meet the rehabilitation specifications and requirements of the PJO environmental authority (EA), which at the time of writing is EPML00879413 dated 19 January 2017.

The strategies and approaches described in this document align with the State government guidelines on mine closure and rehabilitation, and projects with potential impacts to land, namely *Guideline18 – Rehabilitation requirements for Mining Projects* (superseded) and the *Guideline EM961: Application requirements for activities with impacts to land* (EHP 2017).

This plan is a living document and is designed to be updated as the EA is updated, and as best practice rehabilitation techniques are superseded by superior methods. Wherever experimental rehabilitation has been conducted on site and a best approach for site conditions identified, such approaches should be included in this document in the section on Final Land Use Objectives and Best Practice Rehabilitation Standards.

This plan differentiates between three different mine closure scenarios: planned closure, unplanned closure and transition into temporary care and maintenance. The precise approach to rehabilitation strategies described in this plan should be decided depending on he applicable mine closure scenario.

# Introduction

## 1. Final Land Use and Rehabilitation Plan

This Final Land Use and Rehabilitation Plan (FLURP) has been prepared for NQM Gold 2 Pty Ltd which is owned and operated by Minjar Gold Pty Ltd (Minjar). The Pajingo Gold Operations (PJO) is located approximately 55km (80km by road) southeast of Charters Towers in north Queensland. Access to PJO is via the sealed north-south highway connecting Charters Towers and Clermont, the Gregory Development Road. A sealed private access road extends 22km east of the road to administration offices and the mill. A location map for the site is included in Appendix A – Maps.

This FLURP will include information detailing the following:

– Rehabilitation standard for the site relating to existing EA requirements,
– The final land use objectives,
– The identification and delineation of rehabilitation domains,
– The potential rehabilitation methods implemented,
– The further research required to validate the proposed rehabilitation method,
– Methods to confirm and detail rehabilitation success and progress for each domain,
– A proposed work schedule of closure activities.

The above methodology is consistent with the Department of Environment and Heritage Protection's (EHP) *Guideline18 – Rehabilitation requirements for Mining Projects* (superseded) and the *Guideline EM961: Application requirements for activities with impacts to land* (EHP 2017).

## 2. Current Operations

The Pajingo ore deposit was discovered by Battle Mountain Gold (BMA) in 1983. BMA held the tenements until 1991 when it became a joint venture with Newmont Mining. In 2002, the operation became 100 per cent owned by Newmont Mining. North Queensland Metals (NQM) took ownership in 2008 in a joint venture with Heemskirk. Conquest mining took 100 per cent ownership of PJO in 2010. In November 2011, Evolution Mining took 100 per cent ownership of PJO, with Minjar Gold taking 100% on the 1st September 2016.

The mining method utilised at Pajingo throughout the life of the mine include underground and open cut mining. Open cut mining employed a conventional drill and blast with hydraulic excavator (backhoe configuration) dig and truck haul operation. Underground mining methodology uses avoca and longhole open stoping. This system is well proven and understood in Australia and will be undertaken by a mining contractor, which will provide a low risk method for the scale of mining planned and expected ground conditions and ore body geometry. Pajingo is predominantly an owner-operator operation with its own mining and maintenance crews. Four mining crews are utilised in a continuous roster with approximately 25 people underground at any one time. Selective activities are undertaken by contractors and include road train ore haulage from Vera ROM pad back to the mill.

The Pajingo processing mill is a conventional carbon in pulp (CIP) plant that was first built in 1984 for Scott Lode Pit ore. The plant underwent a major rebuild in 1996 upon discovery of

the Vera Nancy strike. A further expansion was undertaken from May 1999 to January 2000 to increase the mill throughput from 216,000 tonnes per annum (tpa) to 582,000 tpa. Three Tailings Storage Facilities are utilised at Pajingo: a conventional paddock style dam within which tailings were first placed in 1987, the mined Scott Lode pit (SLP) within which tailings were first placed in 2000 and Janet A Pit.

# 3. Climate and Existing Environment

The Pajingo Operation (PJO) is located in the dry tropics of North Queensland and has a dry savannah climate. Rainfall in this area is characterised by short, intense rainfall events that occur primarily in the wet season, from November to April (Figure 2). Approximately 80% of annual rainfall occurs during the wet season. The mean average rainfall at Trafalgar Station is 649.7 millimetres and median rainfall is 616.6mm (Bureau of Meteorology, 2013). Annual rainfall is highly variable, with the lowest annual rainfall of only 205.9mm falling in 1923 and the highest annual rainfall of 1410.4mm falling in 1958. Average maximum and minimum temperatures range from 25° to 34°C in summer and 11 to 23°C in winter (Figure 1). Evaporation is consistent throughout the year, as to be expected in the dry tropics environment, with higher levels during the warmer summer months. Annual pan evaporation is 2,209 mm (Table 2).

It is important to note that the maximum annual rainfall is more than double the average annual rainfall, meaning that extreme isolated events may occur in some years, and that the majority of the time between wet seasons is relatively dry with very little rainfall occurring. These extreme events are likely the product of depressions, cyclonic events or other extreme meteorological conditions.

**Table 1: Bureau of Meteorology (BOM) stations in and around the Pajingo mine site**

| BOM Station No. | Station Name | Latitude | Longitude | Years of Good Data* | Distance From Pajingo Mine |
|---|---|---|---|---|---|
| **34008** | Pajingo | -20.7667 | 146.1667 | 38.2 | 39km |
| **34010** | Trafalgar Station | -20.4328 | 146.0131 | 105.2 | 45km |
| **34032** | Wambiana | -20.55 | 146.1 | 6.2 | 34km |
| **34045** | Bletchington Park | -20.4833 | 146.2667 | 11.9 | 18km |
| **34049** | Doongara | -20.5583 | 146.4811 | 37.05 | 6km |
| **34051** | Slogan Downs | -20.5658 | 146.3819 | 43.3 | 7km |

Pajingo Mine

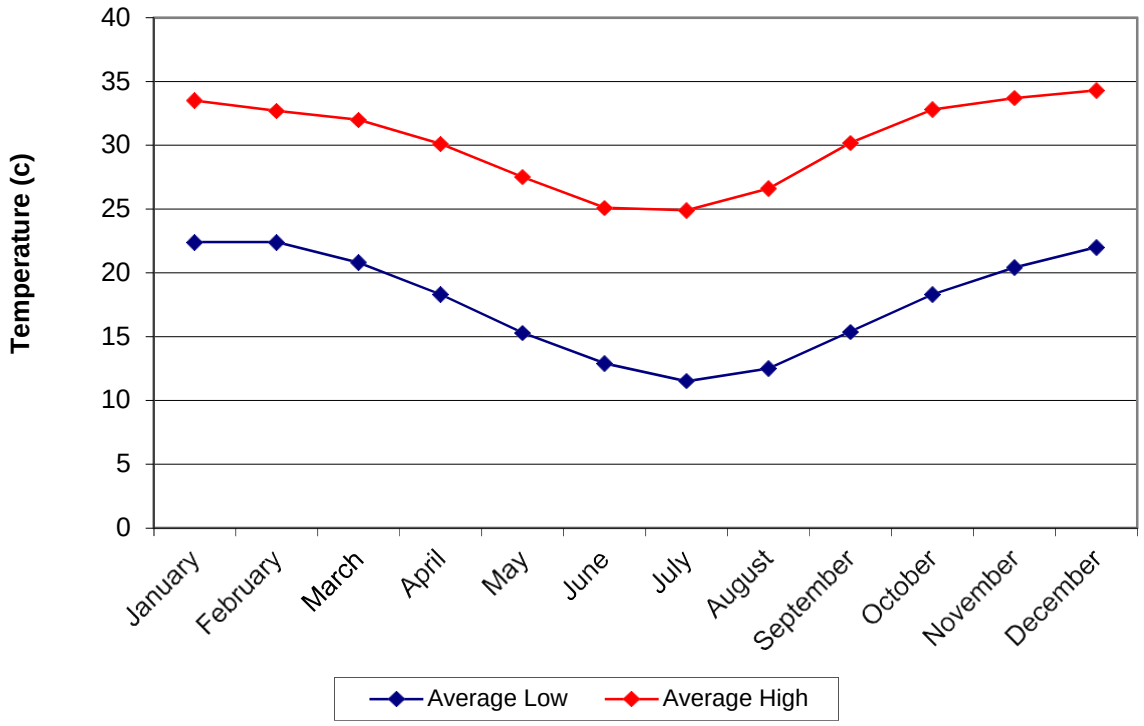


**Figure 1: Average maximum and minimum temperatures at Pajingo**

**Table 2: Average pan evaporation (in millimetres)**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Evaporation | 234 | 185 | 185 | 147 | 139 | 145 | 144 | 139 | 178 | 220 | 234 | 250 | 2209 |

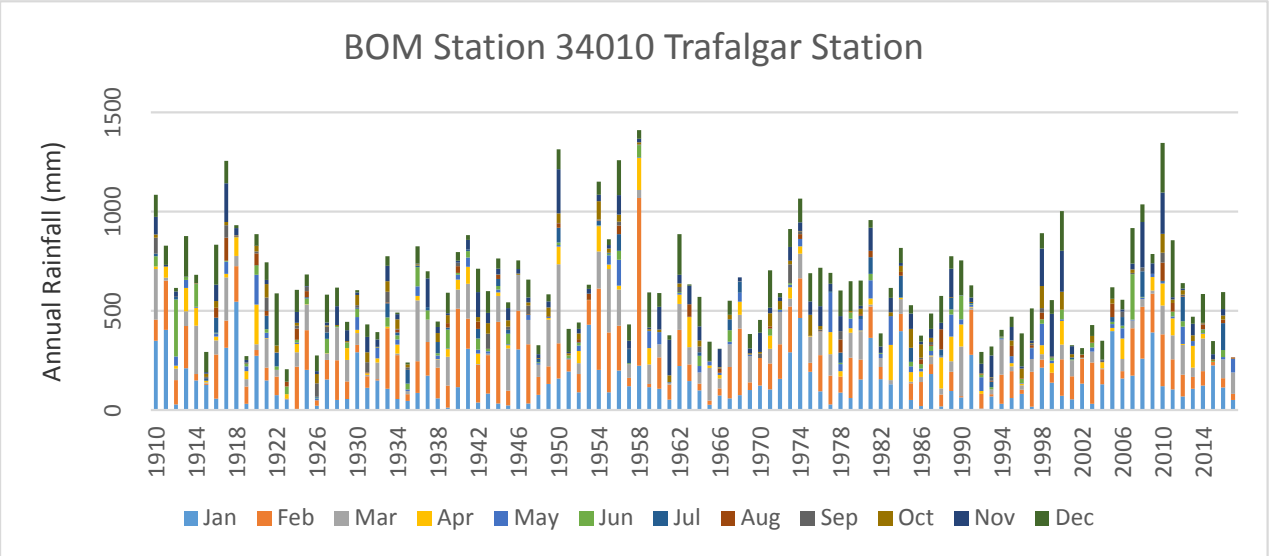


**Figure 2: Annual rainfall (mm) at Trafalgar Station (BoM)**

# 4. Topography

The Pajingo Gold Mine is situated in an area of relatively high relief at the apex of three catchments. All flows from major infrastructure on-site drain to the ephemeral Molly Darling Creek which flows into the Rolleston River, entering the Cape River just upstream of its confluence with the Burdekin Falls Dam 70km downstream from the site.

The western parts of the mining lease drain into Victoria Creek which eventually enters the Campaspe River. However these western areas of the mining lease are currently non-impacted with no infrastructure occurring in the area.

The area draining into Molly Darling Creek can be broken up into two catchments on-site, the Northern Catchment and the Eastern Catchment. The Northern Catchment drains the areas around the Tailings Storage Facility, Site Admin Office and seepage dam. The Madigans Dam, if overflows occur, will also drain into this catchment. A catchment divide occurs between this area and the Scott Lode Dam separating all areas towards the east.

This Eastern Catchment contains the Scott Lode and A Lode Dams, the Cindy and Nancy Dams as well as the Venue Pit, VNU Pit and the Vera Pit. This area drains directly towards the east into Molly Darling Creek, further downstream than where waters from the Northern Catchment enter the creek.

Pajingo Mine

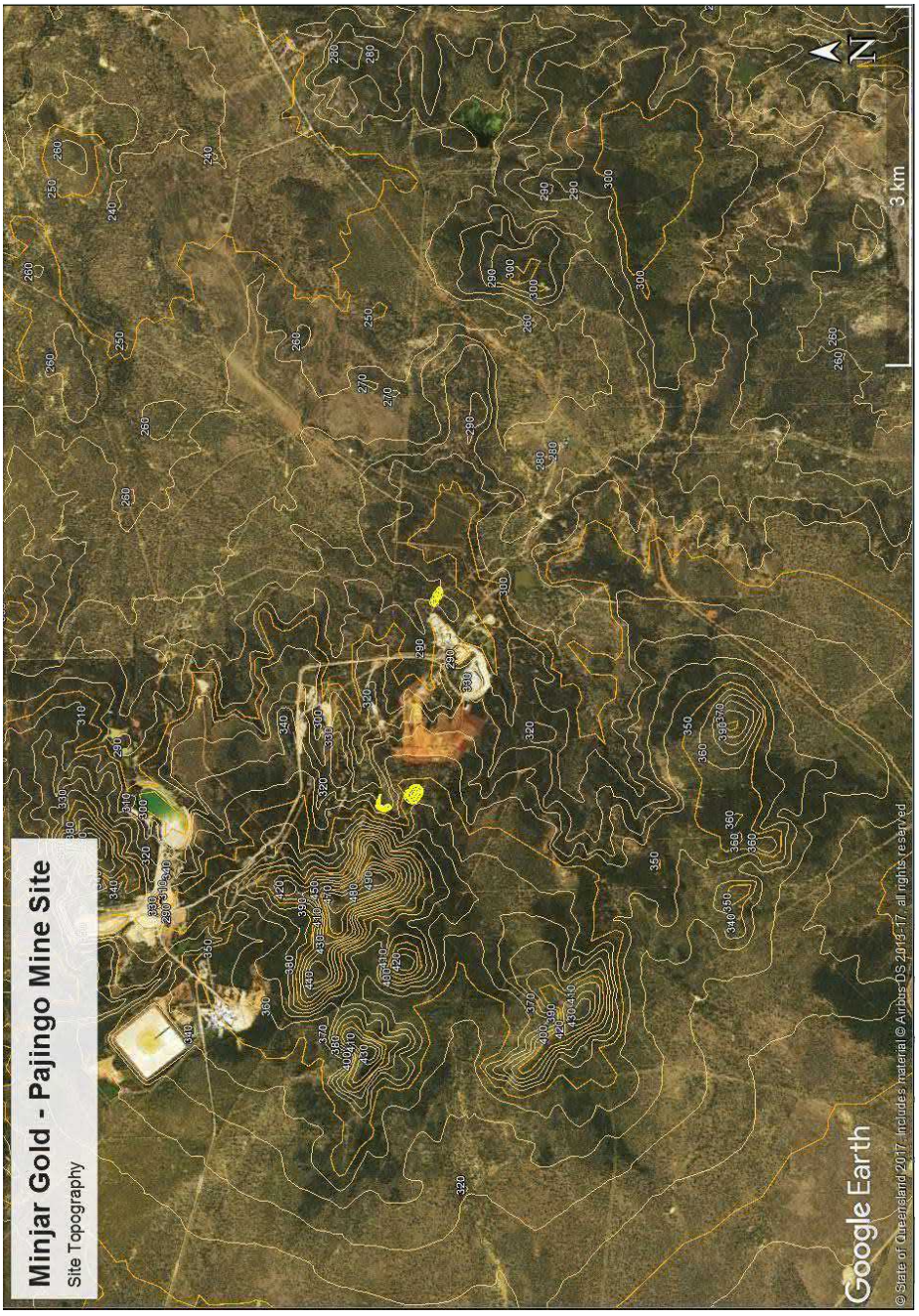


**Figure 3: Topographical map of mine site location – for a full map, please refer to the map appendix accompanying this report.**

# 5. Soils and Land Capability

Seven distinctive soil groups have been recognised in the Pajingo area. They comprise:

– ***Shallow rocky soils:*** The soils of this group exhibit a slightly acidic to neutral pH and have mainly coarse textures. They generally contain gravel or rock fragments derived

from quartz sandstone, acid volcanics or tuffaceous rocks. They also occur on the laterite escarpments, where the characteristic vegetation is lancewood (*Acacia shirleyi*) or narrow-leaved ironbark (*Eucalyptus crebra*).

- ***Uniform coarse-textured soils:*** These soils comprise uniform sands or weakly gradational loamy sands and occur as slopewash or as outwash fan deposits derived from erosion of the Tertiary land surface. Soil reaction is slightly to moderately acidic and gravelly lenses are common within the profile where they occur on the alluvial flats.
- ***Moderately Shallow to Deep Gravelly Coarse to Medium-Textured Soils:*** These soils consist of loamy sand to sandy loam textures, occasional clay loam to light clay textures. They include sub-angular rock fragments and soil reaction is generally slightly acidic to neutral.
- ***Sandy red and Yellow Earths:*** These soils were formed from coarse to medium-textured alluvial or outwash deposits from the Tertiary land surface and sandstone ranges. Soil reaction is very slightly acidic to neutral throughout the soil profiles, which is gradational and exhibit red and yellow colours.
- ***Loamy Red and Yellow Earths:*** These soils occur on more or less intact surfaces of the Tertiary laterite formations whilst the loamy yellow variants are more commonly associated with the Lower Carboniferous sandstone lithology. They are generally fairly deep soils and soil reaction may range from strongly acid at the surface, becoming progressively less acidic at depth.
- ***Texture Contrast (Duplex) Soils:*** These soils occur on footslopes and outwash slopes surrounding the Tertiary laterite escarpment and sandstone/volcanics of the range area. Preliminary chemical analyses indicate that in some areas total soluble salts and chloride may be relatively high at shallow depths and high levels of exchangeable sodium and or magnesium may be present within the profile.
- ***Uniform Fine-Textured Grey and Brown Clay Soils, including Cracking Clay Soils:*** Small occurrences of heavy-textured clays and cracking clay soils are present in the south-eastern sector of the Pajingo project area (adjacent to the Doongara homestead). These soils exhibit strongly alkaline pH values with exchangeable sodium and salinity increasing with depth (500-600mm).

# 6. Flora and Fauna

## 6.1 Vegetation

The Pajingo lease is located in the Brigalow Belt North bioregion (Thackway and Creswell 1995), an area of increasing biological interest that lies at the eastern margin of a zone of interchange between arid zone and those of the wetter coastal fringe. The climate is sub-humid to semi-arid, with vegetation generally consisting of open acacia forests and eucalypt woodlands. Woodlands will also include a significant presence of ironbarks (*E. melanophloia, E. crebra*), poplar box, Brown's box (*E. populnea, E. brownii*), brigalow (*Acacia harpophylla*),blackwood (*A. argyrodendron*) and gidgee (*A. cambagei*) that dominate the bioregion.

Pajingo Mine

**Table 3: Regional Ecosystems on the mining lease**

| Regional Ecosystem | Description | Vegetation Management Act Class (November 2009) |
|---|---|---|
| **11.3.25** | Riverine wetland or fringing riverine wetland. | Least Concern |

| Regional Ecosystem | Description | Vegetation Management Act Class (November 2009) |
|---|---|---|
| **11.3.8** | *Acacia argyrodendron* woodland on alluvial plains. | Least concern |
| **10.5.5** | Mostly *Eucalyptus melanophloia* dominates the very sparse tree layer with very sparse ground layer of *Aristida* spp. and/or *Triodia* spp. | Least concern |
| **11.7.3** | *Eucalyptus persistens, Triodia mitchellii* open woodland on stripped margins of lateritic duricrust. | Least Concern |
| **11.11.2** | *Acacia shirleyi* or *A. catenulata* low open forest on old sedimentary rocks with varying degrees of metamorphism and folding. | Least Concern |
| **11.11.15** | *Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics. Undulating plains. | Least Concern |

Vegetation in and around the site has been established using data collected from transects. Generally, the site is situated within the Brigalow belt, which consists of open, acacia wooded grasslands. Dominant grass in the area was Buffel Grass (*Cenchrus ciliaris*), with lesser occurrences of:

- Seco Stylo (*Stylosanthes scabra*),
- Soft Spinifex (*Triodia pungens*),
- Toothed Ragwort (*Pterocaulon serrulatum*),
- Rock Fern (*Cheilanthes sieberi*),
- Mueller's Saltbush (*Atriplex*

*muelleri*). Tree species present include:

- Brigalow (*Acacia harpophylla*),
- Lancewood (*Acacia shirleyi*),
- Lemon-Scented Gum (*Corymbia citriodora*),
- Shirley's Silver Leafed Ironbark (*Eucalyptus shirleyi*).

## 6.2 Fauna Species

An initial comprehensive mammal survey of site was carried out in 2002 (by Fred Ford, JCU 2002), a follow up internal faunal survey of the area surrounding the Venue and VNU was undertaken in 2011 and faunal observations and vegetation surveys have been recorded annually from 2005 - 2016.

During 2011 the site for the Venue and VNU pits was divided into four quadrats and trapping over a three night interval was conducted. In addition, incidental findings or signs of animals including, calls, scats, tracks, diggings, scratchings and remains have been recorded.

Incidental sighting records were conducted over the Pajingo site generally rather than specifically to the study area (Venue/VNU proposed site).

Trapping was carried out using Sherman traps. In total 36 traps were used during the program: 14 large Sherman traps, 14 small Sherman traps, six large cage traps and two small cage traps. The traps were placed at 10m intervals along four transects and baited with either beef mince or balls of peanut butter containing crushed seed biscuit.

During the 2011 trapping program one animal was successfully trapped. This animal was identified as a Long-Nosed Bandicoot (*Parameles nasuta*) and was caught on the first sampling night. The lack of success trapping and observing animals in the study area was most likely to be caused by a low density of animals in the study area. The mammal fauna of Pajingo is a representative sample of the species present in the Brigalow Belt North Bioregion and small mammals are likely to be rare and ephemeral on the lease.

In 2017 areas including the Orchid Pit, Janine NW and Janine West were studied in line with the proposed Open Pit amendment application. These works included reviewing Cindy WRD and the Nancy mining area.

No animal species have been observed within the study area. Observations made throughout the Pajingo site generally are listed below.

### NATIVE SPECIES

- Eastern Grey Kangaroo (*Macropus giganteus*),
- Sugar glider (*Petaurus breviceps*),
- Brushtail Possum (*Trichosurus vulpecula)*,
- Pebble-mound mouse (*Pseudomys*),
- Echidna (*Tachyglossus aculeatus*),
- Red Kangaroo (*Macropus rufus*),
- Common Wallaroos (*Macropus robustus*),
- Wallaby,
- Black headed Python (*Aspidites melanocephalus)*,
- Goanna (*Varanus*),
- Brown tree snake (*Boiga irregularis*).

### INTRODUCED SPECIES

- Wild dogs (*Canis familiaris*),
- Wild/feral pigs (*Sus scrofa*),
- Feral cat (*Felis catus*),
- European rabbit (*Oryctolagus cuniculus*),
- European hare (*Lepus europaeus*).

### BIRDS

- Royal Spoon bill (*Platalea regia*),
- Australian Magpie (*Cracticus tibicen*),
- The Australian Bustard (*Ardeotis australis*),
- Peewee (*Grallina cyanoleuca*),
- Emu (*Dromaius novaehollandiae*),
- White Ibis (*Threskiomis molucca*),
- Peaceful Dove (*Geopelia striata*),
- Waterhen/Dusky Moorhen (*Gallinula tenebrosa*),
- Masked Lapwing (*Vanellus miles*),
- Laughing Kookaburra, (*Dacelo novaeguineae*),

Whistling Kite (Haliastur sphenurus)Black Kite (*Milvus migrans*),

- Wedge-tailed Eagle (*Aquila audax*),
- Australian Raven (*Corvus coronoides*),
- Black Currawong (*Strepera fuliginosa*),
- Red-Tailed Black Cockatoo (*Calyptorhynchus banksii*),
- Sulphur-Crested Cockatoo (*Cacatua galerita*).

# 7. Water – Surface and Groundwater

## 7.1 Surface Water – Local and Regional

### REGIONAL HYDROLOGY

Pajingo is located in the Rollston River subcatchment of the Cape Campaspe Basin. The Cape Campaspe Basin is intermediate in size (~20,311 km$^2$) and covers about 15% of the Burdekin Water Quality Improvement Plan (BWQIP) region. Rollston River is a small subcatchment where land use is predominantly grazing on native pastures (QLUMP, 2004). The Rollston River subcatchment is a largely dry, sandy creek system with few permanent water holes.

The Pajingo site overlies an area of elevated topography, situated along the divide between three catchments. The largest proportion of the site drains to Molly Darling Creek, an ephemeral drainage system discharging to the Rollston River to the east. The western parts of the mining lease drain into Victoria Creek, which eventually enters the Campaspe River, however, these western areas of the mining lease are currently not impacted with no infrastructure occurring in the area.

The area draining into Molly Darling Creek can be broken up into two catchments on-site, the Northern Catchment and the Eastern Catchment. The Northern Catchment drains the areas around the Tailings Storage Facility, Site Admin Office and Seepage dam. If overflows occur, Madigan's dam will also drain into this catchment. A catchment divide occurs between this area and the Scott Lode dam separating all areas towards the east. This Eastern Catchment contains the Scott Lode and A Lode dams, the Cindy and Nancy dams as well as the Venue Pit, VNU Pit, Vera Pit, the two proposed Janine pits and proposed Orchid Pit. This area drains directly towards the east into Molly Darling Creek, further downstream than where waters from the Northern Catchment enter the creek.

## Surface Water Properties - Receiving waters

Surface water downstream of Pajingo has been found to be dominated typically by cations; Ca and Na and anions; SO4 and HCO3. Total Dissolved Solids (TDS) are generally low at all sites, with median values lower than 500mg/L. As a result of evapotranspiration processes TDS does increase throughout the year. Surface water types collected from ephemeral downstream locations during 2011 and 2012 are shown in Table 4 and Figure

**Table 4: Water types of ephemeral downstream monitoring sites**

| Surface Water Site | Water Type |
|---|---|
| **WP15** | Ca-Na-Mg-$SO_4$-$HCO_3$ |
| **WP16** | Na-Cl-$CO_3$-$HCO_3$-$SO_4$ |
| **WP19** | Ca-Mg-Na-$SO_4$-Cl |
| **WP2** | Na-Mg-$SO_4$-Cl-$HCO_3$ |
| **WP28** | K-Ca-$CO_3$ |
| **WP29** | Ca-Na-Mg-$SO_4$-$HCO_3$ |
| **WP3** | Na-Mg-$SO_4$-$HCO_3$-Cl |

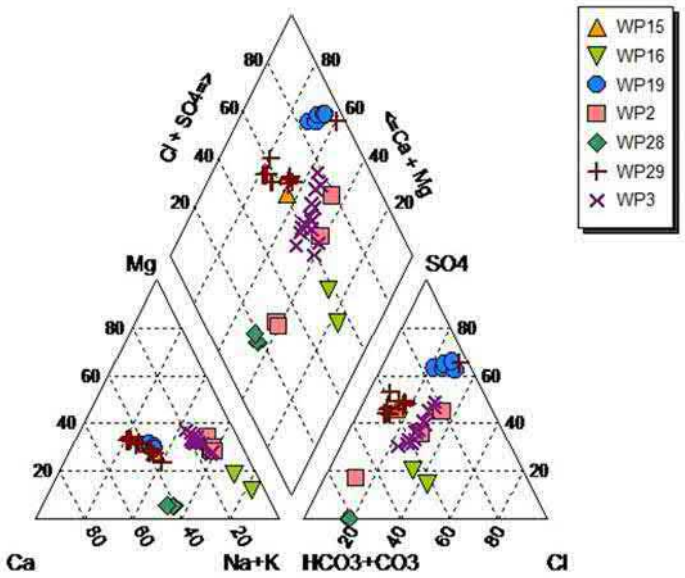


**Figure 4: Downstream surface water results (2011/2012) (NRC 2012)**

## Surface Water Properties - Site waters

Water types of site water storage facilities are generally dominated by cations; Ca and Na and anions; $SO_4$ and Cl. The five site water storage facilities include Madigan's dam, Sam's dam, Vera dam, A Lode dam and Seepage dam. Surface water types from onsite dams, collected during 2012 are displayed in Table 5 and Figure 5.

## Madigan's dam

Madigan's dam has a Na-Ca-Mg-$SO_4$-Cl water type with low dissolved metal concentrations. An increase in pH from neutral to alkaline throughout 2012 was evident in Madigan's dam. Electrical conductivity in the wet season was low (910µS/cm) and increased to 2690µS/cm in late 2012.

## SAM'S DAM

Sam's dam has a Na-Mg-Ca-$SO_4^-$-Cl water type with low dissolved metal concentrations. Throughout 2012 the water sampled from Sam's dam was slightly acidic. EC throughout the year remained below 250µS/cm.

## VERA DAM

Vera dam has a Na-Mg-Ca-$SO_4$-$Cl^-$ water type with low dissolved metal concentrations. During 2012 Vera dam water was alkaline with an EC of 2780 - 3060µS/cm.

## A LODE DAM

A Lode dam has a Na-Mg-Ca-$So_4$-Cl water type with low dissolved metal concentrations. Water samples taken from A Lode dam throughout 2012 were acidic to neutral with an EC of 200-1040µS/cm.

## SEEPAGE DAM

Seepage dam has a Na-Mg-Cl-$SO_4$ water type with low dissolved metal concentrations. Seepage dam water samples were neutral with an EC of 1100 - 4100µS/cm during 2012.

**Table 5: Water types of water dams onsite**

| Surface Water Site | Water Type |
|---|---|
| **Madigan's dam** | Na-Ca-Mg-$SO_4$-Cl |
| **Sam's dam** | Na-Mg-Ca-$SO_4$.-Cl |
| **Vera dam** | Na-Mg-Ca-$SO_4$-Cl |
| **A Lode dam** | Na-Mg-Ca-$SO_4$-Cl |
| **Seepage dam** | Na-Mg-Cl-$SO_4$ |

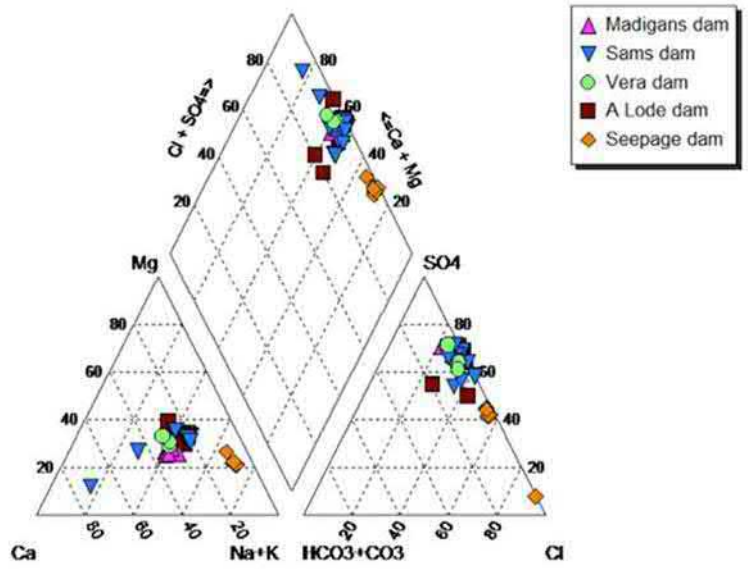


**Figure 5: Water quality of onsite dams (2012) (NRC 2012)**

## 7.2 Groundwater

### GROUNDWATER OCCURRENCE

Groundwater occurs mainly in two aquifer systems within Pajingo mining lease; the alluvial aquifer consisting of tertiary sediments and the underlying fractured rock aquifer consisting of tertiary basalts. In order to monitor both these aquifer systems, several of the monitoring sites contain nested piezometers designed to intersect groundwater from both the tertiary and fractured rock aquifers (e.g. T2S-shallow, T2M-medium depth, and T2D-deep). Many of the shallow casements, intersecting seasonal unconfined aquifers are dry for much of the year, particularly those away from the TSF.

The Britannia bore field was established in 1986 to supply water for the operation of Pajingo mine. It was considered the nearest groundwater aquifer capable of supplying water. It is located approximately 15km northwest of the mine site within fractured geology of the seventy mile range group. Static water levels from 1997 to 2003 show generally steady trends in drawdown. Trends of SWL observed in different wells do not correspond well with each other indicating limited connectivity between production bores in this bore field. It is not certain if these measurements are true static water levels or were taken concurrent with extraction. It nevertheless indicates a heterogeneous bore field with limited connectivity.

Average extraction rates of 5.2L/s in the Britannia bore field caused a rapid dewatering of the fracture-controlled aquifer that resulted in its closure. Recommended sustainable extraction rates for the aquifer were around 1.8L/s, which is an indication of potential yield for smaller livestock use. Extraction from the bore field ceased in 2006 after the resource was unable to meet demand. Water has since been pumped from the Burdekin River via Mt Leyshon Gold Mine, 30km to the north-northwest.

## GROUNDWATER FLOW REGIME

Permeability is typically very low and groundwater yields are poor due to lack of primary porosity, particularly in the underlying fractured rock aquifer. Low sustainable yields from the Brittania borefield suggests that regional flow of groundwater has a very low flow rate and possibly very low velocities suggesting an increased residence time. This leads to transfer of background pollutants from the soil/rock matrix into groundwater resulting in deterioration of quality. Limited water quality parameters monitored over the same period show considerable variations between Britannia bores. For example, electrical conductivity between 1220 and 6960µS/cm, and a pH range of 6.72 and 8.10. Limited water quality analysis for trace metals, in the same waters, shows low concentration (typically <0.01ppm) of most metals. Pumps were reportedly replaced on an annual basis as a result of either scaling or corrosion.

## GROUNDWATER PROPERTIES

Groundwater quality data at Pajingo is restricted mainly to monitoring bores that are designed to detect contamination from facilities such as tailings storage facility (TSF) and waste rock dumps (WRD). Very little water quality monitoring data is available from the wider mining area, except for testing of sump waters pumped from the underground operations and pit sumps along the Vera-Nancy trend.

### pH

The pH of groundwater measured at Pajingo throughout the life of the mine is shown in Figure 6. The median pH value at Pajingo varies between 5.12 for MB14 and 7.96 for MB2. It is evident that the majority of samples taken at all bores except MB2 are acidic. Bore MB14 has observed high acidity for most samples. It is likely that groundwater in bore MB14 is naturally acidic. This range in pH demonstrates the highly localized nature of aquifers at Pajingo mine site.

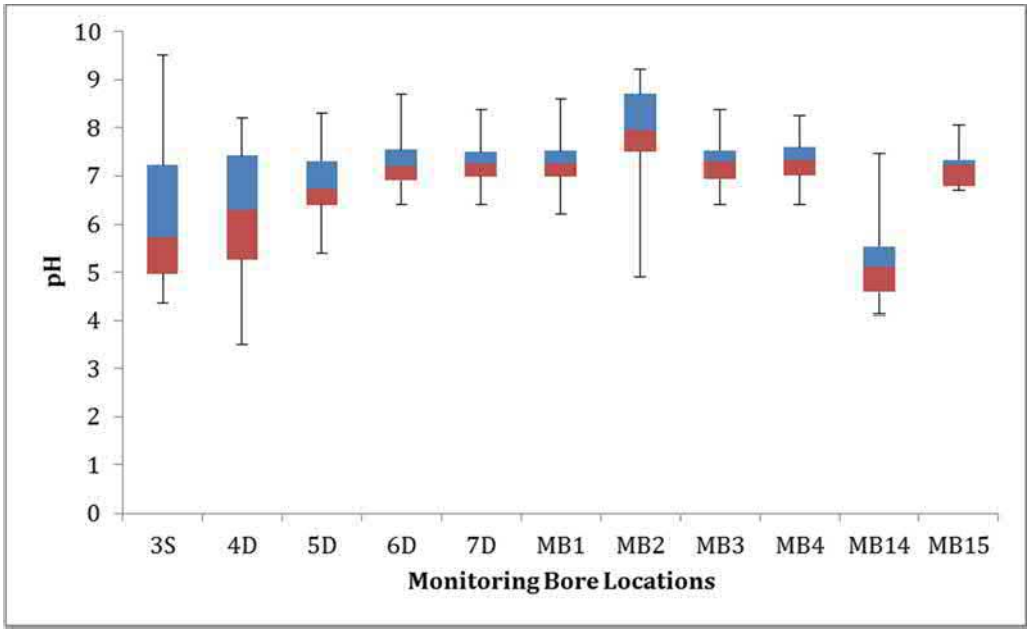


**Figure 6: pH of Groundwater samples recorded for Pajingo LOM (NRC[2] 2012)**

## Total Dissolved Solids

The total dissolved solids of groundwater samples measured at Pajingo over the life of the mine have been plotted in Figure 7. TDS varies widely spatially across the site. Temporal variation in TDS is high at bores 6D, 7D and MB1. At other bores, temporal variation of TDS is limited. Investigations previously undertaken on the high salinity of groundwater occurring on Pajingo mine lease have indicated that the groundwater quality in the receiving bedrock aquifer (Molly Darling Sandstone) shows naturally high TDS and sulphate concentrations. This has been attributed to the high residence time of groundwater in the low permeability bedrock (NRC, 2012).

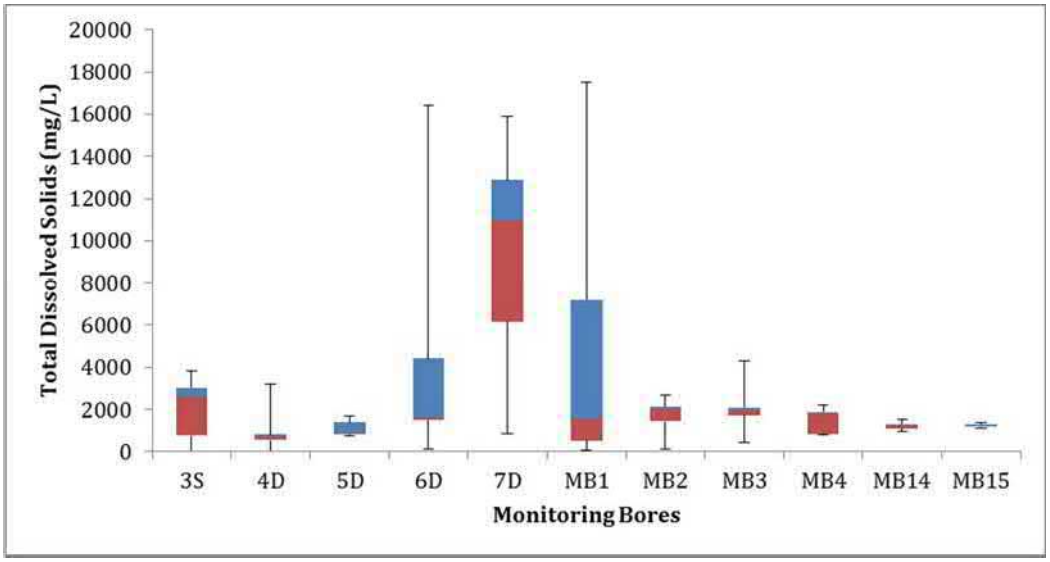


**Figure 7: TDS Concentrations of Pajingo groundwater (NRC 2012)**

## Major Ion Analysis

Groundwater measured during 2011-2012 shows numerous water types, which have been displayed in Table 6. The relative abundance of major ions in groundwater samples can also be seen in Figure 8.

**Table 6: Water Types for Groundwater at the Pajingo Site**

| Groundwater Monitoring Bore | Water Type |
|---|---|
| **3S** | NaMg-Cl |
| **4D** | Na-Cl |
| **5D** | NaMg-Cl$HCO_3$ |
| **6D** | NaMg-Cl$HCO_3$ |
| **7D** | Na-Cl |
| **MB14** | NaCaMg-$HCO_3$ |
| **MB15** | MgCa-$HCO_3$ |
| **MB2** | MgCa-$HCO_3SO_4$ |
| **MB3** | MgCa-$SO_4$ |
| **MB4** | MgCa-$SO_4$ |

Pajingo Mine

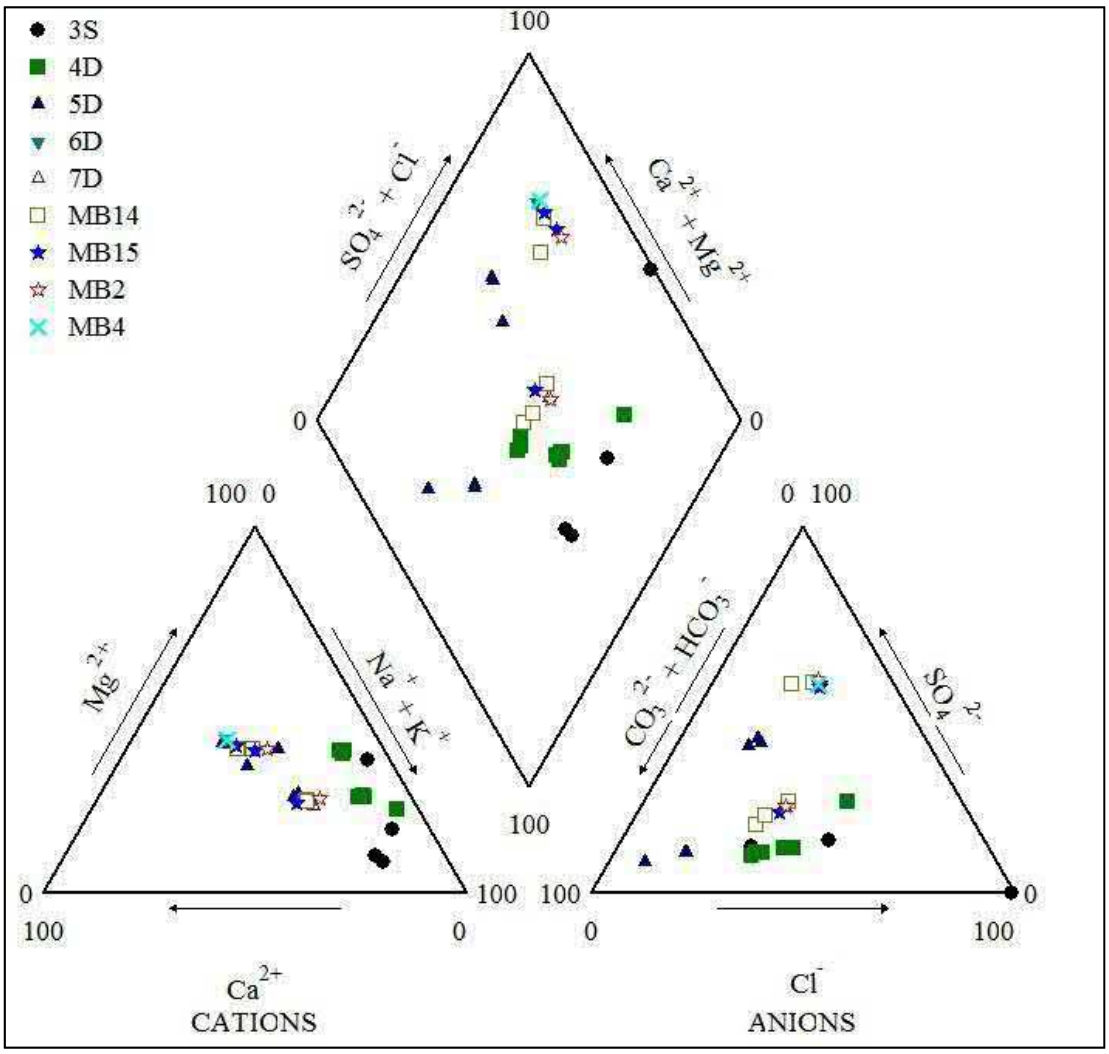


**Figure 8: Major Ions in Groundwater sampled from Pajingo 2011-2012 (NRC 2012)**

## Temporal Trend

Temporal trends of a range of groundwater quality properties have been analysed in a recent groundwater studies report (C&R, 2012). A summary of the findings is presented below:

1. Sulphate concentrations increased at monitoring bores MB3, MB4, 4D and 5D,
2. TDS increased at monitoring bores MB3 and 4D,
3. Bicarbonate increased at monitoring bore MB3,
4. Potassium increased at monitoring bore MB3,
5. Magnesium increased at monitoring bores MB3, MB4, 3S and 6D,
6. Sodium increased at monitoring bores MB3 and 6D,
7. Calcium increased at monitoring bores MB4, 4D and 5D,
8. Nickel increased at monitoring bore 3S,
9. Zinc increased at monitoring bore 3S,
10. pH increased at monitoring bore 4D,
11. Potassium decreased at monitoring bores MB1 and MB2,

12. Sulphate decreased at monitoring bore MB2,
13. Chloride decreased at monitoring bores MB2,
14. Magnesium decreased at monitoring bores MB2 and 7D,
15. Calcium decreased at monitoring bores MB2 and MB15,
16. pH decreased at monitoring bores MB3 and 3S,
17. Lead decreased at monitoring bores MB3, 6D and 3S,
18. Nickel decreased at monitoring bore MB4,
19. Cadmium decreased at monitoring bore 3S,
20. Zinc decreased at monitoring bores 4D and 6D,
21. Copper decreased at monitoring bore 6D.

# 8. Geology and Geochemical Characterisation

## 8.1 Regional Geology

Pajingo mine is located in a group of sedimentary rocks within the Drummond Basin (Figure 9). This basin has been defined as three packages or tectonostratigraphic cycles of mostly terrestrial sedimentation separated by substantial volcanic deposits ranging from uppermost deposits of the youngest Cycle 3 package includes Tertiary aged beds as young as 53 Ma.

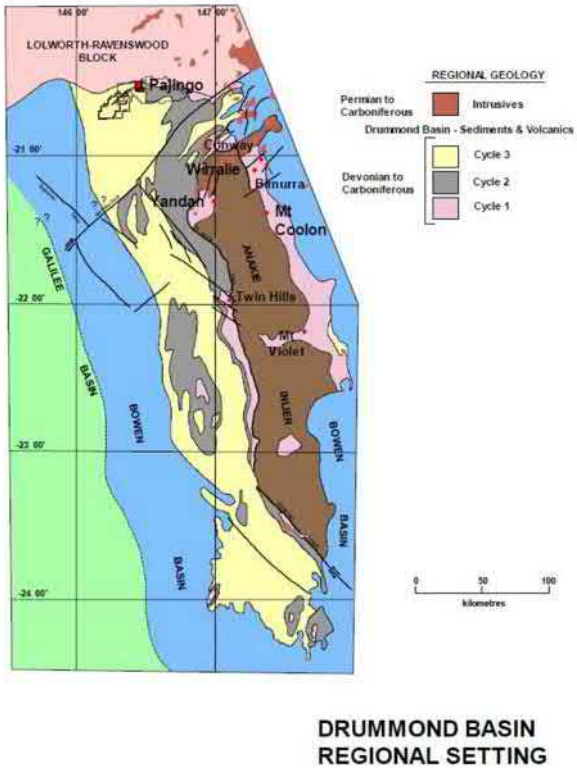


**Figure 9: Drummond Basin Regional Geology Map (Pajingo Exploration Dept.)**

Major fault structures in the Pajingo area trend dominantly northeast and northwest. These major faults are possibly related to reactivation of original graben blocks first generated during extension and formation of the original basin. Fault, shear and gentle fold development of late Palaeozoic and older geology result from multiple tectonic events along the eastern margin of the continent. These events resulted in volcanic arcs and mountain building with associated pulses of mid to upper level igneous intrusive bodies. Surface expressions of major folds in the northern most end of the Drummond, display axial planes in a northeast orientation (Hutton 1989).

The Lolworth-Ravenswood Block and Drummond Basin are intruded by a series of Late Carboniferous high level felsic plugs, dykes and intrusive breccias. The age dating of mineralisation at Pajingo appears to pre-date these intrusives, and thus the ore is considered associated with the Mt. Janet andesitic volcanic complex. The nearest outcrop of Carboniferous granite bodies is approximately 50km east of Pajingo.

## 8.2 Site Geology

The relevant stratigraphy and intrusive history in and around the tenement area is presented in Figure 9. The framework of this geological history is based primarily upon Schafer (1999), who utilises the range of available age dating to constrain stratigraphy.

The oldest lithologies in the Pajingo mine lease are part of the Seventy Mile Range Group which occur under cover in the northeast corner of the lease and are part of the Lolworth-Ravenswood Block; namely the Ordovician Rollston Range Formation (Osr) and (Cambrian)-Early Ordovician Trooper Creek Formation (Ost/s/a). Formerly known as the Cape River Beds, these units include metamorphic varieties of formations in the Pajingo area and comprise schist, quartzite, phyllite, metavolcanics, siltstone, arenite and pyritic shale (PJV 2001 Groundwater Report).

The Seventy Mile Range Group is not expected to be encountered during mining and little is known about the geology of this group locally. Regional mapping does however show a high density of structural elements within the Seventy Mile Range Group (in the form of faults and lineaments). The Janet-A fault structure (Scott Lode) is believed to be part of a larger structure that locally separates the Drummond block from the Lolworth-Ravenswood Block. This structure (with a generally northwest trend) will likely influence hydrogeology to the north of the mining lease. The northern quarter of the lease area is dominated by Devonian Molly Darling Beds (DCp) which consist of clastic sediments interbedded quartz sandstones, siltstones and carbonaceous shales. This unit is greatly exposed around Mt. Molly Darling (immediately north of Scott Lode Pit) and is deposited upon the Lolworth-Ravenswood Block. The most prominent surface geology in the centre of the mine lease is the Mt. Janet Andesite (DCvv/a/r) along the Mt. Janet Range. This unit consists of andesitic lava flows and pyroclastics, with minor intercalated volcaniclastics and sedimentary beds. Lava flows have a known thickness of at least 15m with intercalated tuffs. The pyroclastics include block to fine ash tuffs and lithic tuffs with basaltic to trachytic variations (Bobis 1990). A dacitic sequence at the base of the formation is characterised by ignimbrite (fiamme-rich glassy welded tuffs).

**Table 7: Sedimentary and Igneous history for the Pajingo area**

| Map Unit | Age | Group | Formation | Dominant Lithology |
|---|---|---|---|---|
| **Cainozoic Sediments and Volcanism** | | | | |
| **Qha** | Holocene | | Alluvium | Stream Bed Sediment |
| **Qa, Qr** | Quaternary | | Alluvium & Colluvium | Unconsolidated Sediment |
| | Pliocene | Volcanics | Campaspe Formation | Si Cemented Sediment |
| | Mid Tertiary ~44Ma | | Moonlight Plug (Mingela Basalt equiv.) | Alkali Olivine Basalt |
| **Ts, Td** | Early to Mid-Tertiary >53Ma | | Southern Cross Formation (Suttor Formation equiv.) | Ts – Lateritised Sediment Ferricrete capping (Td) |
| | Cainozoic | Shallow Intrusives | Unnamed Dykes | Basaltic hypabyssal |
| **Cycle 3 – Drummond Basin** | | | | |
| **CPir** | Carboniferous to Permian | Shallow Intrusives | Unnamed Dykes and Volcanics | Andesitic to Rhyolitic hypabyssal |
| | Mid Carboniferous ~342 Ma | Hydrothermal fluids | Scott Lode Mineralisation | Epithermal Quartz Veins |
| | Early Carboniferous | | Unnamed Volcaniclastics | Qtz-free volcaniclastics |
| | Early Carboniferous | | Doongara Formation (Star of Hope Formation equiv.) | Volcaniclastic sediments |
| **Cycle 2 - Drummond Basin** | | | | |
| | Early Carboniferous | | Raymond Formation | Sandstone |
| **Cycle 1 – Drummond Basin** | | | | |
| | Devonian | Shallow intrusives | Unnamed Hypabyssal (Mt Starlight related) | Dacitic to Rhyolitic dykes, stocks & plugs |
| | Late Devonian ~365Ma | | Mt Starlight flow domes | Felsic volcanics |
| | Devonian | Shallow intrusives | Unnamed Hypabyssal (Mt Janet related) | Andesitic dykes, stocks and plugs |
| **DCv v/a**<br>**DCv v/r** | Late Devonian | | Vera-Nancy volcanics (a – Mt Janet Andesite) (Stones Ck Fmn equiv.) | a – Porphyritic Andesite & Pyroclastics, r – Dacitic Sandstone |
| **DCp** | Late Devonian | | Molly Darling Beds (Pallamana Sandstone equiv.) | Quartzose Sandstone |
| **Seventy Mile Range Group (Lolworth-Ravenswood Block)** | | | | |
| | Siluro-Devonian | Mid level intrusive | Molly Darling Granodiorite | Altered medium grained Hbl Bt Granodiorite |
| | Siluro-Devonian | Mid level intrusive | Ravenswood Batholith | Medium grained Hbl Bt Granodiorite |
| **Osr** | Ordovician | | Rollston Range Formation (Cape River Beds equiv.) | Feldspathic Sandstone |
| **Ost/s/a** | (Cambrian) – Early Ordovician | | Trooper Creek Formation (Cape River Beds equiv.) | s - Sandstone/Mudstone<br>a – Andesitic Volcanics |

# 9. Community

## 9.1 Local Community

The project is in an isolated area, with the Doongara homestead, located two kilometres east of the Vera Pit located on ML10215, being the closest resident. This property is owned by Minjar Gold. The closest rural community is Charters Towers, with a population of approximately 12,000 residents. Charters Towers is 55km from the mine site.

The Doongara homestead (1.91km from operational areas) and Slogan homestead (8.11km) are considered sensitive locations for potential air quality and noise impacts. Since start of operations in 1987, however, there have been no air, noise or dust complaints made by nearby residences. Hence, minor to no impacts on the surrounding community are associated with the construction or operations of the pits.

As there are only a number of residences surrounding the mine lease area, potential benefits for the community would be small scale. Benefits already associated with the mine for nearby residences have included paved roads. While the benefits to Charters Towers have included increased revenues spent in the area, more employment opportunities, new development to accommodate workers and more extensive government services for expanding recreational and cultural facilities. Community donations and assistance programs have been rolled out throughout the operations existence.

## 9.2 Cultural Heritage

An archaeological assessment of the site was completed in 1986 as part of the Pajingo Baseline Environmental Survey undertaken by Hollingsworth Consultants. The majority of mine related activities are located in areas of low archaeological sensitivity. Two sites of significance have been identified on the Tertiary laterites, which include settlement evidence and artefact scatters. Neither site is threatened by current developments. Excessive scatters of stone artefacts are located on the creek flats of the Quaternary sediments, which are outside the boundaries of the Vera ML and are not threatened by current developments.

Throughout the Pajingo Mine Operations Leases and Exploration Permits, a stringent management procedure is undertaken to ensure any cultural heritage within the site is identified and preserved. This procedure involves both the management of sites identified as having cultural value and identifying additional sites of cultural significance.

Prior to the commencement of exploration in the exploration or clearing of mining areas, the Pajingo site employs traditional owners of the land, representing the Kudjala people and Birri people to ground truth the area and determine the location of sites of cultural significance. To date no sites of cultural significance have been identified close to mining areas and unlikely to be impacted.

# Closure Management

## 1. Identification and Management of Closure Issues

The PJO-EVN-PHMP-2015 Risk Management Procedure *p*rovides a process of risk assessment to evaluate proposed closure methods and alternative options for the project. The process is based on the AS/NZS ISO 31000:2009 standard.

It is intended that following a risk-based approach will lead to a closure process that offers the following benefits:

- A more confident and rigorous basis for decision-making and planning,
- Better identification of opportunities and threats,
- Gaining value from uncertainty and variability,
- Proactive rather than reactive management,
- More effective allocation and use of resources,
- Improved incident management and reduction in loss and the cost of risk,
- Improved stakeholder confidence and trust,
- Improved compliance with relevant legislation.

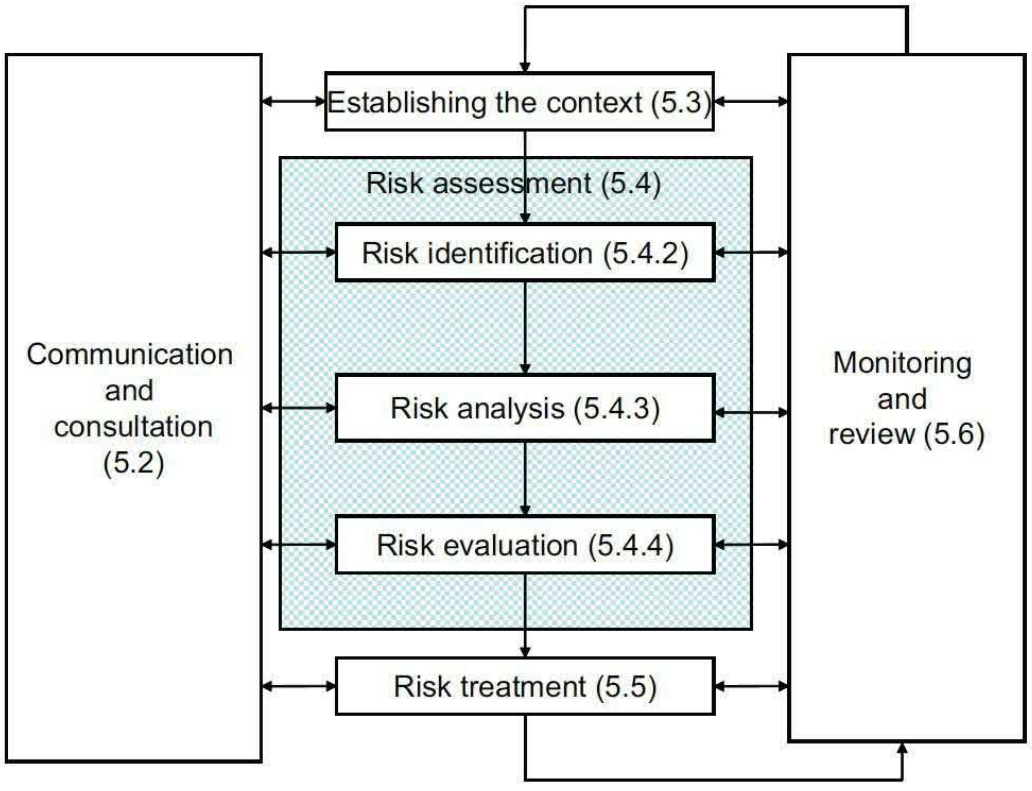


**Figure 10: Risk Management Process (from ISO 31000:2009)**

# 2. Best Practice Rehabilitation

## 2.1 Rehabilitation Guidelines

The rehabilitation guidelines set out by EHP (*Guideline 18: Rehabilitation requirements for mining projects;* EHP 2007b) for areas disturbed by mining specify that the rehabilitated site landforms should be:

- Safe to humans and wildlife,
- Geo-technically stable,
- Geo-chemically stable and non-polluting,
- Able to sustain an agreed post mining land use (see Table 8).

**Table 8: Rehabilitation Guidelines - Guideline 18: Rehabilitation requirements for mining projects, (EHP 2007)**

| OUTCOMES | GOALS | | | |
|---|---|---|---|---|
| | **SAFE** | **NON-POLLUTING** | **STABLE** | **SELF SUSTAINING** |
| **Generally acceptable** | Structurally safe, no hazardous materials<br>Structurally safe, treated hazardous material adequately contained | Runoff and seepage will be good quality water that is unlikely to affect known environmental values | Place wastes below natural land surfaces (i.e. below grade)<br>Places wastes above natural surface with minimal slopes (e.g. less than 5°) | Reinstate original ecosystem<br>Create a different use with enhanced environmental, economic or social values acceptable to stakeholders<br>Return to previous use/condition |
| **May be acceptable** | Structurally safe. Hazardous material adequately contained | Potential for pollution of water that is managed by:<br>– Natural low groundwater connectivity (demonstrated by hydrological studies)<br>– Impervious capping or lining<br>– Store and release capping | Place wastes above ground with moderate slopes | Return to previous use, or different use with reduced environmental, economic or social values (evidence that use is acceptable to stakeholders would be essential |
| **Rarely acceptable** | Uncontained or inadequately contained hazardous materials | Waste disposal facility contains inadequately managed severely contaminated water or water requiring continuing treatment | Place wastes above ground with angle of repose slopes | Unusable, contaminated site that is not adequately managed |

## 2.2 Safe to Humans

When rehabilitating a WRD, it is important to note that a reshaped WRD design must consider the presence of materials that may later cause intractable problems, particularly acid forming, saline or highly alkaline materials. The main goal of rehabilitating domains is the long-term safety of humans and animals, now and in the foreseeable future. An indicator of success is no exposure to or availability of heavy metals and other toxic materials on the rehabilitated domains.

According to EHP's rehabilitation objectives, PJO propose to ensure long-term safety by utilising the following completion criteria:

– Risk assessment to be undertaken on existing structures, high walls and voids, and control measures to restrict access where safety considerations require this. This may include bunding or fencing
– Leaching tests of exposed material meet specified guideline values (using standard protocols such as US EPA Toxic Characteristic Leaching Procedure)
– Surface water quality complies with specified guidelines (ANZECC 2000 and QWQG 2009)
– A site management plan that includes measures for fire reduction and to control woody weeds under the Land Protection (Pest and Stock Route Management) Act 2002

## 2.3 Non-Polluting

In rehabilitating domains, PJO must consider the presence of materials that may later cause pollution, as hazardous leachate may exude from exposed waste materials. Any design must incorporate features to minimise the risks associated with storage of these waste materials. Neutralising or encapsulating techniques are able to manage potentially acid-generating materials.

The requirement for domains to be non-polluting, as set out by EHP, includes a need for polluted water that is contained on site to meet specified criteria relevant to potential contaminants and other toxic materials on the rehabilitated domains.

According to EHP's rehabilitation objectives, PJO propose to ensure non-pollution of the receiving environment by utilising the following completion criteria:

– Ensure water dams and creeks are in line with stock drinking water quality requirements, as outlined in ANZECC 2000,
– Ensure appropriate diversion/containment structures are in place to minimise quantities of polluted water and containing it onsite.

## 2.4 Stable

In order to achieve effective rehabilitation, progressive improvement should be noted in soil structure and soil protection, vegetative cover and development, and stability of erosion features. Continual monitoring verifies habitat self-sustainability and the subsequent ability to tolerate climatic fluctuations.

To determine the success of rehabilitated domains at PJO in terms of stability, EHP outlines the rehabilitation completion criteria to be:

– Vegetation coverage,
– Landform design, and
– Erosion mitigation.

According to EHP's rehabilitation objectives, PJO propose to ensure long-term stability by utilising the following completion criteria:

– Risk assessment to be undertaken on existing structures, high walls and voids, and control measures that will continue to meet agreed requirements put in place upon rehabilitation,
– Foliage cover in accordance with the Rehabilitation Completion Criteria (included in the Environmental Authority) to meet the set values based on the regional assessment of cover requirements,
– Ensure nutrient cycling is occurring through the presence of leaf litter to assist in limiting erosion.

## 2.5 Self-Sustaining

Rehabilitation design must ensure a self-sustaining vegetation cover to meet the agreed post-mine activity plan. EHP outlines all rehabilitated mine areas to maintain sustainable land use through the successful implementation of the appropriate final land use capability score.

According to EHP's rehabilitation objectives, PJO propose to ensure long-term stability by utilising the following completion criteria:

– Soil properties that support and will continue to support the desired land use (pH range of topsoil 5 – 8.5, salinity <0.2% chloride),
– Establish natural vegetation and habitat of key species in line with original vegetation while limiting the abundance of weed species,
– Water bodies to have adequate storage requirements to hold rainfall from an 1:100 ARI event,
– Water contaminants should continue to be monitored until rehabilitation and revegetation considered successful,
– Before using topsoil, it should be determined whether the material contains weeds and hence deemed unreliable for rehabilitation.

# 3. Closure Implementation

## 3.1 Closure Stages

Final mine closure occurs in two distinct stages.

1. Decommissioning: involves removal and appropriate disposal of all infrastructure and contaminated material.
2. Rehabilitation: includes undertaking of specific earthworks to create appropriate landforms and subsequent re-vegetation of those landforms.

After the activity stages of closure a period of maintenance and monitoring occurs. This period can extend for many years to allow for the regeneration of vegetation and rehabilitation performance monitoring to occur. Compliance monitoring with the Environmental Authority is still required during this time.

Closure implementation stages can be applied through both planned and unplanned mine closure. A third option to be considered is the temporary shutdown of operations, in which case the project goes into a state of 'care and maintenance' until further notice.

## 3.2 Planned Closure

Planned closure takes place at the end of mine life, when no further exploitable mineral resource remains. Closure implementation will follow a project schedule outlined in a Post Closure Management Plan that will be submitted to the regulator at least six months prior to cessation of all mining and mineral processing activities. Planned closure may see mineral processing extend for some time after all actual mining ceases. All salvageable equipment and infrastructure will be removed as the miners retreat back out of the mine. All services to the mine workings (including dewatering operations) will cease and all access points and any underground openings will be sealed. An appropriate abandonment bund will be constructed around the entire mine pit.

Once mineral processing ceases, all mine related infrastructure (process plant, workshops, stores, core yards, magazine, laboratory, administration and support buildings) will be decontaminated prior to the dismantling and removal of all salvageable machinery, structures and plant. All remaining infrastructure will be demolished and either sold for scrap or buried on site. Any contaminated soils or water will be identified, assessed and if necessary remediated.

All decontamination work will be done in consultation with the relevant government guidelines and the effectiveness of such work audited by a suitably qualified external consultant. Rehabilitation activities on disturbance domains are commenced to create geotechnically stable, non-polluting landforms. It will only be possible to do the final reclamation works on the decant portion of the TSF after decommissioning, to allow time for dewatering and adequate drying of the tailings such that equipment can safely access the upper tailings surface. All mine landforms are to have water retaining closure designs and encapsulation of any PAF/mineralised material and tailings material. All surfaces are to be rehabilitated and seeded with appropriate seed stock. Where possible, progressive rehabilitation will occur during the operation stage and performance trends will be established well before closure. Rehabilitation performance monitoring will continue until such time as closure criteria have been met and the Final Rehabilitation Report accepted by the regulator.

## 3.3 Unplanned Closure

The unforseen, earlier than expected cessation of mining may happen due to a number of reasons, including market forces and initial overestimation of ore reserves. The closure process followed is similar to that for planned closure, except that many mine waste landforms will not have been constructed to final design.

At PJO, a number of ore and sub-grade ore stockpiles may remain on the ROM and adjacent WRD in the event of unplanned closure. These represent a resource that may in future years have considerable value to other mining companies. The mine pit and underground will also probably still contain potential ore and not be classified as sterile. In the event of an unplanned closure scenario, the processing plant and mining operation may cease operations simultaneously, with the result that all closure related work will need to be done by a third party.

It will be necessary to maintain the mine affected water management system (given the operational approach to water balance management) and basic services until such time as demolition crews are able to salvage equipment and infrastructure. This could add considerable expense to the closure provision and a cost benefit analysis will need to be done as soon after closure as possible, so that a timely decision can be made as to what, if anything, (pumping equipment and pipeline) is worth salvaging within the open pit.

## 3.4 Care and Maintenance

A third closure planning scenario may occur when a mine goes into temporary shut down or 'Care and Maintenance' (C&M). A C&M period may come about for a number of reasons including the possible sale of the operation to a third party. The C&M period may be months or years in duration, where site activities are reduced to a minimum.

It is expected that that following activities would be conducted during the C&M period:

- A risk assessment of the current requirements for the management of environmental aspects,
- The demobilisation of mining fleet,
- Continual operation of the mine affected water management system,
- Fencing off of all mine property, with locked gates to ensure that only official mine vehicles are able to gain access,
- Processing of the remaining ore stockpiles in some instances, in addition to cleaning the ROM Pad, ore bins, conveyor system, crushing and processing plant,
- Flushing and wash down of all areas prior to lubricating machinery,
- Where possible, return of any excess stores, lubricants, fuels, chemicals and spares to suppliers,
- Flushing of all tailings disposal pipelines, storage tanks and bins,
- Reducing fuel storage levels to that required by the remaining skeleton crew,
- Maintenance of buildings and infrastructure, including main access roads, in working order,
- Compliance monitoring and reporting as required by the site's Environmental Authority.

The operation would establish an C&M emergency response action plan, to be initiated if compliance monitoring indicates non-compliance with the terms of the site's EA.

# 4. Stakeholder Management

## 4.1 Stakeholder Consultation Planning

In the event of mine closure, whether that be planned, unplanned or a temporary transition into care and maintenance, there is a palpable effect on project stakeholders that is best managed by the proponent. The operation has a social responsibility beyond that of caring for its own employees. That responsibility can be discharged in the event of mine closure through implementation of a stakeholder consultation plan.

## 4.2 Stakeholder Identification

In order to estimate the impact of mine closure, the first step is identifying the mine's stakeholders. The mine employees and contractors are obvious stakeholders, as are landholders for underlying and neighbouring properties. However mine closure can have further impacts, for instance on local industry and business who relied on the presence of mine workers and their families.

At a high level, the town of Charters Towers is likely to be most heavily impacted by the closure of the PJO mine site.

## 4.3 Stakeholder Tiers

### Stakeholder Ranking

The next step after identifying stakeholders would be to divide them into tiers, using criteria on the frequency and degree of likely impact upon each tier to determine the tier structure. In identifying the tier system, the group can be broken down to the following:

- Tier One Stakeholders
  - Those likely to be impacted most frequently and most heavily.
- Tier Two Stakeholders
  - Those likely to be impacted with less frequency and less severity, but who will still have a high degree of interest in the opportunities and potential outcomes of the project.
- Tier Three Stakeholders
  - Those likely to be impacted infrequently and negligibly affected by the closure of the project.

### Tier One Stakeholders

For the purpose of the closure planning process, identified tier one stakeholders, or interested and affected parties are as follows:

- Staff and contractors of the PJO,
- Title holders across the tenement and on land bordering the tenement,
- Property managers on land across the tenement,
- The traditional owners of the land,
- Local government,

– Local interest groups including agricultural and business organisations such as the chamber of commerce,
– State government departments.

Given the commitment to meaningful engagement with these parties, PJO should aim to communicate specifically tailored information to these tier one stakeholders as a priority. These stakeholders should be sent all relevant information about the impending closure and be invited to participate in focus groups and a closure consultation committee.

These stakeholders will be sent all compulsory information, but should be given the opportunity to opt out of receiving any marketing collateral or general community updates.

### Tier Two Stakeholders

The tier two stakeholder listing includes the broader community around the project. Tier two stakeholders represent a much larger group including:

– Local businesses as individual entities,
– Primary, secondary and tertiary education institutions,
– Local financial institutions,
– Community groups including the Rotary Clubs, Lions Clubs and Country Women's Associations,
– Community engagement officers working with the local councils,
– Voluntary and welfare organisations in the Charters Towers region,
– Providers of services like power and water to the tenement.

Tier two stakeholders should be sent generic information on the impending closure, and given the opportunity to opt in to receiving any marketing collateral and general community updates.

### Tier Three Stakeholders

Tier three stakeholder listing includes state organisations, NGOs and businesses geographically removed from the immediate project region. Communication with tier three stakeholders is flexible, and allows stakeholders themselves to register increased levels of interest and request further information at any time in the consultation process. Similarly, tier two stakeholders who feel sufficiently informed can request less frequent information, or nominate specific areas of focus, moving themselves into tier three for communication strategy purposes.

## 4.4 Consultation Process

The Stakeholder Consultation Register has been developed to record consultation activities undertaken with stakeholder groups and individuals. This register allows for record keeping of stakeholder interests, comments and concerns and records Minjar's response to their comments and concerns. The Closure Communication strategy is detailed within Table 9. It is highly likely that certain aspects of closure will be of more interest to individual stakeholder groups, these have also been identified.

**Table 9: Closure Communication Engagement Strategy for Tier One and Two Stakeholders**

| Stakeholder Group | Proposed Consultation Timing (minimum) | Proposed Consultation Methods | Topics Likely to be Addressed |
|---|---|---|---|
| **Tier One Stakeholders** | | | |
| **Adjacent Farm Properties** | Annually or as requested by the stakeholder | Site/Community meetings<br>One on one meetings<br>Update emails | Erosion<br>Groundwater/surface water management<br>Feral animal control<br>Future land use |
| **Traditional Owners** | Annually, or as requested by the stakeholder | Site/Community meetings<br>One on one meetings<br>Closure Committee<br>Update emails | Erosion and surface water management<br>Groundwater/ surface water management<br>Future land use including impacts on traditional land use |
| **Dept of Environment and Heritage Protection** | Ongoing | Regular review of the Final Land use and Rehabilitation Plan<br>Site Inspections<br>Closure Committee<br>Update emails | Decommissioning<br>Safety<br>Rehabilitation progress and financial assurance<br>Closure criteria<br>Surface water and groundwater management<br>Sustainability<br>Final land use |
| **Charters Towers Council** | Annually, or as requested by the stakeholder | Shire council meetings<br>Site/Community meetings<br>Closure committee<br>Update emails | Future land use<br>Transition to post-mining business<br>Sustainability |
| **Registered interest-Community Groups** | Annually, or as requested by the stakeholder | Shire council meetings<br>Site/Community meetings<br>Closure Committee<br>Update emails | Sustainability<br>Transition to post-mining business<br>Welfare |
| **Tier Two Stakeholders** | | | |
| **Other Community Groups** | On an as-and-when basis (when there is news to be shared) | Community meetings and information sessions<br>One on one meetings | Sustainability<br>Transition to post-mining business |
| **Local Businesses and Services** | On an as-and-when basis (when there is news to be shared) | Community meetings and information sessions<br>One on one meetings | Contracting opportunities<br>Transition to post-mining business |

| | | | |
|---|---|---|---|
| **Other Government Depts and Utility Providers** | On an as-and-when basis (when there is news to be shared) | Community meetings and information sessions<br>One on one meetings | Decommissioning or sustaining use of infrastructure |

The Health Safety and Community Department is the main contact for stakeholder communications with regards to mine closure. The Department has regular contact with members of the local traditional owners, government departments, local community and farmers.

## 4.5 Employees

Employees will be updated at least one year prior to the closure of the site to ensure that they are provided with the information, support and training to minimise the impact of the closure of the operations. Employee consultation will be managed by the Minjar Human Resources Department. Prior to closure, feedback from the workforce will be collected on:

– Redundancy timing,
– Transfers,
– Closure concerns,
– Re-training,
– Advice on dealing with closure,
– Access to counselling.

The responses to the feedback sessions will form the basis for establishment of communication, training and counselling services. The following areas will be targeted and specific initiatives/tasks proposed for each:

– Communication/Information meetings – either directly with the employees or with their chosen representatives,
– Employee counselling services – to assist personnel in maintaining the effort with respect to safety and productivity until mine closure,
– Career and financial advice – to prepare for work prospects and other opportunities after closure,
– Employee appraisals – to ensure that performance until closure is maintained at the highest level possible,
– Training – to ensure that operating tickets are renewed.

# Final Land Use Objectives and Best Practice Rehabilitation Standards

## 1. Domains, Status, History and Status

### 1.1 Domain List

The site at PJO can be classified into a number of domains that will each require rehabilitation to achieve a pre-set final land use objective. These domains are:

- Open cut pits,
- Underground,
- Waste rock dump (WRD),
- Tailings storage facility (TSF),
- Processing plant (heavy infrastructure),
- Admin, workshops, magazine and stores (light infrastructure),
- Water management,
- Roads, fences, power lines, drains.

A schematic representation of the final landform depicting each domain and the drainage features of the project area can be found in the mapping appendix of this document.

## 2. Status

The rehabilitation and operational status of each domain was assessed over a number of site inspections in 2013. There has been no operational changes that differ from this inspection apart from the proposed Open Pits. The results of site inspection and status for each domain is detailed below.

### 2.1 Open Cut Pits

#### VERA

- Vera pit has a disturbance footprint of 16.8 ha and was mined in the mid-1990s and contains the portal for the underground mine.
- The final land use of the pit is impacted water storage and as a repository for PAF backfill.
- Mining has ceased in the pit; however, it is still an underground access. The underground active access LOM plan is currently three years. The planned date for completion for the abandonment bund is when the access is no longer required.

#### VENUE/VNU

- Venue/VNU pit has a disturbance footprint of 6.3 ha and was completed in 2013.
- The final land use of the pit is impacted water storage and as a repository for PAF backfill.
- Mining has ceased in the pit.

### CINDY

- Cindy pit has a disturbance footprint of 6.8 ha and has an access portal for the underground mine.
- The final land use of the pit is impacted water storage and as a repository for PAF backfill.
- Mining has ceased in the pit; however, it is still an underground access.

### JANET A

- Janet A pit has a disturbance footprint of 3.75 ha and was mined in 2012.
- The final land use of the pit is impacted water storage and potentially as a repository for PAF backfill.

### JANINE EAST

- Janine East pit has a proposed disturbance footprint of 3.0 ha.
- The final land use of the pit is impacted water storage and potentially as a repository for PAF backfill.

### JANINE NORTHWEST

- Janine Northwest pit has a proposed disturbance footprint of 1.9 ha.
- The final land use of the pit is impacted water storage and potentially as a repository for PAF backfill.

### ORCHID

- Orchid pit has a proposed disturbance footprint of 2.1 ha.
- The final land use of the pit is impacted water storage.

## 2.2 Underground Operations

- The Pajingo Underground has been in operation since the 1990's. It is expected to continue operations until 2021 under current LOM.
- Once decommissioned, the underground will be plugged with 20m of mine waste and then rebounding groundwater will flood the underground workings and portal area. Vent shafts will be closed through the placement of permanent concrete covers.
- The expected final closure date and completion plugging of the portal and covering of vent shafts is within two years of full mine closure.

## 2.3 Waste Rock Dumps, Including ROM and Stockpiles

### VERA ROM AND WRD

- Vera ROM/WRD has a disturbance footprint of 16.8 ha and waste material has been progressively placed. The original intention for the feature was as a ROM pad; however, subsequent mining has led to additional waste rock being stockpiled onto and adjoining the ROM. The current volumes of waste rock are not known. Although the waste is considered to be NAF there may be insufficient documentary evidence to support this with a PAF floor where ore has been stockpiled. It is likely the homogeneity of the stockpile will need to be reviewed further.
- The final land use of the rehabilitated landform area is light/intermittent grazing.
- The current closure date for the WRD is LOM closure in 2021.

### VENUE/VNU WRD

- Venue/VNU WRD has a disturbance footprint of 19.2 ha. The disturbance area includes a NAF WRD and a cleared area that previously contained PAF material, which has since been rehandled in to the pit.
- The final land use of the rehabilitated landform area is light/intermittent grazing.
- The cleared area will be ripped, topsoiled and seeded, drainage systems will be implemented to ensure runoff is directed appropriately and erosion is controlled.
- The current closure date for the WRD is 2021.

### CINDY WRD

- Cindy WRD has a disturbance footprint of 8.7 ha. Construction has been completed.
- The final land use of the rehabilitated landform area is light/intermittent grazing.
- The WRD is well revegetated and stable.
- This WRD has been closed and is in the monitoring phase.

### SCOTT LODE WRD

- Scott Lode WRD has a disturbance footprint of 24.2 ha. Construction has been completed.
- The disturbance area includes a NAF and a PAF stockpile on the disturbed top section of the WRD which is currently being considered for use in TSF lift programs at the Scott Lode in-pit TSF.
- Original waste rock dump from the Battle Mountain (Australia) mining of the Scott Lode deposit. Known to have been constructed over the period 1987 to 1992, and composed of oxide and primary (PAF) waste (Newmont, 2007).
- The design of the dump comprised a central core of selectively placed primary waste within basal and perimeter layers of oxide waste and an oxide waste cap and compacted soil cover (Pajingo Gold Mine Waste Rock Dump Lease Relinquishment Site Contamination Assessment, Lloyd Consulting Pty Ltd, 2000).
- Some remediation works have been completed on a number of occasions since 1999.
- The final land use of the partially rehabilitated landform area is light/intermittent grazing.
- The WRD's seepage sumps and drain system are in place and will remain in place to manage surface runoff and seepage from the WRD.

– In 2015 the WRD had a portion of contaminated transitional sulphide bearing material that had been incorrectly dumped on the margin was removed and hauled to the tailings dam for disposal.
– The WRD has since been closed but further maintenance work is required on the batters and final rehandle or in situ rehabilitation for the mine waste stored on the top needs to be completed. Depending on the schedule for further lifts of the TSFs and the impact that has in terms of the use of the stored material, the top of the landform may be rehabilitated fully prior to the end of mining.

#### JANET A STOCKPILE

– Placement occurred in 2012. The disturbance area is wholly a PAF stockpile. The material is currently being considered for use in TSF lift programs or will otherwise need to be rehandled in to the Janet A pit by September 2014 according to regulatory commitments.
– The final land use of the rehabilitated footprint area is very light/intermittent grazing in the long term.
– Final rehabilitation of the footprint should occur in 2014.

#### Proposed Open Pits (Janine & Orchid)

– No new waste dumps are proposed as part of this work in 2018.
– The WRD for these pits is on existing disturbance areas of the VNU Venue WRD and all PAF should it be encountered is within the VNU/Venue Pit void as current practise dictates.
– The existing ROM and a new ROM on the previously disturbed VNU/Venue PAF WRD footprint will be utilised for all ore from these proposed Open Pits. This will mean no new disturbance and on completion of use, the area can be scrapped and rehabilitated in a similar fashion to previous works at this location.

## 2.4 Tailings Storage Facilities

### TSF 1

– TSF 1 is a traditional paddock style tailings storage facility and has a disturbance footprint of 26.5 ha. Major deposition was paused in 2004 with the facility used on

occasion for small deposition events or excess water evaporation on a periodic basis. The tailings material is generally benign. The TSF was raised and has been used since September 2017 with the completion of SLP TSF.
- The final land use of the rehabilitated landform area is light/intermittent grazing.
- The TSF is well revegetated and generally stable.
- This TSF will not be finally closed until after the cessation of operations as it may be utilised as an evaporation pond during the final dewatering and closure of impacted water dams.

### Scott Lode In-pit TSF

- Scott Lode TSF is an in-pit TSF and has a disturbance footprint of 25.2 ha. Deposition has ceased in September 2017.
- The final land use of the rehabilitated landform area is light/intermittent grazing. The TSF will be sheeted with waste rock to a depth still to be determined, topsoiled and revegetated. A drainage plan is required to manage run on from the high wall and rainfall catchment. Existing clean water diversions will be maintained.
- This TSF will not be finally closed until after the cessation of operations as it may be utilised as an evaporation pond during the final dewatering and closure of impacted water dams. A cover design and drainage plan will be prepared in 2018-2019 to ensure the DSA is achieved.

## 2.5 Heavy Infrastructure

### Process Plant

- The Process Plant has a disturbance footprint of 2 ha. Current LOM estimates closure of the plant site in 2021.
- The final land use of the rehabilitated landform area is light/intermittent grazing.
- The Process Plant site will be the subject of a decommissioning plan closer to the time of final closure, which will include a plan for the removal or all mobile plant, infrastructure, salvage, inert waste and contaminated waste. The area will then be reprofiled, with drainage measures installed as required and the site revegetated using the standard methodologies applied throughout the operation.
- This Process Plant is currently operational with closure forecast for 2021. However this is subject to change through altered project economics or the institution of a care and maintenance period.

### Paste Thickener

- The Thickener Plant has a disturbance footprint of 2 ha. Current LOM estimates indicate closure of the Thickener in 2021. There is some possibility that the Thickener Plant may be moved from its current location at the edge of Scott Lode TSF to allow for expansion of the TSF, although this is as yet only conceptual.
- The final land use of the rehabilitated landform area is light/intermittent grazing.
- The Thickener Plant will be the subject of a decommissioning plan closer to the time of final closure, which will include a plan for the removal of all mobile plant, infrastructure, salvage, inert waste and contaminated waste. The area will then be reprofiled, with

drainage measures installed as required and revegetated using the standard methodologies applied throughout the site.
– The Thickener Plant is operational with closure forecast for 2021. However this is subject to change through altered project economics or the institution of a care and maintenance period.

## 2.6 Light Infrastructure

– Light Infrastructure areas have a cumulative disturbance footprint of approximately <10 ha and include administration areas, workshops and stores. Current LOM estimates indicate closure of these areas in 2021.
– The final land use of the rehabilitated landform area is light/intermittent grazing.
– Light Infrastructure will be the subject of a decommissioning plan closer to the time of final closure, which will include a plan for the removal or all mobile plant, infrastructure, salvage, inert waste and contaminated waste. The area will then be reprofiled, with drainage measures installed as require and revegetated using the standard methodologies applied throughout the site.
– Light infrastructure areas are operational with closure forecast for 2021. However, this is subject to change through altered project economics or the institution of a care and maintenance period.

## 2.7 Water Management Infrastructure and Dams

– Impacted water dams have various disturbance footprints as set out in the EA.
– The final land use of the closed dams is water storage.
– Impacted water dams will be the subject of a decommissioning plan closer to the time of final closure which will include a testing of sediments and removal and encapsulation of sediments in exceedance of established NEPM guidelines, construction of spillways, pipes or other overflow mechanisms which are to an approved design standard, removal of, or reprofiling of dam walls and embankment, monitoring of dam seepage or flow discharges at agreed frequencies for agreed water quality parameters.
– Impacted water dams are operational with closure forecast for 2021. However, this is subject to change through altered project economics or the institution of a care and maintenance period. Dams may continue to operate for a period after closure until water quality is demonstrated to meet criteria.

## 2.8 Roads, Fences, Pipelines and Drains

– The final land use of the rehabilitated disturbance area is light/intermittent grazing.
– The areas will be rehabilitated using the standard site techniques of reprofiling, establishing drainage controls where necessary, topsoil application, and seeding with native seed.

# 3. Rehabilitation Objectives

## 3.1 Contemporary Objectives

Contemporary rehabilitation objectives adopted by government (EHP) are proposed for Pajingo. The objectives include ensuring that the rehabilitated land must be to an agreed land use and is:

– Safe to humans, stock and wildlife,
– Non-polluting,
– Stable,
– Able to sustain an agreed post-mining land use.

The definition of 'an agreed land use' is the use of the landform after successful rehabilitation has been achieved. The use of the landform post successful rehabilitation should be agreed to with stakeholders during the closure planning process. The nominated land use can be different for each rehabilitated domain, for example an open pit may have a water storage as the final land use, where as a Waste Rock Dump's land use could be identified as habitat values or light intensity grazing.

A post closure proposed land use and land use classification, in accordance with EHP Guidelines on Land Suitability Classification, has been established for each disturbance area. In accordance with the Environmental Authority, completion criteria have been established for the contemporary rehabilitation objectives.

## 3.2 The Pit

### Post Activity Land Use Objectives

The intended final land use for the pit at PJO is as a residual void acting as water storage. In order to achieve this land use, it is vital that the water in the pit poses no harm to the receiving environment. The safety risk of a water body of this nature also needs to be managed, so the water body poses minimal risk to people, wildlife and stock. Indicative Completion Goals

The pit can be considered successfully rehabilitated to an agreed final land use when:

– Access to the pit is restricted by construction of a bund or fencing that would prevent accidental access to the pit.
– In the case of a person or animal ending up in the water body in the pit, egress from the pit is manageable through reasonable means.
– Drainage systems are successfully directing water with minimal erosion occurring.

### Rehabilitation Design Specifications and Activities

In order to achieve the indicative completion goals for rehabilitating the pit to an agreed final land use, the following actions should take place post operational activity.

Safety bund walls will be constructed around each void from appropriate material to limit access for human and livestock. The safety bund walls will be constructed in accordance with the Safety Bund walls around Abandoned Open Cut Mines – Guideline Document No. ZMA048HA (DoIR, 1997) in line with the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland (EPA, 1995). The Guideline requires the bund wall to have a minimum base width of 4m, a minimum height of 2 m and be positioned at least 20m from any area potentially affected by instability of the pit edge.

Where possible, access slopes into the pit should be retained to allow reasonable egress in the event of accidental immersion in the water body. A fence and signage around the perimeter of the pit may also be installed to restrict entry of wildlife and livestock.

Drainage systems will remain in place or be upgraded where necessary to manage clean surface water runoff around the pit and direct water towards the surrounding natural environment. Seepage from the pits should be directed into the seepage dams. The water level is to remain below freeboard level.

### Rehabilitation Success Monitoring

In order to ensure that the pit has been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's Guideline 18 Rehabilitation requirements for mining projects:

- Surface water quality should be monitored at regular intervals.
- The slope into the pit should be assessed for integrity and ongoing stability. This can be via photographic comparison.
- The site should be mapped to include the bund and the residual void and site inspections should take place at acceptable intervals to ensure the integrity of the bund and residual void.

Monitoring of indicators will start as soon as practically possible after decommissioning.

## 3.3 Waste Rock Dumps

### Post Activity Land Use Objectives

The post activity land use objectives for the waste rock dumps are for habitat value with and the possibility of light intensity cattle grazing where the steepness of the slopes allows it.

The steepness of the slopes on the finished landform must be conducive to a geotechnically stable structure, with erosion and sediment control landscaping that ensure erosion rates will not interfere with the achievement of final land use.

### Indicative Completion Goals

- With the exception of landforms that are partially rehabilitated (Scott Lode WRD) the maximum bench intervals should be approximately 10m with a two degree back slope, batters should have a slope of 1V:3H and a height of 10m.
- The berms and batters will be reshaped if required to achieve long term geotechnical stability.

– Drainage measures on tops and batter faces should be designed to ensure long term sustainability. Drainage features will aim to reduce the potential for runoff and seepage from the WRDs and minimise the potential for the pit water level to rise above the regional groundwater level.

## Rehabilitation Design Specifications and Activities

According to EHP's rehabilitation objectives and Pajingo's rehabilitation completion criteria, the waste rock dumps must demonstrate the following to ensure long-term safety:

On decommissioning, the respective WRD will be designed with batters to a slope of 1V:3H, approximately 10m in height. The benches will be approximately 10m with a two degree back slope to promote rain to flow away from the crest and towards the strongest part of the structure. Armour may be used in drains to ensure no unacceptable erosion or seepage occurs. The maximum bench intervals should be no greater than 20m. The aim when reshaping WRDs is to produce slopes with angles, lengths and shapes compatible with the surrounding landscape, suitable for the proposed post-mine land use of light intensity cattle grazing and not prone to an unacceptable rate of erosion. Combinations of acceptable slope angles and satisfactory revegetation usually maintain runoff velocities at roughly constant, non-erosive values.


**Figure 11: Cross section of the WRD**

WRDs which contain only NAF rock do not need to be clay capped. A layer of topsoil, or an engineered soil layer then a layer of topsoil will be constructed on the WRD once decommissioned.

WRDs that contain PAF rock will be rehandled to a approved pit void or have an appropriate cap applied. The store release cap will limit infiltration of surface water into the WRD and minimise the chance of contaminated leachate production. A layer of topsoil, or an engineered soil layer then a layer of topsoil will be constructed on the WRD clay capping.

The top surface of the WRD should be formed into a slightly convex shape, as this assists in reducing infiltration and diversion of the runoff to the outer slopes of the dump to designated drainage structures.

Each WRD's seepage sumps and drain system will remain in place or be upgraded where necessary to manage surface runoff and seepage from the WRDs.

The drains would be formed on grade and constructed by excavation to flow towards the pit. Drain surfaces would be armoured with strong, benign waste rock. To minimise scouring at the drain discharge area, rock armouring will be placed over a sufficient drain length to dissipate flows.

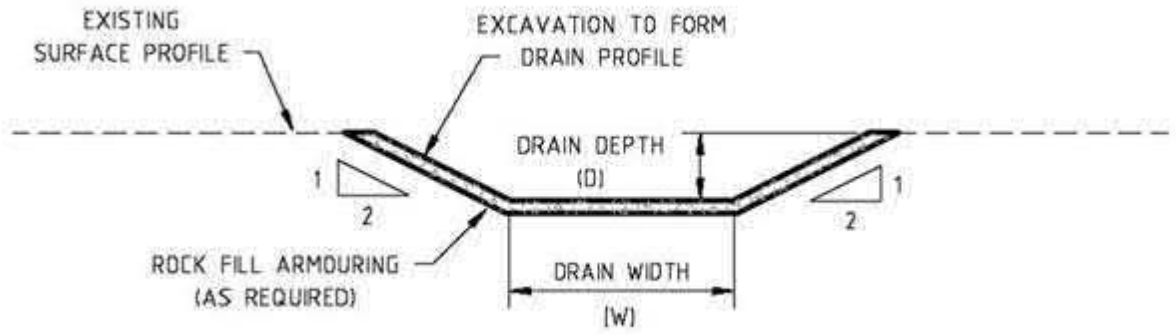


**Figure 12: Sample drainage cross section (Allan Watson Associates 2012)**

### Rehabilitation Success Monitoring

In order to ensure that the WRDs have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18: Rehabilitation requirements for mining projects*:

- Surface water quality should be monitored at regular intervals.
- Stream sediment quality should be monitored at regular intervals.
- Revegetation assessments should be undertaken biannually, once in the wet season and once in the dry season. Revegetation assessments should include:
  - Assessment of vegetation on both slopes and flat areas using the site rehabilitation monitoring methodology,
  - Land suitability assessment,
  - Slope stability analysis including an erosion assessment,
  - Determination of areas impacted by acid mine drainage (AMD) that will require further rehabilitation and revegetation,
- The slopes should be assessed for integrity and ongoing stability.

Monitoring of indicators will start as soon as practically possible after decommissioning.

## 3.4 Tailings Storage Facility

### Post Activity Land Use Objectives

The post activity land use objectives for a TSF is the ability to support habitat values and the possibility of light intensity cattle grazing on flat sections.

The steepness of the embankment slopes on the finished landform must be conducive to a geotechnically stable structure, with erosion and sediment control features that ensure erosion rates will not interfere with the achievement of final land use.

All hazardous material content of the final landform must be managed appropriately to ensure that any runoff of precipitation or seepage from the tailings storage facility poses no harm to the receiving environment or to environmental values.

## Indicative Completion Goals

– The post activity land use capability for the rehabilitated TSFs should be class VI for the top sections, and class VII for embankment slopes.
– The final landform should be geotechnically stable with no unacceptable erosion or seepage.

## Rehabilitation Design Specifications and Activities

In order to achieve the indicative completion goals for rehabilitating the TSFs to an agreed final land use, the following structure design and actions should be implemented post operational activity.

– The structure of the TSF should be constructed with maximum bench intervals no greater than 10m, maximum bench width no wider than 5m.

– The embankment slopes should be reshaped if necessary to achieve long term geotechnical stability and establish adequate drainage to limit ponding.
– The seepage sumps and drain system will remain in place or be upgraded where necessary to manage seepage from the TSF. Interception of any seepage will be redirected through a network of interception drains.
– Drain surfaces would be armoured with strong, benign waste rock. To minimise scouring at the drain discharge area, rock armouring will be placed over a sufficient drain length to dissipate flows.
– Construction of a low permeability store and release cap will be undertaken on decommissioning. The cover design for the TSF will be determined once rehabilitation trials have been completed. The possible TSF cap designs include, 100mm NAF rock, 100m engineered soil/rock layer and 200mm topsoil. The cover will be profiled to prevent ponding and promote clean surface water runoff to discharge to the environment.

The revegetation of the structures should involve ripping to 300mm on flat sections to allow for the establishment of vegetation. Revegetation of embankment slope and top surfaces using available topsoil resources (to 200mm thick where possible) and native, tree and pasture species to meet the final land use classes and original ecosystem. Significant exotic species control should be undertaken to allow native vegetation time to grow and establish, as required under the Land Protection (Pest and Stock Route Management) Act 2002.

## Rehabilitation Success Monitoring

In order to ensure that the TSFs have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18 Rehabilitation requirements for mining projects:*

– Surface water quality should be monitored at regular intervals.
– Stream sediment quality should be monitored at regular intervals.
– An assessment of slope stability should be undertaken.

- There should be an assessment of exposed hazardous material and treatment where required.
- Erosion and sediment control structures should be inspected regularly.
- Revegetation assessments should be undertaken periodically, both in the wet season and the dry season. Revegetation assessments should include:
  - An assessment of vegetation on both slopes and flat areas using the site rehabilitation monitoring methodology
  - A land suitability assessment.

Monitoring of indicators will start as soon as practically possible after decommissioning.

## 3.5 Roads and Access Tracks

### Post Activity Land Use Objectives

The intended final land use for road and access tracks at PJO is light intensity grazing. In order to achieve this land use, it is vital that all areas are rehabilitated, with erosion managed and runoff water of a quality that does not present a risk of environmental harm.

### Indicative Completion Goals

- Surfaces should align with natural contours of the land either side.
- If access roads are to remain, these should be done so under written agreement with the landholder and should be left in an appropriate condition.

### Rehabilitation Activities

In order to achieve the indicative completion goals for rehabilitating roads and access tracks to an agreed final land use, the following actions should take place post operational activity.

Higher road surfaces should be minimised to align with the natural contour of the land. Slopes should be minimised to limit erosion potential and water runoff potential. Revegetation work should involve the ripping to 300mm on all sections to allow for the establishment of vegetation. Revegetation should occur using available topsoil resources (to 100mm thick where possible) and native, tree and pasture species to meet the final land use. Significant exotic species control should be undertaken to allow native vegetation time to grow and establish, as required under the Land Protection (Pest and Stock Route Management) Act 2002.

### Rehabilitation Success Monitoring

In order to ensure that the roads and access tracks have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18 Rehabilitation requirements for mining projects*:

- Surface water quality should be monitored at regular intervals.
- Stream sediment quality should be monitored at regular intervals.
- Accumulation of fine sediment in streams downstream of rehabilitated roads should be monitored.
- Erosion and sediment control structures should be inspected regularly.
- Revegetation assessments should be undertaken periodically, both in the wet season and the dry season. Revegetation assessments should include:

– Assessment of vegetation on both slopes and flat areas using approaches specified in the Pajingo Environmental Monitoring Manual,
– Land suitability assessment.

## 3.6 Workshops and Light Infrastructure Management Areas

### Post Activity Land Use Objectives

The intended final land use for workshops and infrastructure areas at PJO is light intensity grazing. In order to achieve this land use, it is vital that all areas are rehabilitated appropriately, with erosion managed and runoff water of a quality that does not present a risk of environmental harm.

### Indicative Completion Goals

The post activity land use capability for workshop and infrastructure areas at PJO should be class VI unless otherwise agreed to be maintained on the land:

– Surfaces should align with natural contours of the land.
– If any infrastructure is to remain, this should be done so under written agreement with the landholder and should be left in an appropriate condition.
– Otherwise, all infrastructures should be decommissioned and removed from the site Recoverable scrap metal to be recycled.
– Any contaminated soil should be removed appropriately and managed adequately before rehabilitation of these domains take place.
– Drainage systems will remain in place or be upgraded where necessary to manage surface runoff effectively.

### Rehabilitation Activities

In order to achieve the indicative completion goals for rehabilitating workshop and infrastructure areas to an agreed final land use, the following actions should take place post operational activity.

Any contaminated soil from workshop areas will be cleaned up using appropriate spill kits and managed to prevent further environmental harm. Rehabilitation works will commence once the area to be rehabilitated has been verified as being at or below acceptable contamination levels. Where activities have resulted in land contamination, a land contamination assessment should be undertaken in compliance with the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland* (DoE 1998). Where contamination exists, the site management plan should include clean-up options.

All surfaces should be minimised to align with the natural contour of the land. Any slopes should be minimised to limit erosion potential and water runoff potential. Revegetation work should involve the ripping to 300mm on all sections to allow for the establishment of vegetation. Revegetation should occur using available topsoil resources (to 100mm thick where possible) and native, tree and pasture species to meet the final land use. Significant exotic species control should be undertaken to allow native vegetation time to grow and establish, as required under the Land Protection (Pest and Stock Route Management) Act 2002.

### REHABILITATION SUCCESS MONITORING

In order to ensure that the workshop and infrastructure areas have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18: Rehabilitation Requirements for Mining Projects*:

- Surface water quality should be monitored at regular intervals.
- Stream sediment quality should be monitored at regular intervals.
- Erosion and sediment control structures should be inspected regularly.
- Revegetation assessments should be undertaken periodically, both in the wet season and the dry season. Revegetation assessments should include:
  - Assessment of vegetation on both slopes and flat areas using approaches specified in the Pajingo Environmental Monitoring Manual
  - Land suitability assessment.

Monitoring of indicators will start as soon as practically possible after decommissioning.

## 3.7 Water Management Infrastructure and Dams

### POST ACTIVITY LAND USE OBJECTIVES

The intended final land use for water management infrastructure and dams at PJO are to remain as water storages. In order to achieve this land use, it is vital that the water in the dams poses no harm to the receiving environment. The safety risk of a water body of this nature also needs to be managed, so the water body poses minimal risk to people, wildlife and stock.

### INDICATIVE COMPLETION GOALS

The water dams can be considered successfully rehabilitated to an agreed final land use when:

- Dam walls and bypass channels are stabilised with adequate vegetation or rock.
- Erosion does not compromise dam wall integrity.
- In the case of a person or animal ending up in the water body, egress from the dam should be manageable through reasonable means.
- Drainage systems will remain in place or be upgraded where necessary to manage surface runoff effectively.

### REHABILITATION ACTIVITIES

In order to achieve the indicative completion goals for rehabilitating water dams to the agreed final land use, the following actions should take place post operational activity.

- Sediment dams should be de-silted as necessary with any sediment placed in the pit.
- Where appropriate, dam walls should be re-profiled to allow adequate drainage and limit erosion potential.
- Dam walls and bypass channels should be stabilised by using native vegetation or rock.

### REHABILITATION SUCCESS MONITORING

In order to ensure that water dams have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18: Rehabilitation Requirements for Mining Projects*:

- Surface water quality should be monitored at regular intervals as specified in the Pajingo Environmental Monitoring Manual.
- The slope into the dams should be assessed for integrity and ongoing stability.
- If dam walls and bypass channels are revegetated, revegetation assessment should occur periodically, both in the wet season and the dry season. Revegetation assessments should include:
  - Assessment of vegetation on both slopes and flat areas using approaches specified in the Pajingo Environmental Monitoring Manual.

## 3.8 Summary of Rehabilitation Objectives and Control Measures

This section summarises the rehabilitation objectives for the mine domains and outlines the control measures and the basic monitoring to be undertaken to determine if the rehabilitation is successful. Monitoring methods and revegetation completion criteria are described in detail in Section 6.

**Table 10: Rehabilitation objective, control measures and monitoring**

| Rehabilitation objective | Control Measure | Monitoring |
|---|---|---|
| **The Pit** | | |
| Minimise erosion from pit and surrounding area. | Runoff from the area discharges to a stable drainage system. Areas of unacceptable erosion that poses an accident hazard to a walking human or could lead to uncontrolled water discharge from an area are to be reworked and erosion control methods applied. | Surface water monitoring at regular intervals. |
| Access to the pit and water storage facilities is restricted. | A 2m high bund with a 4m base should be constructed approximately >10 metres from the lip of the residual voids to prevent accidental access. Fences and signs established where required. | The site should be mapped to include the bund and the residual void and site inspections should take place at acceptable intervals to ensure the integrity of the bund and residual void. |
| Slope in pit is stable. | Pit slope angles and lengths are designed to acceptable industry standard. | The slope into the pit should be assessed for integrity and ongoing stability. |
| In the case of a person or animal ending up in the water body, egress from the pit is manageable. | Access slopes into the pit should be retained. | The slope into the pit should be assessed for integrity and ongoing stability. |
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Waste Rock Dumps** | | |
| Stability of Waste Rock dumps and no unacceptable erosion. | The maximum bench intervals should be approximately 10m with a 2° back slope, batters should have a slope of 1V:3H and height of 10m. | |
| The berms and batters will be reshaped if required to achieve long term geotechnical stability. | Slope stability analysis including an erosion assessment to ensure integrity and ongoing stability. | |
| No potentially harmful seepage or runoff to the receiving environment. | Drainage measures on tops and batter faces should be designed to ensure long term sustainability. | Surface water quality should be monitored at regular intervals. Stream sediment quality should be monitored at regular intervals. |

| Rehabilitation objective | Control Measure | Monitoring |
|---|---|---|
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Tailings Storage Facility** | | |
| Steepness of the embankment slopes on the TSF must be conducive to a geotechnically stable structure. | The final TSF design should incorporate the following structure specifications:<br>The maximum bench intervals should be no greater than 10m.<br>The maximum bench width no wider than 5m. | Assessment of slope stability at regular intervals. |
| No potentially harmful seepage or runoff to receiving environment. | Interception of any seepage will be redirected through a network of interception drains. | Surface water quality should be monitored at regular intervals. Stream sediment quality should be monitored at regular intervals. Assessment of exposed hazardous material and treatment where required. |
| No unacceptable erosion from TSF. | The embankment slopes should be reshaped if necessary to achieve long term geotechnical stability and establish adequate drainage. | Erosion and sediment control structures should be inspected regularly. |
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Roads and Access Tracks** | | |
| No potentially harmful runoff to receiving environment. | Interception of any seepage will be redirected through a network of interception drains. | Surface water quality should be monitored at regular intervals. Stream sediment quality should be monitored at regular intervals. Accumulation of fine sediment in streams downstream of rehabilitated roads should be monitored. |
| No unacceptable erosion. | Slopes should be minimised to limit erosion potential and water runoff potential. | Erosion and sediment control structures should be inspected regularly. |
| Surfaces should align with natural contours of the land either side. | Higher road surfaces should be minimised to align with the natural contour of the land. | Land suitability assessment. |

| | | |
|---|---|---|
| Revegetate area. | Rip surfaces, add topsoil, add mix of seed. | Monitor species diversity, native abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Workshops and Light Infrastructure Areas** | | |
| **Rehabilitation objective** | **Control Measure** | **Monitoring** |
| Surfaces should align with natural contours of the land. | All surfaces should be minimised to align with the natural contour of the land. Any slopes should be minimised to limit erosion potential and water runoff potential. | Land suitability assessment Erosion and sediment control structures should be inspected regularly. |
| Removal of infrastructure from site. | Infrastructure should be decommissioned and removed from the site. Recoverable scrap metal to be recycled. | N/A |
| Any contaminated soil should be removed appropriately and managed adequately before rehabilitation is undertaken. | Contaminated soil will be cleaned up using appropriate spill kits and managed to prevent further environmental harm. Contamination assessment and testing to be undertaken to ensure contamination levels are acceptable. | Surface water quality should be monitored at regular intervals. Stream sediment quality should be monitored at regular intervals. |
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Water Management Infrastructure and Dams** | | |
| Water storages are safe and stable. | Dam walls and bypass channels are stabilised with adequate vegetation or rock. Sediment dams should be de-silted as necessary with any sediment placed in the pit. | Surface water quality should be monitored at regular intervals as specified in the Pajingo Environmental Monitoring Manual. The slope into the dams should be assessed for integrity and ongoing stability. |
| Erosion does not compromise dam wall integrity. | Where appropriate, dam walls should be re-profiled to allow adequate drainage and limit erosion potential. | The slopes should be assessed for integrity and ongoing stability. |
| In the case of a person or animal ending up in the water body, egress from the pit is manageable. | Access slopes into the water body should be retained. | The slopes should be assessed for integrity and ongoing stability. |
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |

# 4. Knowledge Gaps and Research Program

The Final Land Use and Rehabilitation Plan is a living document that is based on the current Plan of Operations, EA and best practice rehabilitation techniques. In order to prepare for the closure of the mine, all knowledge gaps must be filled.

Studies required to close knowledge gaps should be undertaken with the operating mine life of each domain in mind. Milestones have been assigned to each study area with priority given to work that is a dependency for any aspect of another study.

Major milestones for the research program include the completion of the hydrological, geotechnical and geochemical investigations in addition to the rehabilitation trials. These investigations and trials would be most effective if completed by late 2019 to early 2020 to allow sufficient time to undertake the studies and to implement the findings into rehabilitation activities at the Pajingo site.

## INVESTIGATION INTO THE FINAL FOOTPRINT OF EACH MINE DOMAIN

The final footprint, volume and characteristics of the waste rock material for Venue/VNU, Scott Lode WRD, Vera WRD and Janet A Stockpile will need to be determined in order to design the final drainage and abandonment bunds and to decide the placement of the PAF waste rock material.

**Milestone timeframe: December 2020**

## REHABILITATION TRIALS

Further research will be undertaken which involves rehabilitation trials at Pajingo. Results from these trials will add to the rehabilitation knowledge already gained from the Cindy WRD rehabilitation at Pajingo. A number of rehabilitation trial methods would be used to find the most effective style of rehabilitation for each site domain, focussing mainly on the TSF, water storage dams and light infrastructure domains in the project area. Over a period of approximately 12 months a small scale representative area of approximately 1 – 2 hectares would be used to trial a variety of rehabilitation options including cover type and thickness, seed species and proportion of understorey to overstorey species. A 12 month trial will be undertaken so that monitoring of progress can occur over the dry season and wet season.

Trial approaches will be undertaken on the TSF to determine the most effective rehabilitation method. Growth of seed will be investigated using the following substrate:

– TSF material,
– TSF material covered with topsoil,
– TSF material, engineered rock/soil layer and topsoil,
– TSF material, clay capping, engineered rock/soil layer and topsoil.

## GEOTECHNICAL INVESTIGATION

– A geotechnical investigation should be undertaken on Scott Lode WRD to ensure that the drainage measures are adequate to ensure long term erosional stability.

**Milestone timeframe: June 2019**

## WATER STORAGE PLAN – TREATMENT AND DISCHARGE

– Water storage plans for estimates of water volume, which will not be dischargeable and require passive or active treatment will need to be created. The plans should include intended methodologies of water treatment and expected duration of treatment, post closure monitoring locations, frequency and parameters.

**Milestone timeframe: June 2020**

### DECOMMISSIONING AND SALVAGE PLAN

– A decommissioning and salvage plan for the removal of the process plant, thickener and light infrastructure will be created.

**Milestone timeframe: June 2020**

# 5. Revegetation Activities

## 5.1 Ripping and Topsoil Preparation

All surfaces to be rehabilitated should be ripped to 300mm to increase the success of seeding. Before using topsoil, it should be determined whether the material contains weeds and hence deemed unsuitable for rehabilitation. It should also be determined whether topsoil contains suitable nutrients or whether fertiliser application will be required.

The design criteria for ripping operations are represented in Table 11. The slope of the land determines the spacing between rip lines; this acts to reduce soil erosion and increase plant establishment rates.

**Table 11: Ripping design for surface preparation**

| Slope | Ripping Depth | Tyne Spacing |
|---|---|---|
| **>10%** | 300mm | <1.5m |
| **5-10%** | 300mm | <2.5m |
| **<5%** | 300mm | <5m |

## 5.2 Topsoil Spreading

Topsoil to be used for rehabilitation will be taken from topsoil stockpiles around the Pajingo site. According to the Plan of Operations - Financial Assurance calculations, the approximate amount of topsoil required to rehabilitate the project area is 420,000 $m^3$, assuming a depth of 100mm.

The following treatments are recommended in order to maximise the potential of soils used in the rehabilitation program:

– Topsoil to be spread to a depth of 100 mm to 200 mm at areas being rehabilitated,
– Where required, erosion control methods will be implemented,
– Topsoil to be replaced to locations as near as possible to its point of origin. This will be undertaken to minimise transport costs and maximise the potential for germination from within the soil seed bank.

## 5.3 Contouring

Surface contouring will be undertaken in the preparation of disturbed areas prior to the establishment of vegetation. Surface contouring will minimise erosion and maximise beneficial land use.

## 5.4 Seeding

Re-establishment of vegetation will be based on direct seeding. The plant species in Table 12. are potential species for PJO rehabilitation and a sub set of these species is used on specific rehabilitation projects based on specific local vegetation types, seed availability and land use factors such as where grazing or woodland land use objectives are more or less prominent in particular settings.

Seeds will be sourced from Greening Australia's Seed Bank or an equivalent approved provider. The topsoil stockpiled on site may also contain seeds, these seeds will be used where available. The seeds in the stockpiles are native to the area; therefore, their chance of growth is higher than seeds that are not local to the site. Seeds will be spread mechanically or by hand and watered via water truck, where appropriate.

**Table 12: Potential Rehabilitation Species**

| Family | Species Name | Common Name |
|---|---|---|
| **Tree/Shrub** | | |
| ***Fabaceae*** | *Acacia bidwillii* | Corkwood wattle, Dogwood |
| | *Acacia holosericea* | Candelabra wattle |
| ***Rhamnaceae*** | *Alphitonia excelsa* | Red ash |
| ***Sapindaceae*** | *Atalaya hemiglauca* | Whitewood |
| ***Myrtaceae*** | *Corymbia dallachyana* | Dallachy's gum |
| | *Corymbia erythrophloia* | Variable-barked bloodwood |
| | *Corymbia tessellaris* | Moreton bay ash, Carbeen |
| | *Eucalyptus brownii* | Reid river box |
| | *Eucalyptus crebra* | Narrow-leafed ironbark |
| | *Lophostemon grandiflorus* | Northern swamp mahogany |
| | *Melaleuca leucadendra* | Weeping tea-tree, Weeping paperbark |
| ***Proteaceae*** | *Grevillea striata* | Beefwood, Silver honeysuckle |
| **Grass** | | |
| ***Poaceae*** | *Aristida calycine* | Dark wiregrass |
| | *Aristida latifolia* | Feathertop wiregrass |
| | *Bothriochloa ewartiana* | Desert bluegrass |
| | *Chloris inflate* | Swollen fingergrass |
| | *Dichanthium fecundum* | Curly bluegrass |
| | *Dichanthium sericeum* | Queensland bluegrass |
| | *Heteropogon contortus* | Spear grass |
| | *Themeda triandra* | Kangaroo grass |

Any seeds waiting for use in rehabilitation should be stored in cool, dry conditions and protected from insects. Some seeds may require pre-treatment to enhance or facilitate germination. All direct seeding should take place prior to the wet season to allow for adequate rainfall during the establishment period. Establishment of seedlings should take place in approximately one month with adequate rainfall. Reseeding may be necessary if germination fails in some areas.

The ratio of each species used in the rehabilitation seed mix will be varied based on the rehabilitated land use type for the area. For example, the seed mix for areas being rehabilitated to low intensity grazing would have a higher proportion of grass species than tree species. Whereas, native tree and shrub species would dominate the seed mix for areas to be returned to bushland.

Weed invasion should be controlled by spot spraying during the establishment period to ensure native species are not outcompeted. The Pajingo Weed Management Plan will be implemented to make sure there is a balance between revegetation initiatives and the management of existing weed species and those established due to land disturbance.

# 6. Rehabilitation Monitoring

A significant component of determining the rehabilitation success of decommissioned sites is to monitor vegetation re-establishment, growth and sustainability. Objectives for revegetation will be monitored by the methods identified in this section. Specific criteria, standards and corrective actions being used to determine rehabilitation success are defined in Table 14.

## 6.1 Revegetation Monitoring Methods

The framework for rehabilitation monitoring will be based on the principles of Ecosystem Function Analysis (EFA). The EFA encompasses the following components, vegetation structure and composition, as well as photographic comparison and habitat complexity. EFA will be used to obtain information on the success of rehabilitation by drawing comparisons to control/analogue sites for a variety of target values. Monitoring will be undertaken in both dry and wet seasons periodically to capture seasonal variability in growth of vegetation.

Regular vegetation monitoring forms a relevant requirement by EHP to make decisions on the adequacy and sustainability of rehabilitation. EHP's *Guideline 18: Rehabilitation requirements for mining projects* states that monitoring the indicators for an area of progressive rehabilitation should result in a clarification of issues, minimisation of risks and an increasing certainty in the sustainability of the rehabilitation.

As part of PJO's ongoing commitment to environmental management, areas disturbed by mining activity at the Pajingo Mine are progressively rehabilitated. The general objective of rehabilitation is to rehabilitate land to a condition, which is safe, stable and self-sustaining. Vegetation monitoring of these areas is undertaken to establish whether the areas are progressing towards achieving self-sustaining ecosystems and stable environments.

## 6.2 Transect Monitoring

Transects were established in 1999 on rehabilitated and undisturbed control areas of the Pajingo mining leases, as discussed in Mattiske's *Assessment of Rehabilitation Areas*.

Where possible, 100m transects were established; however, in some areas, this was not possible due to the constraints of the specific sites (e.g. the transects down the slopes on Scott Lode were slightly less than 100m as the slope ended and changed to undisturbed native vegetation). These transects have been monitored annually since 1999 - 2015.

Monitoring is undertaken following the wet season (approximately April each year). A total of 32 transects are established at the Pajingo Mine in rehabilitated areas and relatively undisturbed control areas. Transects range in length from 30 to 100 metres and include 1m x 1m quadrats at 5m intervals. A summary of transects used for quadrat monitoring at Pajingo Mine as shown in Table 13.

**Table 13: Rehabilitation Monitoring Locations - Transects and Quadrats**

| Area | Transect no. | Transect length (m) | Number of quadrats | Topography | Easting (AGD84) | Northing (AGD84) |
|---|---|---|---|---|---|---|
| Cindy | 1 | 30 | 6 | flat | 443427 | 7728985 |
| Cindy | 2 | 30 | 6 | flat | 443374 | 7728975 |
| Cindy | 3 | 35 | 7 | flat | 443323 | 7728968 |
| Cindy | 4 | 45 | 9 | flat | 443277 | 7728949 |
| Cindy | 5 | 40 | 8 | flat | 443230 | 7728941 |
| Cindy | 6 | 30 | 6 | slope | 443254 | 7728937 |
| Cindy | 7 | 40 | 8 | slope | 443301 | 7728949 |
| Cindy | 8 | 50 | 10 | slope | 443353 | 7728962 |
| Cindy | 9 | 55 | 11 | slope | 443402 | 7728971 |
| Cindy | 10 | 100 | 20 | slope | 443483 | 7729000 |
| Cindy | 11 | 100 | 20 | slope | 443439 | 7729018 |
| Scott Lode | 16* | 100 | 20 | flat | 441915 | 7730382 |
| Scott Lode | 17 | 100 | 20 | flat | 441949 | 7730572 |
| Scott Lode | 18 | 100 | 20 | slope | 441936 | 7730833 |
| Scott Lode | 19 | 100 | 20 | flat | 441740 | 7730679 |
| Scott Lode | 20 | 100 | 20 | slope | 441852 | 7730827 |
| Scott Lode | 21* | 100 | 20 | flat | 441937 | 7730263 |
| Scott Lode | 22 | 90 | 18 | slope | 441714 | 7730767 |
| Scott Lode | 23 | 95 | 19 | slope | 441680 | 7730537 |
| Exploration | 12 | 100 | 20 | flat | 443165 | 7728103 |
| Exploration | 13 | 100 | 20 | flat | 443195 | 7727999 |
| Control | 14 | 100 | 20 | flat | 443174 | 7727889 |
| Control | 15 | 100 | 20 | flat | 443590 | 7728280 |
| Control | 24* | 100 | 20 | flat | 441478 | 7730256 |
| Control | 25 | 100 | 20 | slope | 442434 | 7730204 |
| Control | 26 | 100 | 20 | slope | 442435 | 7730270 |
| Control | 27 | 100 | 20 | flat | 443921 | 7728873 |
| Control | 28 | 100 | 20 | flat | 442019 | 7727586 |
| Control | 29 | 100 | 20 | flat | 442134 | 7727617 |
| K dump | 30 | 40 | 8 | Flat | 442129 | 7729974 |
| K Dump | 31 | 44 | 8 | Flat | 442210 | 7729967 |
| K Dump | 32 | 50 | 10 | flat | 442268 | 7729954 |

* Tree plots associated with transect (approx. 25 x 25 metres)

### Quantitative Vegetation Monitoring

Rehabilitation data to be recorded at each transect should include the following parameters:

- Species diversity,
- Species abundance,
- Species composition,
- Tree Density (trees/ha),
- Shrub Density (shrubs/ha),
- Herb / Grass Density (grasses/ha),
- Dry matter production,
- Habitat complexity,
- Number of new recruits,
- Stocking rates,
- Erosion indicators (depth of rills or erosion lines, surface crusting, slopes),
- Photographic records of the site to provide a visual record of the vegetation, erosion, and general appearance of each reference and rehabilitation site over time.

Transect monitoring methodology involves:

- Transects up to 100m in length are to be set up with a measuring tape, marked with a picket at 0m.
- At each 5m interval, 1 x 1m quadrats are formed along the transect. The quadrat should extend towards the right and the end of the transect.
- Within each quadrat the following parameters shall be recorded:
    - Number of individuals of each species present (separated into live and dead). Individuals that are not rooted inside the quadrat shall not include in the count of individuals.
    - Percentage foliage cover (%) of each species present (separated into live and dead). Foliage cover is estimated by eye. Overhanging foliage (e.g. overhanging wattle canopy) shall be included in the estimate of foliage cover.
    - Litter cover (%) and type (e.g. leaves, logs etc.).
    - Bare ground cover (%) observed.

## 6.3 Photographic Monitoring

Photographic monitoring and review over time has replaced landscape functional analysis (LFA) as a major component of EFA and will be used to determine how the rehabilitated area is performing when presented with possible disturbance and various climatic conditions. In order to undertake consistent imagery suitable for comparison, established photo points will be installed for one sloped site and one flat site within each domain.

*Landscape Function Analysis: Procedures for monitoring and assessing landscapes with special reference to mine sites and rangelands* by Tongway and Hindley is considered a best practice guide for LFA. LFA will be considered for periodic review of the sites but no longer on annual basis at the Pajingo site. The photographic monitoring method for each transect should include:

### Site Imagery

- Prior to walking the transect it is important to take an undisturbed image.

– Place the digital camera flat on the star picket mount with the landscape function set. NOTE: Ensure camera has GPS active and record starting image number for each transect.

– Take several images with differing amounts of horizon to allow for angle changes over the years with tree growth, user differences etc.

#### WALKING THE TRANSECT AND IDENTIFYING FEATURES

– After taking images walk the transect noting erosion scours and condition of the surface including litter, erosion type and severity, amount of deposited materials and tracks/impacts.

#### QUANTIFYING VEGETATION COVER

– Using quadrats to quantify vegetation cover, which is explained further in Section 6.6.

## 6.4 Tree Plot Monitoring

Adjacent to transects 16 (Scott Lode), 21 (Scott Lode) and 24 (control) additional Tree Plots shall be monitored. Tree plots measure 25m x 25m.

On Scott Lode, each tree plot is immediately to the right of the transect, with the transect forming the left-hand boundary of the plot. The control plot is also positioned on the right-hand side of the transect, although it is separated by about 50m. Pickets are arranged at 10m intervals around the outer perimeter of each plot.

For each tree over 130cm in height, the following parameters shall be recorded:

– Species.
– Height. This is measured from a distance about 10m away from the tree, using an inclinometer.
– Reproductive status of the tree (i.e. whether bearing flowers or fruit).
– Potential cause of any physiological stress (e.g. drought, insect attack etc.);
– Condition. This is visually assessed, using a 5 level scale:

- Healthy
- Slightly stressed
- Stressed
- Very stressed
- Dead

For eucalypt species, the following extra data is to be recorded:

- Number of stems
- Condition of each stem
- Diameter of each stem at breast height (DBH) measured using measuring tape.

## 6.5 General Photographic Monitoring

General photographic monitoring will be undertaken as part of the rehabilitation monitoring plan. Photographs provide a record of the conditions of the rehabilitated areas and also allow for qualitative comparisons of the site over the years of rehabilitation. Photos should be taken approximately 1.5m above the ground, with comments noted. NOTE: Ensure camera has GPS active and record starting image number for each transect.

## 6.6 Statistical Analysis

During rehabilitation monitoring, all observations and parameters are to be recorded in the field. A report summarising the monitoring data and statistical analysis is to be periodically prepared by a consultant discussing the results in relation to progress towards the final rehabilitation criteria and provide recommendations for improvements or changes in management practices to move towards these final criteria.

- Statistical analysis for the quadrats along the transects include;
  - Species diversity is calculated by using total density, i.e. live + dead, with introduced or weed species excluded:
    - Species richness (no. of species per quadrat);
    - Shannon-Wiener diversity (H′), calculated using the formula:

$$H' = -\sum p_i \ln p_i,$$

Where $p_i$ is the proportion of the total number of individuals occurring in species i.

- Comparisons between the parameters are to be made using an analysis of variance (ANOVA) to determine significant differences. Species that are recorded in more than 30% of transects are to have their total densities (live + dead) compared between rehabilitation and control areas.
- Species composition is to be compared between rehabilitation and control areas using the Bray-Curtis index of similarity ($IS_B$), which determines the similarity of different communities based on the species present as well as their relative abundance. The index is calculated according to the formula:

$$IS_B = \frac{2(jN)}{(aN + bN),}$$

where aN = the number of individuals in community A

bN = the number of individuals in community B

jN = the number of individuals common to both communities.

Similarity ranges from 0 for communities with no species in common, to 1 for communities with identical species in identical abundance. Similarity is to be calculated using total density (live + dead) of native and weed or introduced species.

Statistical analysis for the tree plot establishment and monitoring shall be based on tree height and DBH measures compared between the rehabilitation and control plots using analysis of variance (ANOVA) for significant differences. Comparisons of tree stress between rehabilitation and control plots are also to be made using the Kruskal-Wallis test (SYSTAT 7.0.1) which is the non-parametric analogue of a one-way analysis of variance.

## 6.7 Water and Stream Sediment Monitoring

The monitoring locations, frequencies and specification of analysis requirements are set out in the current Environmental Authority with detailed procedures prescribed in the Pajingo Environmental Monitoring Manual.

Monitoring activities will occur in a similar fashion to the operational period, however frequency of monitoring will be reduced according to the level of data and trend analysis required.

## 6.8 Rehabilitation Success Criteria

Rehabilitation success of the Pajingo mine site will be determined by achieving the rehabilitation goals set out in this plan. The criteria, standards and corrective actions being used to determine rehabilitation success are defined in Table 14 to Table 16.

**Table 14: EA Rehabilitation Completion Criteria for 1-2 years**

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Has the area been ripped? (<0.5m depth?) | All ripping should be on the contour to minimise water runoff and soil erosion | Minimal uncontrolled water runoff or soil erosion. | Areas of unacceptable erosion (i.e. That which poses an accident hazard to a walking human or could lead to uncontrolled water discharge from an area) to be reworked and erosion control methods applied. |

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Does runoff from the area discharge to a stable drainage system? | Runoff from the area discharges to a stable drainage system. | Runoff leaves the area by a stable drainage system. | As above. |
| Is there adequate cover of topsoil or other nominated material? | Soil should be spread across the whole rehabilitated area. Areas less than 0.5 ha not receiving soil are acceptable provided these areas do not exceed 30% of the rehabilitated area. | Soil is spread over a minimum of 70% of the rehabilitated area. | Soil combined with additional seed/fertiliser may be used in disturbed areas where topsoil unavailable. |
| Are there adequate densities of both Eucalypt and acacia sp. In comparison with reference sites? | Rehabilitated areas must have plant density that will meet proposed land use. | An average of > 500 stems per ha to be present at 1-2 years, | Rehabilitated areas not meeting the standard will be reseeded. |
| Is there an adequate legume content (understory)? | Areas to have an average of one legume/m2. Areas up to 0.5 ha not meeting the standard are acceptable provided these areas do not exceed 10% of the rehabilitated area. | An average of >1 legume/m2 based on establishment monitoring (1 to 2 years) including Acacias. | Areas will be scarified and seeded with legumes. |
| Is there an adequate grass (understory) content? | Areas to have an average of one grass/m2. Areas up to 0.5 ha not meeting the standard are acceptable provided these areas do not exceed 10% of the rehabilitated area. | An average of > 1 grass/m2 based on establishment monitoring (1 or 2 years). | Areas will be scarified and seeded with grass. |
| Is there appropriate species richness? | Areas to have a representative number of control site species present. | Minimum of 25% of reference sites species based on establishment monitoring. | Areas may need to receive additional seed. Sites to be scarified and seeded. |
| Is weed invasion a problem for establishment of native species? | Area must show evidence that weed competition is not restricting long term stability in rehabilitation areas. | No noxious weeds present on area. Less than 25% of the cover is from non-declared weeds. | Identify treatments available to correct situation. |
| If the area discharges water off-site is the water quality adequate? | Discharges off-site should be low in salts and suspended solids. | Water quality to meet livestock watering (ANZECC) guidelines. | Sumps to remove suspended solids prior to discharge may be required. |

**Table 15: EA Rehabilitation Completion Criteria for 5 - 7 years**

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Is there appropriate species richness? | Areas to have both overstorey and understorey species. | Minimum of 25% of species numbers of control site species based on establishment monitoring. | Areas may need to receive additional seed. Use of a scarifier will depend on the location of the area and potential damage caused to other areas in gaining access. |
| Is the vegetation showing resilience to stress? | Vegetation shows resilience to stresses such as Insect attack and drought. | Less than 20% of perennials are showing severe physiological signs of stress at the mid period monitoring. | Treatments to be determined as required (may include thinning or reseeding). |
| Is recruitment occurring? | Some freely seeding species (such as grasses, legumes and other understorey species) have seeded and new recruits are evident. | New recruits are occurring from 60% of the understorey species. Areas of up to 0.5 ha not meeting the standard are acceptable provided they do not exceed 50% of the area. | Treatment if required to be determined on an as needs basis. Drought or other factors may affect recruitment. |

**Table 16: EA Rehabilitation Completion Criteria for >7 years**

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Are there adequate numbers of Acacia and Eucalypt? | Numbers need to be adequate to meet the designated land use. | Minimum of 50 stems per ha with average height > 1.5m. | A thinning may be required by burning off or by clearing practices. |
| Is there appropriate species richness? | Areas to have a representative number of control site species present. | Minimum of 25% of control species richness based on late period monitoring. | Areas may need to receive additional seed. Sites to be scarified and seeded. |
| Is there appropriate species richness? | Areas to have both overstorey and understorey species. | Minimum of 25% of species numbers of control site species based on establishment monitoring. | Areas may need to receive additional seed. Use of a scarifier will depend on the location of the area and potential damage caused to other areas in gaining access. |
| Is recruitment occurring? | Freely seeding species (such as grasses, legumes and other understorey species) and infrequent seeders (such as eucalypts and acacias) have seeded and new recruits are evident. | At least 30% of trees monitored are seedlings (1.3m high) and recruitment is occurring on at least 60% of the area. Areas of up to 0.5 ha not meeting the standard are acceptable. | Treatment if required to be determined on an as needs basis. Drought or other factors may affect recruitment. |

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Has erosion on the site caused unacceptable access problems of turbid water run-off? | Areas need to be stable and surface vegetated. There should be no signs of subsidence. | Area stable and covered with soil and plants. | Areas of erosion and slumping may need treatment. |
| Are there adequate stocking rates of over and understorey species capable of withstanding a burn or wildfire? | Area has a range of sizes and ages for over and understorey species showing a functioning ecosystem. | The site is capable of being burnt in mosaic pattern or a method conducive to good vegetation management. | Silvicultural treatment of flattening of understorey may be considered. |
| Is the vegetation showing resilience to stress? | Vegetation shows resilience to stresses such as insect attack and drought. | Less than 20% of perennials are showing severe physiological signs of stress at the mid period of monitoring. | Treatments to be determined as required (may include thinning or reseeding). |
| Are insects preferentially attacking the area? If so, is insect damage causing adverse impact on the health of the plant? | An assessment should be made as to the extent of any insect damage (crown or bow damage) and determine whether the rehabilitation is being selectively attacked in the region? Is a treatment warranted? | Less than 20% of perennials are showing severe physiological signs of stress at the late period of monitoring. | Carry out corrective action where a treatment is required. |
| Are there any weed problems requiring treatment? | There are no declared weeds on the area. Other weeds do not dominate the area. | Annual basal and aerial spraying of weeds to be undertaken as per the following guidelines: - Dalrymple Shire Council weed management plan – DNR Land protection branch guidelines - Landcare weed control initiatives. | Spray or grub areas that do not meet standard. |

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# Appendices

## A. Appendix - Maps

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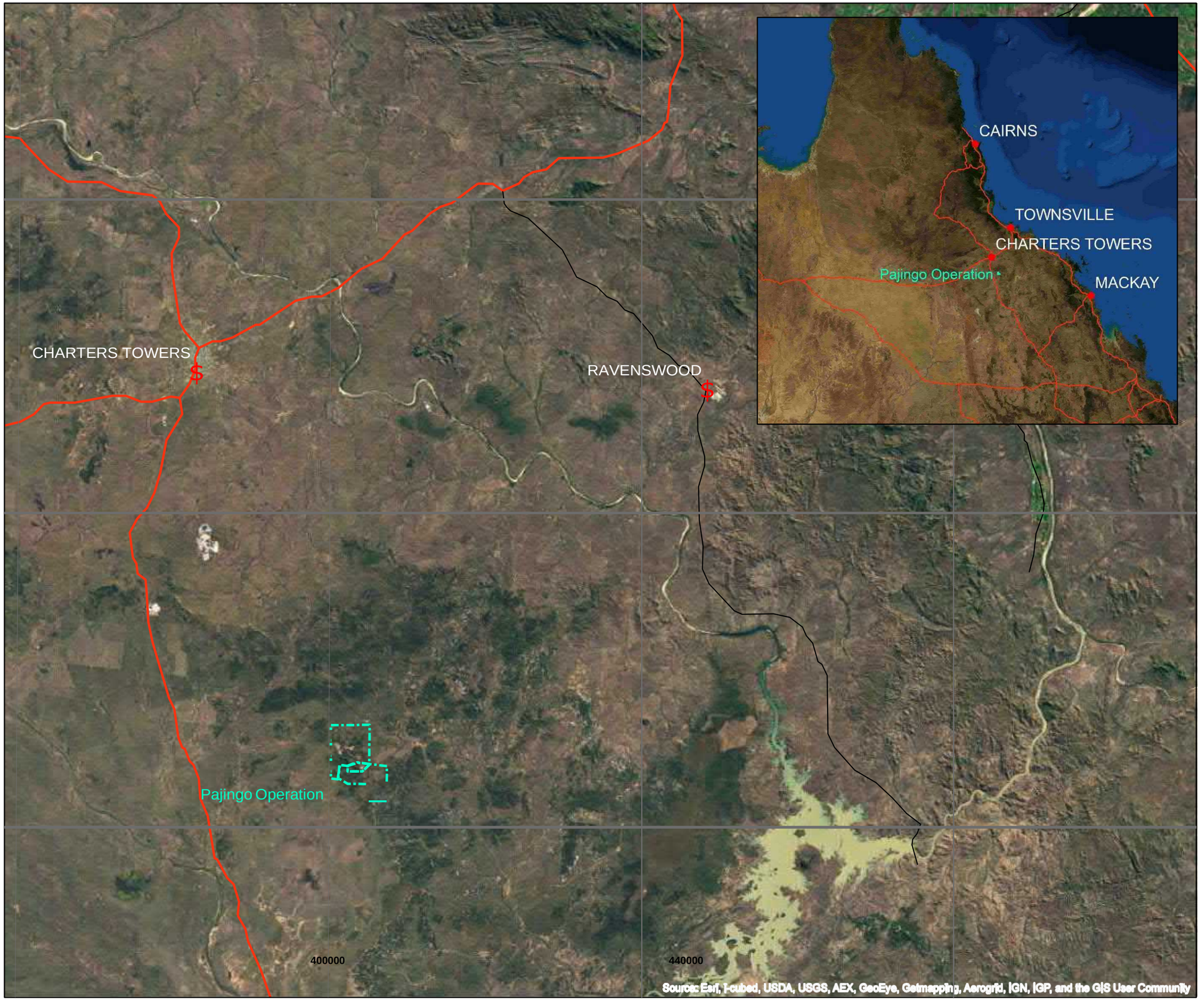


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# LOCATION OF PAJINGO OPERATION

0 10 20
Kilometres

Scale:1:500,000

## Legend

- Mine Lease
- Towns
- Highways
- Main Roads

Notes:

# PAJINGO OPERATIONS MINJAR GOLD

## TOPOGRAPHY AND HYDROLOGY


**Legend**

- Mine Lease
- Watercourse

**Contours (10m)**

- Index Contour
- Intermediate Contour

500 250 0 500

Meters

Scale: 1:35,000 at A3

Notes:

Base Image supplied by Evolution Mining.
Disturbance within ML10215 is from QLD Globe (© State of Queensland 2012) capture date 26/07/2012 and superimposed over base image.
Mine Lease boundary extracted from ml.shp, from IRTM© State of Queensland 2012.
Hydrology from: IQ_VM_WATERCOURSE_MAP_100K_250K.shp© State of Queensland 2012.
Contours from: IQ_QLD_10MCONT_CHARTERS_TOW.shp © State of Queensland 2012.

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 25/03/2014

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Document Path: C:\GIS_Projects\PJO\NRC_data\General_MXD\EVO_PJO_Topography_Hydrology.mxd

442000

444000

7730000

7728000

Scott Lode WRD (Rehabilitated)

Sams Dam

Scott Load WRD (Active)

ROM

A Lode Dam

Waste Rock Dump

TSF1

Scott Load Pit (TSF)

Laydown/ Storage

Scott Lode Pit

K-DUMP

Raw Water Dam

Suicide Dam

P-DUMP

Offices

Offices

Processing Plant

ROM

ML 1575

Cindy WRD

Low Grade Ore Stockpile

Helipad

Cindy Workshop

Cindy Pit

Nancy North Pit - Proposed

Nancy Dam

Nancy Dewatering Dam

Nancy Pit

Venue North WRD

Venue Pit

VNU Pit

Vera Workshop

Orchid Pit

Venue South WRD

ML 10215

Vera Pit

WRD - PAF

Vera Silt Trap

WRD - NAF

Vera ROM and WRD Dam

Low Grade Ore Stockpile

ML 10246

Document Path: C:\GIS_Projects\PJO\NRC_data\FLUR\EVO_PJO_Site_Features.mxd

# PAJINGO OPERATIONS MINJAR GOLD

## SITE FEATURES

### Legend

- Mine Lease
- Roads

**Drainage**

- Clean Water
- Site Water

**Site_Features**

- Dam/ Water Storage
- Open Cut Mines
- WRD and Stockpiles
- Infrastructure
- TSF

200 100 0 200

Meters

Scale: 1:15,000 at A3

Notes:

Base Image supplied by Evolution Mining.
Disturbance within ML10215 is from QLD Globe (© State of Queensland 2012) capture date 26/07/2012 and superimposed over base image.
Mine Lease boundary extracted from ml.shp, from IRTM© State of Queensland 2012.

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 27/03/2014

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# Appendix B:

## 2014 FLURP

# Final Land Use and Rehabilitation Plan

## Pajingo Operations

April 2014

prepared for NQM Gold 2 Pty Ltd

by Northern Resource Consultants

northern resource consultants

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# Limitations of this Report

Client: NQM Gold 2 Pty Ltd – Pajingo Operation

Prepared by Northern Resource Consultants (NRC)

This disclaimer brings the limitations of the investigations to the attention of the reader.

The information in this report is for the exclusive use of NQM Gold 2 Pty Ltd. NQM Gold 2 Pty Ltd is the only intended beneficiary of our work.

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This report has been formulated in the context of published guidelines, field observations, discussions with site personnel, and results of laboratory analyses.

NRC's opinions in this document are subject to modification if additional information is obtained through further investigation, observations or analysis. They relate solely and exclusively to environmental management matters, and are based on the technical and practical experience of environmental scientists.

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Any advice, opinions or recommendations contained in this document should be read and relied upon only in the context of the document as a whole and are considered current as of the date of this document.

# Table of Contents

# List of Figures



# List of Tables

# Executive Summary

This Final Land Use and Rehabilitation Plan has been prepared for NQM Gold 2 Pty Ltd, a wholly owned subsidiary of Evolution Mining Ltd. This plan is designed to meet the rehabilitation specifications and requirements of the PJO environmental authority (EA), which at the time of writing is EPML00879413 dated 16 May 2013.

The strategies and approaches described in this document align with the State government guidelines on mine closure and rehabilitation, and projects with potential impacts to land, namely *Guideline18 – Rehabilitation requirements for Mining Projects* (superseded) and the *Guideline EM961: Application requirements for activities with impacts to land* (EHP 2013).

This plan is a living document and is designed to be updated as the EA is updated, and as best practice rehabilitation techniques are superseded by superior methods. Wherever experimental rehabilitation has been conducted on site and a best approach for site conditions identified, such approaches should be included in this document in the section on Final Land Use Objectives and Best Practice Rehabilitation Standards.

This plan differentiates between three different mine closure scenarios: planned closure, unplanned closure and transition into temporary care and maintenance. The precise approach to rehabilitation strategies described in this plan should be decided depending on the applicable mine closure scenario.

# Introduction

## 1. Final Land Use and Rehabilitation Plan

This Final Land Use and Rehabilitation Plan (FLURP) has been prepared for NQM Gold 2 Pty Ltd which is owned and operated by Evolution Mining Limited (Evolution). The Pajingo Gold Operations (PJO) is located approximately 55km (80km by road) southeast of Charters Towers in north Queensland. Access to PJO is via the sealed north-south highway connecting Charters Towers and Clermont, the Gregory Development Road. A sealed private access road extends 22km east of the road to administration offices and the mill. A location map for the site is included in Appendix A – Maps.

This FLURP will include information detailing the following:

– Rehabilitation standard for the site relating to existing EA requirements,
– The final land use objectives,
– The identification and delineation of rehabilitation domains,
– The potential rehabilitation methods implemented,
– The further research required to validate the proposed rehabilitation method,
– Methods to confirm and detail rehabilitation success and progress for each domain,
– A proposed work schedule of closure activities.

The above methodology is consistent with the Department of Environment and Heritage Protection's (EHP) *Guideline18 – Rehabilitation requirements for Mining Projects* (superseded) and the *Guideline EM961: Application requirements for activities with impacts to land* (EHP 2013).

## 2. Current Operations

The Pajingo ore deposit was discovered by Battle Mountain Gold (BMA) in 1983. BMA held the tenements until 1991 when it became a joint venture with Newmont Mining. In 2002, the operation became 100 per cent owned by Newmont Mining. North Queensland Metals (NQM) took ownership in 2008 in a joint venture with Heemskirk. Conquest mining took 100 per cent ownership of PJO in 2010. In November 2011, Evolution Mining took 100 per cent ownership of PJO.

The mining method utilised at Pajingo throughout the life of the mine include underground and open cut mining. Open cut mining employed a conventional drill and blast with hydraulic excavator (backhoe configuration) dig and truck haul operation. Underground mining methodology uses avoca and longhole open stoping. This system is well proven and understood in Australia and will be undertaken by a mining contractor, which will provide a low risk method for the scale of mining planned and expected ground conditions and ore body geometry. Pajingo is predominantly an owner-operator operation with its own mining and maintenance crews. Four mining crews are utilised in a continuous roster with approximately 25 people underground at any one time. Selective activities are undertaken by contractors and include road train ore haulage from Vera ROM pad back to the mill.

The Pajingo processing mill is a conventional carbon in pulp (CIP) plant that was first built in 1984 for Scott Lode Pit ore. The plant underwent a major rebuild in 1996 upon discovery of

the Vera Nancy strike. A further expansion was undertaken from May 1999 to January 2000 to increase the mill throughput from 216,000 tonnes per annum (tpa) to 582,000 tpa. Two Tailings Storage Facilities are utilised at Pajingo: a conventional paddock style dam within which tailings were first placed in 1987 and the mined Scott Lode pit (SLP) within which tailings were first placed in 2000.

# 3. Climate and Existing Environment

The Pajingo Operation (PJO) is located in the dry tropics of North Queensland and has a dry savannah climate. Rainfall in this area is characterised by short, intense rainfall events that occur primarily in the wet season, from November to April (Figure 2). Approximately 80% of annual rainfall occurs during the wet season. The mean average rainfall at Trafalgar Station is 649.7 millimetres and median rainfall is 616.6mm (Bureau of Meteorology, 2013). Annual rainfall is highly variable, with the lowest annual rainfall of only 205.9mm falling in 1923 and the highest annual rainfall of 1410.4mm falling in 1958. Average maximum and minimum temperatures range from 25° to 34°C in summer and 11 to 23°C in winter (Figure 1). Evaporation is consistent throughout the year, as to be expected in the dry tropics environment, with higher levels during the warmer summer months. Annual pan evaporation is 2,209 mm (Table 2).

It is important to note that the maximum annual rainfall is more than double the average annual rainfall, meaning that extreme isolated events may occur in some years, and that the majority of the time between wet seasons is relatively dry with very little rainfall occurring. These extreme events are likely the product of depressions, cyclonic events or other extreme meteorological conditions.

**Table 1: Bureau of Meteorology (BOM) stations in and around the Pajingo mine site**

| BOM Station No. | Station Name | Latitude | Longitude | Years of Good Data* | Distance From Pajingo Mine |
|---|---|---|---|---|---|
| **34008** | Pajingo | -20.7667 | 146.1667 | 37.44 | 39km |
| **34010** | Trafalgar Station | -20.4328 | 146.0131 | 96.04 | 45km |
| **34032** | Wambiana | -20.55 | 146.1 | 6.93 | 34km |
| **34045** | Bletchington Park | -20.4833 | 146.2667 | 12 | 18km |
| **34049** | Doongara | -20.5583 | 146.4811 | 37.05 | 6km |
| **34051** | Slogan Downs | -20.5658 | 146.3819 | 34.92 | 7km |

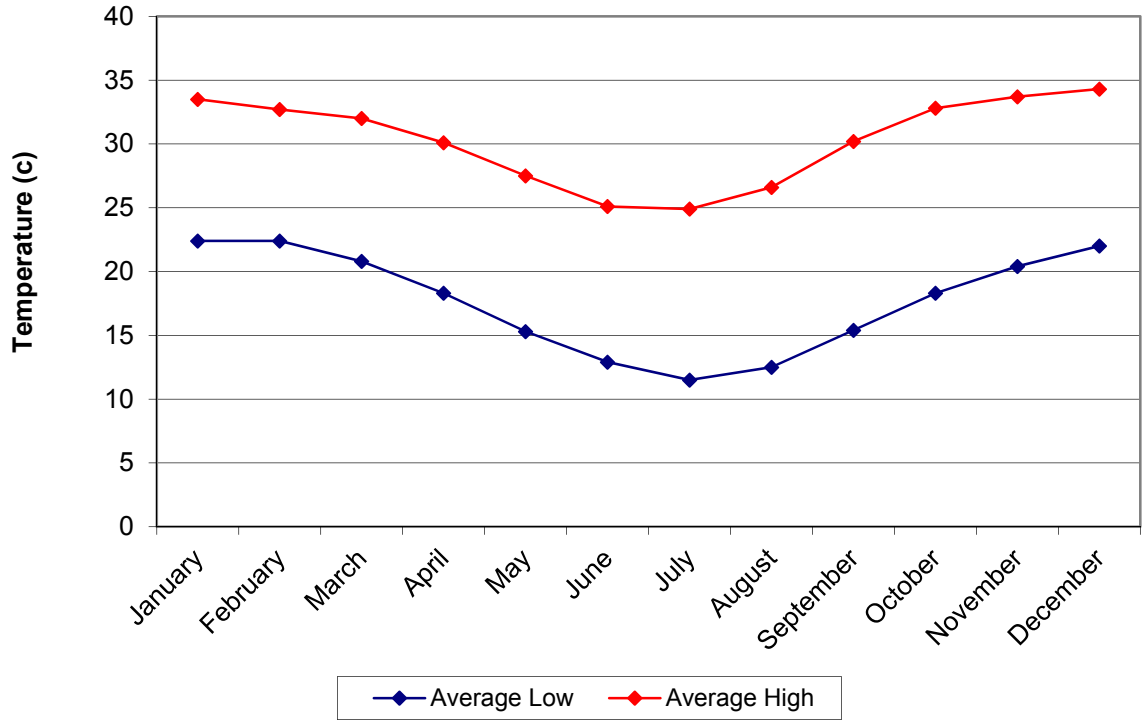


**Figure 1: Average maximum and minimum temperatures at Pajingo**

**Table 2: Average pan evaporation (in millimetres)**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average Evaporation** | 234 | 185 | 185 | 147 | 139 | 145 | 144 | 139 | 178 | 220 | 234 | 250 | 2209 |

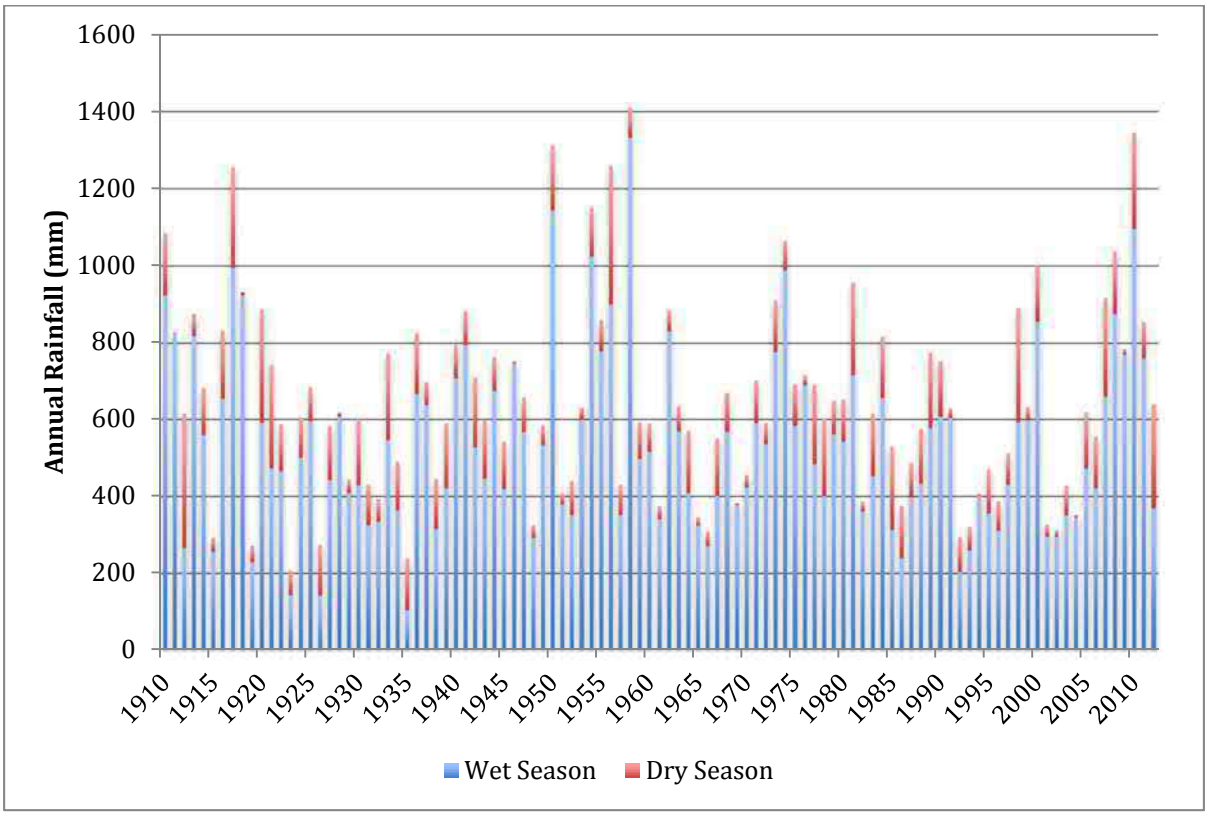


**Figure 2: Annual rainfall (mm) at Trafalgar Station (BoM)**

# 4. Topography

The Pajingo Gold Mine is situated in an area of relatively high relief at the apex of three catchments. All flows from major infrastructure on-site drain to the ephemeral Molly Darling Creek which flows into the Rolleston River, entering the Cape River just upstream of its confluence with the Burdekin Falls Dam 70km downstream from the site.

The western parts of the mining lease drain into Victoria Creek which eventually enters the Campaspe River. However these western areas of the mining lease are currently non-impacted with no infrastructure occurring in the area.

The area draining into Molly Darling Creek can be broken up into two catchments on-site, the Northern Catchment and the Eastern Catchment. The Northern Catchment drains the areas around the Tailings Storage Facility, Site Admin Office and seepage dam. The Madigans Dam, if overflows occur, will also drain into this catchment. A catchment divide occurs between this area and the Scott Lode Dam separating all areas towards the east.

This Eastern Catchment contains the Scott Lode and A Lode Dams, the Cindy and Nancy Dams as well as the Venue Pit, VNU Pit and the Vera Pit. This area drains directly towards the east into Molly Darling Creek, further downstream than where waters from the Northern Catchment enter the creek.


**Figure 3: Topographical map of mine site location – for a full map, please refer to the map appendix accompanying this report.**

# 5. Soils and Land Capability

Seven distinctive soil groups have been recognised in the Pajingo area. They comprise:

– ***Shallow rocky soils:*** The soils of this group exhibit a slightly acidic to neutral pH and have mainly coarse textures. They generally contain gravel or rock fragments derived

from quartz sandstone, acid volcanics or tuffaceous rocks. They also occur on the laterite escarpments, where the characteristic vegetation is lancewood (*Acacia shirleyi*) or narrow-leaved ironbark (*Eucalyptus crebra*).

- ***Uniform coarse-textured soils:*** These soils comprise uniform sands or weakly gradational loamy sands and occur as slopewash or as outwash fan deposits derived from erosion of the Tertiary land surface. Soil reaction is slightly to moderately acidic and gravelly lenses are common within the profile where they occur on the alluvial flats.
- ***Moderately Shallow to Deep Gravelly Coarse to Medium-Textured Soils:*** These soils consist of loamy sand to sandy loam textures, occasional clay loam to light clay textures. They include sub-angular rock fragments and soil reaction is generally slightly acidic to neutral.
- ***Sandy red and Yellow Earths:*** These soils were formed from coarse to medium-textured alluvial or outwash deposits from the Tertiary land surface and sandstone ranges. Soil reaction is very slightly acidic to neutral throughout the soil profiles, which is gradational and exhibit red and yellow colours.
- ***Loamy Red and Yellow Earths:*** These soils occur on more or less intact surfaces of the Tertiary laterite formations whilst the loamy yellow variants are more commonly associated with the Lower Carboniferous sandstone lithology. They are generally fairly deep soils and soil reaction may range from strongly acid at the surface, becoming progressively less acidic at depth.
- ***Texture Contrast (Duplex) Soils:*** These soils occur on footslopes and outwash slopes surrounding the Tertiary laterite escarpment and sandstone/volcanics of the range area. Preliminary chemical analyses indicate that in some areas total soluble salts and chloride may be relatively high at shallow depths and high levels of exchangeable sodium and or magnesium may be present within the profile.
- ***Uniform Fine-Textured Grey and Brown Clay Soils, including Cracking Clay Soils:*** Small occurrences of heavy-textured clays and cracking clay soils are present in the south-eastern sector of the Pajingo project area (adjacent to the Doongara homestead). These soils exhibit strongly alkaline pH values with exchangeable sodium and salinity increasing with depth (500-600mm).

# 6. Flora and Fauna

## 6.1 Vegetation

The Pajingo lease is located in the Brigalow Belt North bioregion (Thackway and Creswell 1995), an area of increasing biological interest that lies at the eastern margin of a zone of interchange between arid zone and those of the wetter coastal fringe. The climate is sub-humid to semi-arid, with vegetation generally consisting of open acacia forests and eucalypt woodlands. Woodlands will also include a significant presence of ironbarks (*E. melanophloia, E. crebra*), poplar box, Brown's box (*E. populnea, E. brownii*), brigalow (*Acacia harpophylla*), blackwood (*A. argyrodendron*) and gidgee (*A. cambagei*) that dominate the bioregion.

**Table 3: Regional Ecosystems present on the mining lease**

| Regional Ecosystem | Description | Vegetation Management Act Class (November 2009) |
|---|---|---|
| **11.3.25** | Riverine wetland or fringing riverine wetland. | Least Concern |

| Regional Ecosystem | Description | Vegetation Management Act Class (November 2009) |
|---|---|---|
| **11.3.8** | *Acacia argyrodendron* woodland on alluvial plains. | Least concern |
| **10.5.5** | Mostly *Eucalyptus melanophloia* dominates the very sparse tree layer with very sparse ground layer of *Aristida* spp. and/or *Triodia* spp. | Least concern |
| **11.7.3** | *Eucalyptus persistens, Triodia mitchellii* open woodland on stripped margins of lateritic duricrust. | Least Concern |
| **11.11.2** | *Acacia shirleyi* or *A. catenulata* low open forest on old sedimentary rocks with varying degrees of metamorphism and folding. | Least Concern |
| **11.11.15** | *Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics. Undulating plains. | Least Concern |

Vegetation in and around the site has been established using data collected from transects. Generally the site is situated within the Brigalow belt, which consists of open, acacia wooded grasslands. Dominant grass in the area was Buffel Grass (*Cenchrus ciliaris*), with lesser occurrences of:

– Seco Stylo (*Stylosanthes scabra*),
– Soft Spinifex (*Triodia pungens*),
– Toothed Ragwort (*Pterocaulon serrulatum*),
– Rock Fern (*Cheilanthes sieberi*),
– Mueller's Saltbush (*Atriplex muelleri*).

Tree species present include:

– Brigalow (*Acacia harpophylla*),
– Lancewood (*Acacia shirleyi*),
– Lemon-Scented Gum (*Corymbia citriodora*),
– Shirley's Silver Leafed Ironbark (*Eucalyptus shirleyi*).

## 6.2 Fauna Species

An initial comprehensive mammal survey of site was carried out in 2002 (by Fred Ford, JCU 2002), a follow up internal faunal survey of the area surrounding the Venue and VNU was undertaken in 2011 and faunal observations and vegetation surveys have been recorded annually from 2005.

During 2011 the site for the Venue and VNU pits was divided into four quadrats and trapping over a three night interval was conducted. In addition, incidental findings or signs of animals including, calls, scats, tracks, diggings, scratchings and remains have been recorded. Incidental sighting records were conducted over the Pajingo site generally rather than specifically to the study area (Venue/VNU proposed site).

Trapping was carried out using Sherman traps. In total 36 traps were used during the program: 14 large Sherman traps, 14 small Sherman traps, six large cage traps and two small cage traps. The traps were placed at 10m intervals along four transects and baited with either beef mince or balls of peanut butter containing crushed seed biscuit.

During the 2011 trapping program one animal was successfully trapped. This animal was identified as a Long-Nosed Bandicoot (*Parameles nasuta*) and was caught on the first sampling night. The lack of success trapping and observing animals in the study area was most likely to be caused by a low density of animals in the study area. The mammal fauna of Pajingo is a representative sample of the species present in the Brigalow Belt North Bioregion and small mammals are likely to be rare and ephemeral on the lease.

No animal species have been observed within the study area. Observations made throughout the Pajingo site generally are listed below.

### Native Species

- Eastern Grey Kangaroo (*Macropus giganteus*),
- Sugar glider (*Petaurus breviceps*),
- Brushtail Possum (*Trichosurus vulpecula)*,
- Pebble-mound mouse (*Pseudomys*),
- Echidna (*Tachyglossus aculeatus*),
- Red Kangaroo (*Macropus rufus*),
- Common Wallaroos (*Macropus robustus*),
- Wallaby,
- Black headed Python (*Aspidites melanocephalus)*,
- Goanna (*Varanus*),
- Brown tree snake (*Boiga irregularis*).

### Introduced species

- Wild dogs (*Canis familiaris*),
- Wild/feral pigs (*Sus scrofa*),
- Feral cat (*Felis catus*),
- European rabbit (*Oryctolagus cuniculus*),
- European hare (*Lepus europaeus*).

### Birds

- Royal Spoon bill (*Platalea regia*),
- Australian Magpie (*Cracticus tibicen*),
- The Australian Bustard (*Ardeotis australis*),
- Peewee (*Grallina cyanoleuca*),
- Emu (*Dromaius novaehollandiae*),
- White Ibis (*Threskiomis molucca*),
- Peaceful Dove (*Geopelia striata*),
- Waterhen/Dusky Moorhen (*Gallinula tenebrosa*),
- Masked Lapwing (*Vanellus miles*),
- Laughing Kookaburra, (*Dacelo novaeguineae*),
- Whistling Kite (*Haliastur sphenurus*),

- Black Kite (*Milvus migrans*),
- Wedge-tailed Eagle (*Aquila audax*),
- Australian Raven (*Corvus coronoides*),
- Black Currawong (*Strepera fuliginosa*),
- Red-Tailed Black Cockatoo (*Calyptorhynchus banksii*),
- Sulphur-Crested Cockatoo (*Cacatua galerita*).

# 7. Water – Surface and Groundwater

## 7.1 Surface Water – Local and Regional

### Regional Hydrology

Pajingo is located in the Rollston River subcatchment of the Cape Campaspe Basin. The Cape Campaspe Basin is intermediate in size (~20,311 km$^2$) and covers about 15% of the Burdekin Water Quality Improvement Plan (BWQIP) region. Rollston River is a small subcatchment where land use is predominantly grazing on native pastures (QLUMP, 2004). The Rollston River subcatchment is a largely dry, sandy creek system with few permanent water holes.

The Pajingo site overlies an area of elevated topography, situated along the divide between three catchments. The largest proportion of the site drains to Molly Darling Creek, an ephemeral drainage system discharging to the Rollston River to the east. The western parts of the mining lease drain into Victoria Creek, which eventually enters the Campaspe River, however, these western areas of the mining lease are currently not impacted with no infrastructure occurring in the area.

The area draining into Molly Darling Creek can be broken up into two catchments on-site, the Northern Catchment and the Eastern Catchment. The Northern Catchment drains the areas around the Tailings Storage Facility, Site Admin Office and Seepage dam. If overflows occur, Madigan's dam will also drain into this catchment. A catchment divide occurs between this area and the Scott Lode dam separating all areas towards the east. This Eastern Catchment contains the Scott Lode and A Lode dams, the Cindy and Nancy dams as well as the Venue Pit, VNU Pit and the Vera Pit. This area drains directly towards the east into Molly Darling Creek, further downstream than where waters from the Northern Catchment enter the creek

### Surface Water Properties - Receiving waters

Surface water downstream of Pajingo has been found to be dominated typically by cations; Ca and Na and anions; SO4 and HCO3. Total Dissolved Solids (TDS) are generally low at all sites, with median values lower than 500mg/L. As a result of evapotranspiration processes TDS does increase throughout the year. Surface water types collected from ephemeral downstream locations during 2011 and 2012 are shown in Table 4 and Figure 4.

**Table 4: Water types of ephemeral downstream monitoring sites**

| Surface Water Site | Water Type |
|---|---|
| **WP15** | Ca-Na-Mg-$SO_4$-$HCO_3$ |
| **WP16** | Na-Cl-$CO_3$-$HCO_3$-$SO_4$ |
| **WP19** | Ca-Mg-Na-$SO_4$-Cl |
| **WP2** | Na-Mg-$SO_4$-Cl-$HCO_3$ |
| **WP28** | K-Ca-$CO_3$ |
| **WP29** | Ca-Na-Mg-$SO_4$-$HCO_3$ |
| **WP3** | Na-Mg-$SO_4$-$HCO_3$-Cl |

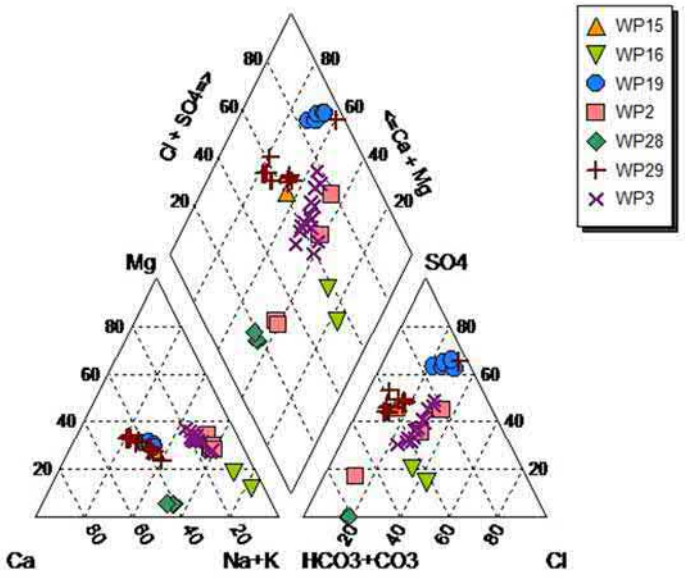


**Figure 4: Downstream surface water results (2011/2012) (NRC 2012)**

## Surface Water Properties - Site waters

Water types of site water storage facilities are generally dominated by cations; Ca and Na and anions; $SO_4$ and Cl. The five site water storage facilities include Madigan's dam, Sam's dam, Vera dam, A Lode dam and Seepage dam. Surface water types from onsite dams, collected during 2012 are displayed in Table 5 and Figure 5.

## Madigan's dam

Madigan's dam has a Na-Ca-Mg-$SO_4^-$-Cl water type with low dissolved metal concentrations. An increase in pH from neutral to alkaline throughout 2012 was evident in Madigan's dam. Electrical conductivity in the wet season was low (910µS/cm) and increased to 2690µS/cm in late 2012.

## SAM'S DAM

Sam's dam has a Na-Mg-Ca-$SO_4^-$-Cl water type with low dissolved metal concentrations. Throughout 2012 the water sampled from Sam's dam was slightly acidic. EC throughout the year remained below 250µS/cm.

## VERA DAM

Vera dam has a Na-Mg-Ca-$SO_4$-$Cl^-$ water type with low dissolved metal concentrations. During 2012 Vera dam water was alkaline with an EC of 2780 - 3060µS/cm.

## A LODE DAM

A Lode dam has a Na-Mg-Ca-$So_4$-Cl water type with low dissolved metal concentrations. Water samples taken from A Lode dam throughout 2012 were acidic to neutral with an EC of 200-1040µS/cm.

## SEEPAGE DAM

Seepage dam has a Na-Mg-Cl-$SO_4$ water type with low dissolved metal concentrations. Seepage dam water samples were neutral with an EC of 1100 - 4100µS/cm during 2012.

**Table 5: Water types of water dams onsite**

| Surface Water Site | Water Type |
|---|---|
| **Madigan's dam** | Na-Ca-Mg-$SO_4$-Cl |
| **Sam's dam** | Na-Mg-Ca-$SO_4$.-Cl |
| **Vera dam** | Na-Mg-Ca-$SO_4$-Cl |
| **A Lode dam** | Na-Mg-Ca-$SO_4$-Cl |
| **Seepage dam** | Na-Mg-Cl-$SO_4$ |

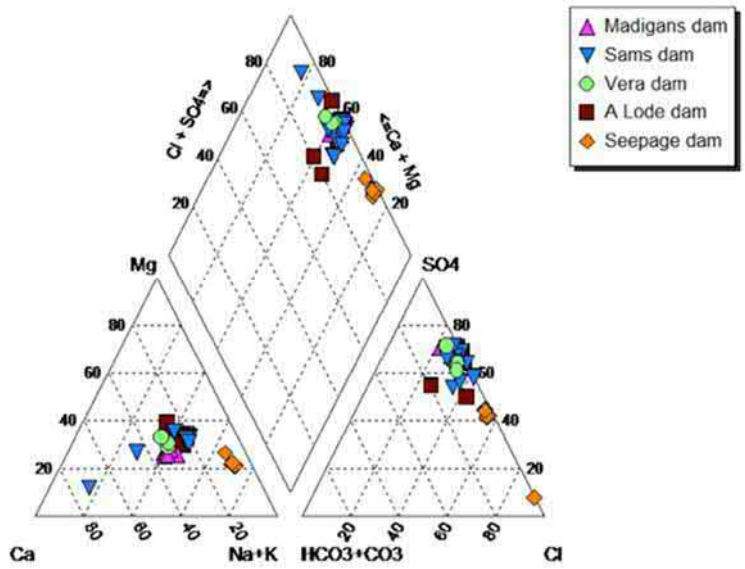


**Figure 5: Water quality of onsite dams (2012) (NRC 2012)**

## 7.2 Groundwater

### GROUNDWATER OCCURRENCE

Groundwater occurs mainly in two aquifer systems within Pajingo mining lease; the alluvial aquifer consisting of tertiary sediments and the underlying fractured rock aquifer consisting of tertiary basalts. In order to monitor both these aquifer systems, several of the monitoring sites contain nested piezometers designed to intersect groundwater from both the tertiary and fractured rock aquifers (e.g. T2S-shallow, T2M-medium depth, and T2D-deep). Many of the shallow casements, intersecting seasonal unconfined aquifers are dry for much of the year, particularly those away from the TSF.

The Britannia bore field was established in 1986 to supply water for the operation of Pajingo mine. It was considered the nearest groundwater aquifer capable of supplying water. It is located approximately 15km northwest of the mine site within fractured geology of the seventy mile range group. Static water levels from 1997 to 2003 show generally steady trends in drawdown. Trends of SWL observed in different wells do not correspond well with each other indicating limited connectivity between production bores in this bore field. It is not certain if these measurements are true static water levels or were taken concurrent with extraction. It nevertheless indicates a heterogeneous bore field with limited connectivity.

Average extraction rates of 5.2L/s in the Britannia bore field caused a rapid dewatering of the fracture-controlled aquifer that resulted in its closure. Recommended sustainable extraction rates for the aquifer were around 1.8L/s, which is an indication of potential yield for smaller livestock use. Extraction from the bore field ceased in 2006 after the resource was unable to meet demand. Water has since been pumped from the Burdekin River via Mt Leyshon Gold Mine, 30km to the north-northwest.

## Groundwater Flow Regime

Permeability is typically very low and groundwater yields are poor due to lack of primary porosity, particularly in the underlying fractured rock aquifer. Low sustainable yields from the Brittania borefield suggests that regional flow of groundwater has a very low flow rate and possibly very low velocities suggesting an increased residence time. This leads to transfer of background pollutants from the soil/rock matrix into groundwater resulting in deterioration of quality. Limited water quality parameters monitored over the same period show considerable variations between Britannia bores. For example, electrical conductivity between 1220 and 6960µS/cm, and a pH range of 6.72 and 8.10. Limited water quality analysis for trace metals, in the same waters, shows low concentration (typically <0.01ppm) of most metals. Pumps were reportedly replaced on an annual basis as a result of either scaling or corrosion.

## Groundwater Properties

Groundwater quality data at Pajingo is restricted mainly to monitoring bores that are designed to detect contamination from facilities such as tailings storage facility (TSF) and waste rock dumps (WRD). Very little water quality monitoring data is available from the wider mining area, except for testing of sump waters pumped from the underground operations and pit sumps along the Vera-Nancy trend.

**pH**

The pH of groundwater measured at Pajingo throughout the life of the mine is shown in Figure 6. The median pH value at Pajingo varies between 5.12 for MB14 and 7.96 for MB2. It is evident that the majority of samples taken at all bores except MB2 are acidic. Bore MB14 has observed high acidity for most samples. It is likely that groundwater in bore MB14 is naturally acidic. This range in pH demonstrates the highly localized nature of aquifers at Pajingo mine site.

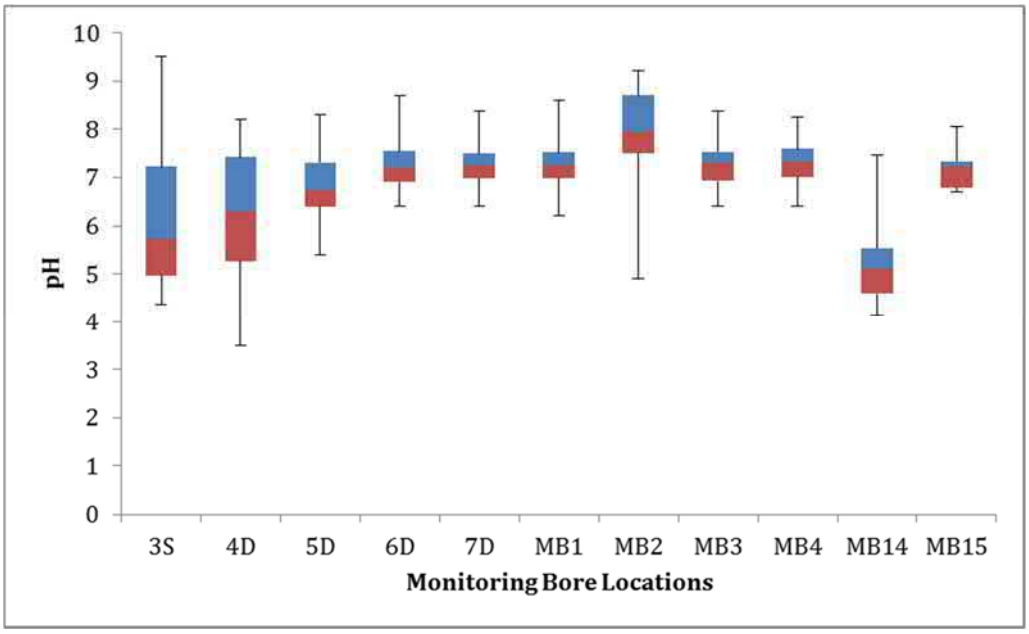


**Figure 6: pH of Groundwater samples recorded for Pajingo LOM (NRC[2] 2012)**

### Total Dissolved Solids

The total dissolved solids of groundwater samples measured at Pajingo over the life of the mine have been plotted in Figure 7. TDS varies widely spatially across the site. Temporal variation in TDS is high at bores 6D, 7D and MB1. At other bores, temporal variation of TDS is limited. Investigations previously undertaken on the high salinity of groundwater occurring on Pajingo mine lease have indicated that the groundwater quality in the receiving bedrock aquifer (Molly Darling Sandstone) shows naturally high TDS and sulphate concentrations. This has been attributed to the high residence time of groundwater in the low permeability bedrock (NRC, 2012).

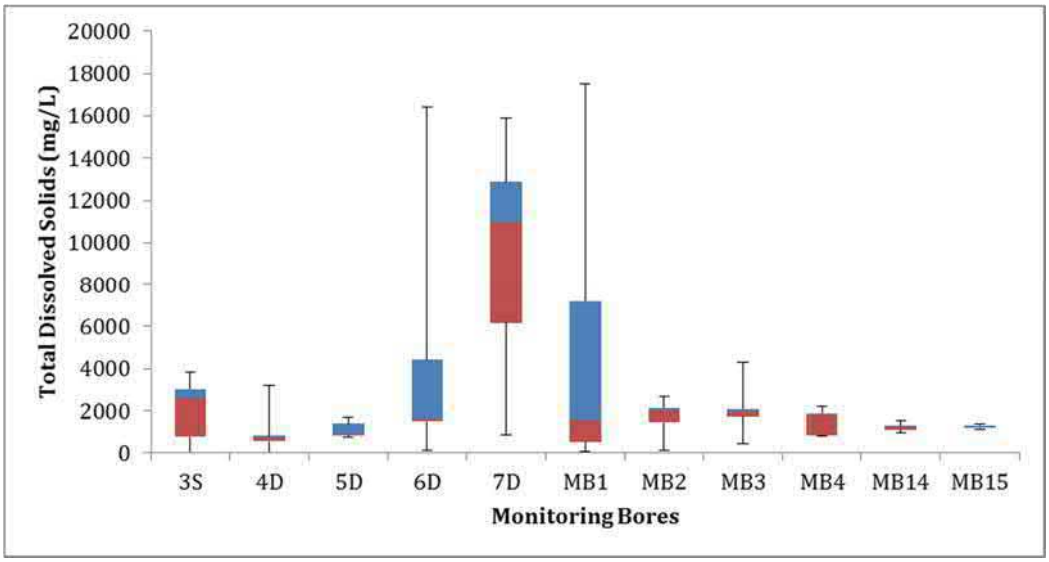


**Figure 7: TDS Concentrations of Pajingo groundwater (NRC 2012)**

## Major Ion Analysis

Groundwater measured during 2011-2012 shows numerous water types, which have been displayed in Table 6. The relative abundance of major ions in groundwater samples can also be seen in Figure 8.

**Table 6: Water Types for Groundwater at the Pajingo Site**

| Groundwater Monitoring Bore | Water Type |
|---|---|
| **3S** | NaMg-Cl |
| **4D** | Na-Cl |
| **5D** | NaMg-Cl$HCO_3$ |
| **6D** | NaMg-Cl$HCO_3$ |
| **7D** | Na-Cl |
| **MB14** | NaCaMg-$HCO_3$ |
| **MB15** | MgCa-$HCO_3$ |
| **MB2** | MgCa-$HCO_3SO_4$ |
| **MB3** | MgCa-$SO_4$ |
| **MB4** | MgCa-$SO_4$ |

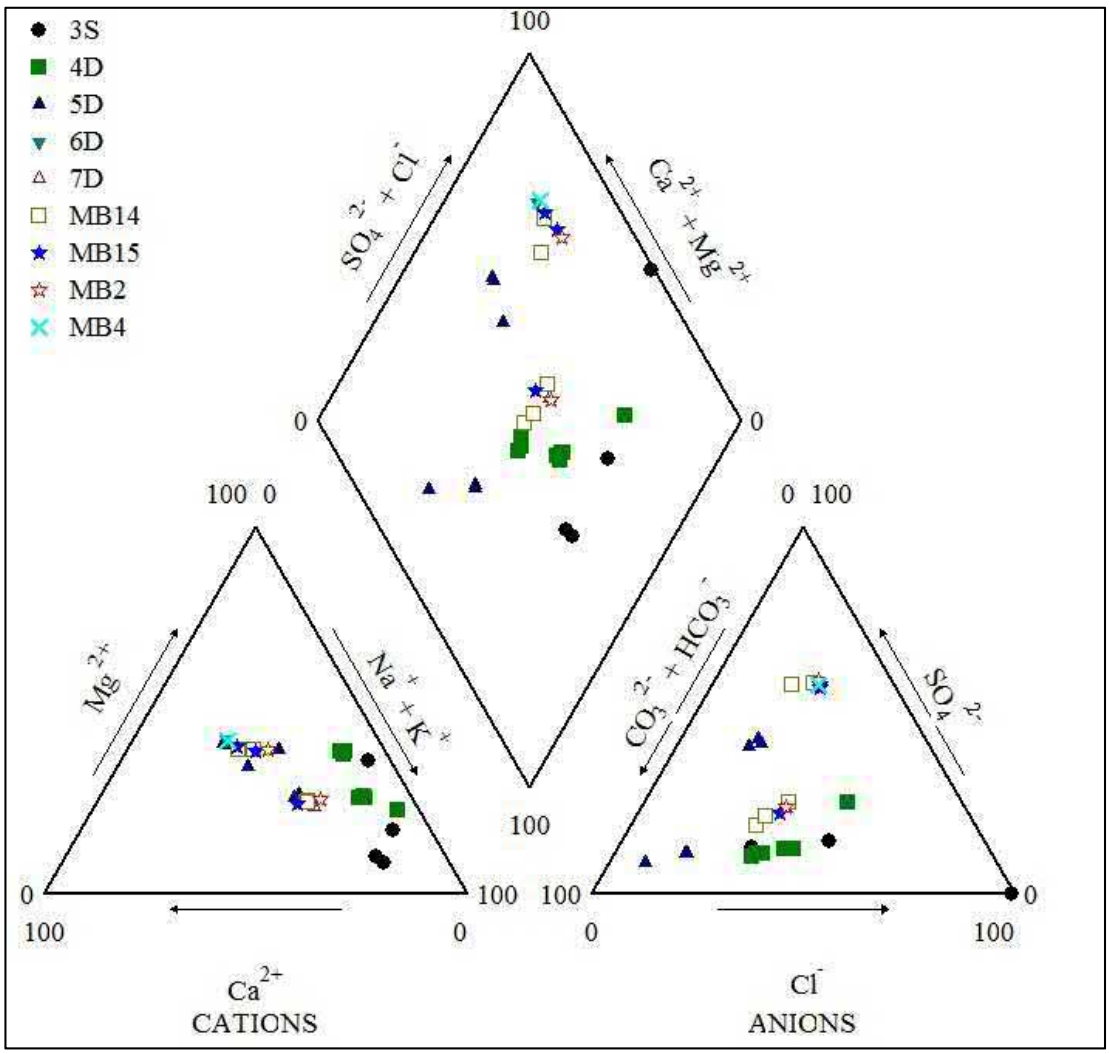


**Figure 8: Major Ions in Groundwater sampled from Pajingo 2011-2012 (NRC 2012)**

### Temporal Trend

Temporal trends of a range of groundwater quality properties have been analysed in a recent groundwater studies report (C&R, 2012). A summary of the findings is presented below:

1. Sulphate concentrations increased at monitoring bores MB3, MB4, 4D and 5D,
2. TDS increased at monitoring bores MB3 and 4D,
3. Bicarbonate increased at monitoring bore MB3,
4. Potassium increased at monitoring bore MB3,
5. Magnesium increased at monitoring bores MB3, MB4, 3S and 6D,
6. Sodium increased at monitoring bores MB3 and 6D,
7. Calcium increased at monitoring bores MB4, 4D and 5D,
8. Nickel increased at monitoring bore 3S,
9. Zinc increased at monitoring bore 3S,
10. pH increased at monitoring bore 4D,
11. Potassium decreased at monitoring bores MB1 and MB2,

12. Sulphate decreased at monitoring bore MB2,
13. Chloride decreased at monitoring bores MB2,
14. Magnesium decreased at monitoring bores MB2 and 7D,
15. Calcium decreased at monitoring bores MB2 and MB15,
16. pH decreased at monitoring bores MB3 and 3S,
17. Lead decreased at monitoring bores MB3, 6D and 3S,
18. Nickel decreased at monitoring bore MB4,
19. Cadmium decreased at monitoring bore 3S,
20. Zinc decreased at monitoring bores 4D and 6D,
21. Copper decreased at monitoring bore 6D.

# 8. Geology and Geochemical Characterisation

## 8.1 Regional Geology

Pajingo mine is located in a group of sedimentary rocks within the Drummond Basin (Figure 9). This basin has been defined as three packages or tectonostratigraphic cycles of mostly terrestrial sedimentation separated by substantial volcanic deposits ranging from uppermost deposits of the youngest Cycle 3 package includes Tertiary aged beds as young as 53 Ma.

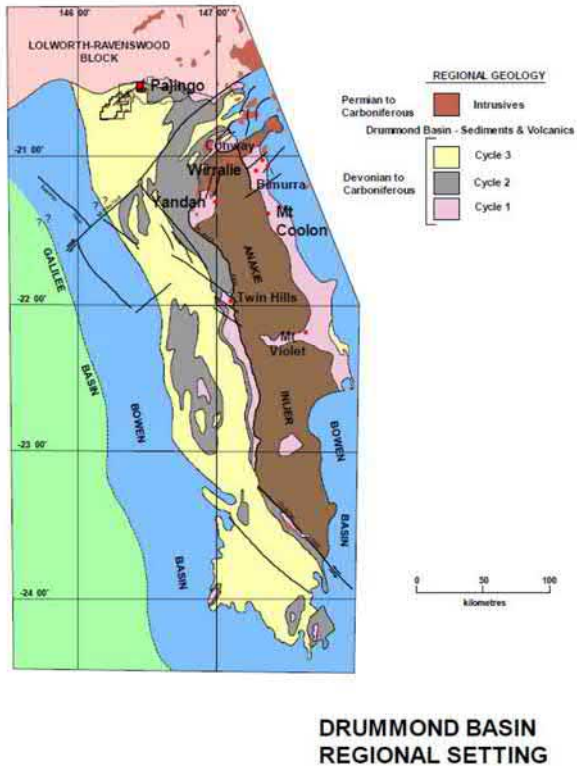


**Figure 9: Drummond Basin Regional Geology Map (Pajingo Exploration Dept.)**

Major fault structures in the Pajingo area trend dominantly northeast and northwest. These major faults are possibly related to reactivation of original graben blocks first generated during extension and formation of the original basin. Fault, shear and gentle fold development of late Palaeozoic and older geology result from multiple tectonic events along the eastern margin of the continent. These events resulted in volcanic arcs and mountain building with associated pulses of mid to upper level igneous intrusive bodies. Surface expressions of major folds in the northern most end of the Drummond, display axial planes in a northeast orientation (Hutton 1989).

The Lolworth-Ravenswood Block and Drummond Basin are intruded by a series of Late Carboniferous high level felsic plugs, dykes and intrusive breccias. The age dating of mineralisation at Pajingo appears to pre-date these intrusives, and thus the ore is considered associated with the Mt. Janet andesitic volcanic complex. The nearest outcrop of Carboniferous granite bodies is approximately 50km east of Pajingo.

## 8.2 Site Geology

The relevant stratigraphy and intrusive history in and around the tenement area is presented in Figure 9. The framework of this geological history is based primarily upon Schafer (1999), who utilises the range of available age dating to constrain stratigraphy.

The oldest lithologies in the Pajingo mine lease are part of the Seventy Mile Range Group which occur under cover in the northeast corner of the lease and are part of the Lolworth-Ravenswood Block; namely the Ordovician Rollston Range Formation (Osr) and (Cambrian)-Early Ordovician Trooper Creek Formation (Ost/s/a). Formerly known as the Cape River Beds, these units include metamorphic varieties of formations in the Pajingo area and comprise schist, quartzite, phyllite, metavolcanics, siltstone, arenite and pyritic shale (PJV 2001 Groundwater Report).

The Seventy Mile Range Group is not expected to be encountered during mining and little is known about the geology of this group locally. Regional mapping does however show a high density of structural elements within the Seventy Mile Range Group (in the form of faults and lineaments). The Janet-A fault structure (Scott Lode) is believed to be part of a larger structure that locally separates the Drummond block from the Lolworth-Ravenswood Block. This structure (with a generally northwest trend) will likely influence hydrogeology to the north of the mining lease. The northern quarter of the lease area is dominated by Devonian Molly Darling Beds (DCp) which consist of clastic sediments interbedded quartz sandstones, siltstones and carbonaceous shales. This unit is greatly exposed around Mt. Molly Darling (immediately north of Scott Lode Pit) and is deposited upon the Lolworth-Ravenswood Block. The most prominent surface geology in the centre of the mine lease is the Mt. Janet Andesite (DCvv/a/r) along the Mt. Janet Range. This unit consists of andesitic lava flows and pyroclastics, with minor intercalated volcaniclastics and sedimentary beds. Lava flows have a known thickness of at least 15m with intercalated tuffs. The pyroclastics include block to fine ash tuffs and lithic tuffs with basaltic to trachytic variations (Bobis 1990). A dacitic sequence at the base of the formation is characterised by ignimbrite (fiamme-rich glassy welded tuffs).

**Table 7: Sedimentary and Igneous history for the Pajingo area**

| Map Unit | Age | Group | Formation | Dominant Lithology |
|---|---|---|---|---|
| **Cainozoic Sediments and Volcanism** | | | | |
| **Qha** | Holocene | | Alluvium | Stream Bed Sediment |
| **Qa, Qr** | Quaternary | | Alluvium & Colluvium | Unconsolidated Sediment |
| | Pliocene | Volcanics | Campaspe Formation | Si Cemented Sediment |
| | Mid Tertiary ~44Ma | | Moonlight Plug (Mingela Basalt equiv.) | Alkali Olivine Basalt |
| **Ts, Td** | Early to Mid-Tertiary >53Ma | | Southern Cross Formation (Suttor Formation equiv.) | Ts – Lateritised Sediment Ferricrete capping (Td) |
| | Cainozoic | Shallow Intrusives | Unnamed Dykes | Basaltic hypabyssal |
| **Cycle 3 – Drummond Basin** | | | | |
| **CPir** | Carboniferous to Permian | Shallow Intrusives | Unnamed Dykes and Volcanics | Andesitic to Rhyolitic hypabyssal |
| | Mid Carboniferous ~342 Ma | Hydrothermal fluids | Scott Lode Mineralisation | Epithermal Quartz Veins |
| | Early Carboniferous | | Unnamed Volcaniclastics | Qtz-free volcaniclastics |
| | Early Carboniferous | | Doongara Formation (Star of Hope Formation equiv.) | Volcaniclastic sediments |
| **Cycle 2 - Drummond Basin** | | | | |
| | Early Carboniferous | | Raymond Formation | Sandstone |
| **Cycle 1 – Drummond Basin** | | | | |
| | Devonian | Shallow intrusives | Unnamed Hypabyssal (Mt Starlight related) | Dacitic to Rhyolitic dykes, stocks & plugs |
| | Late Devonian ~365Ma | | Mt Starlight flow domes | Felsic volcanics |
| | Devonian | Shallow intrusives | Unnamed Hypabyssal (Mt Janet related) | Andesitic dykes, stocks and plugs |
| **DCv v/a**<br>**DCv v/r** | Late Devonian | | Vera-Nancy volcanics (a – Mt Janet Andesite) (Stones Ck Fmn equiv.) | a – Porphyritic Andesite & Pyroclastics, r – Dacitic Sandstone |
| **DCp** | Late Devonian | | Molly Darling Beds (Pallamana Sandstone equiv.) | Quartzose Sandstone |
| **Seventy Mile Range Group (Lolworth-Ravenswood Block)** | | | | |
| | Siluro-Devonian | Mid level intrusive | Molly Darling Granodiorite | Altered medium grained Hbl Bt Granodiorite |
| | Siluro-Devonian | Mid level intrusive | Ravenswood Batholith | Medium grained Hbl Bt Granodiorite |
| **Osr** | Ordovician | | Rollston Range Formation (Cape River Beds equiv.) | Feldspathic Sandstone |
| **Ost/s/a** | (Cambrian) – Early Ordovician | | Trooper Creek Formation (Cape River Beds equiv.) | s - Sandstone/Mudstone<br>a – Andesitic Volcanics |

# 9. Community

## 9.1 Local Community

The project is in an isolated area, with the Doongara homestead, located two kilometres east of the Vera Pit located on ML10215, being the closest resident. The closest rural community is Charters Towers, with a population of approximately 12,000 residents. Charters Towers is 55km from the mine site.

The Doongara homestead (1.91km from operational areas) and Slogan homestead (8.11km) are considered sensitive locations for potential air quality and noise impacts. Since start of operations in 1987, however, there have been no air, noise or dust complaints made by nearby residences. Hence, minor to no impacts on the surrounding community are associated with the construction or operations of the pits.

As there are only a number of residences surrounding the mine lease area, potential benefits for the community would be small scale. Benefits already associated with the mine for nearby residences have included paved roads. While the benefits to Charters Towers have included increased revenues spent in the area, more employment opportunities, new development to accommodate workers and more extensive government services for expanding recreational and cultural facilities.

## 9.2 Cultural Heritage

An archaeological assessment of the site was completed in 1986 as part of the Pajingo Baseline Environmental Survey undertaken by Hollingsworth Consultants. The majority of mine related activities are located in areas of low archaeological sensitivity. Two sites of significance have been identified on the Tertiary laterites, which include settlement evidence and artefact scatters. Neither site is threatened by current developments. Excessive scatters of stone artefacts are located on the creek flats of the Quaternary sediments, which are outside the boundaries of the Vera ML and are not threatened by current developments.

Throughout the Pajingo Mine Operations Leases and Exploration Permits, a stringent management procedure is undertaken to ensure any cultural heritage within the site is identified and preserved. This procedure involves both the management of sites identified as having cultural value and identifying additional sites of cultural significance.

Prior to the commencement of exploration in the Venue/VNU area, the Pajingo geological team employed traditional owners of the land, representing the Kudjala people and Birri people to ground truth the area and determine the location of sites of cultural significance. The assessment was completed with no sites of cultural significance identified.

# Closure Management

## 1. Identification and Management of Closure Issues

The Evolution Corporate Performance Standard (*EVN-COR-STD-0003 Risk Management)* provides a process of risk assessment to evaluate proposed closure methods and alternative options for the project. The process is based on the AS/NZS ISO 31000:2009 standard.

It is intended that following a risk-based approach will lead to a closure process that offers the following benefits:

- A more confident and rigorous basis for decision-making and planning,
- Better identification of opportunities and threats,
- Gaining value from uncertainty and variability,
- Proactive rather than reactive management,
- More effective allocation and use of resources,
- Improved incident management and reduction in loss and the cost of risk,
- Improved stakeholder confidence and trust,
- Improved compliance with relevant legislation.

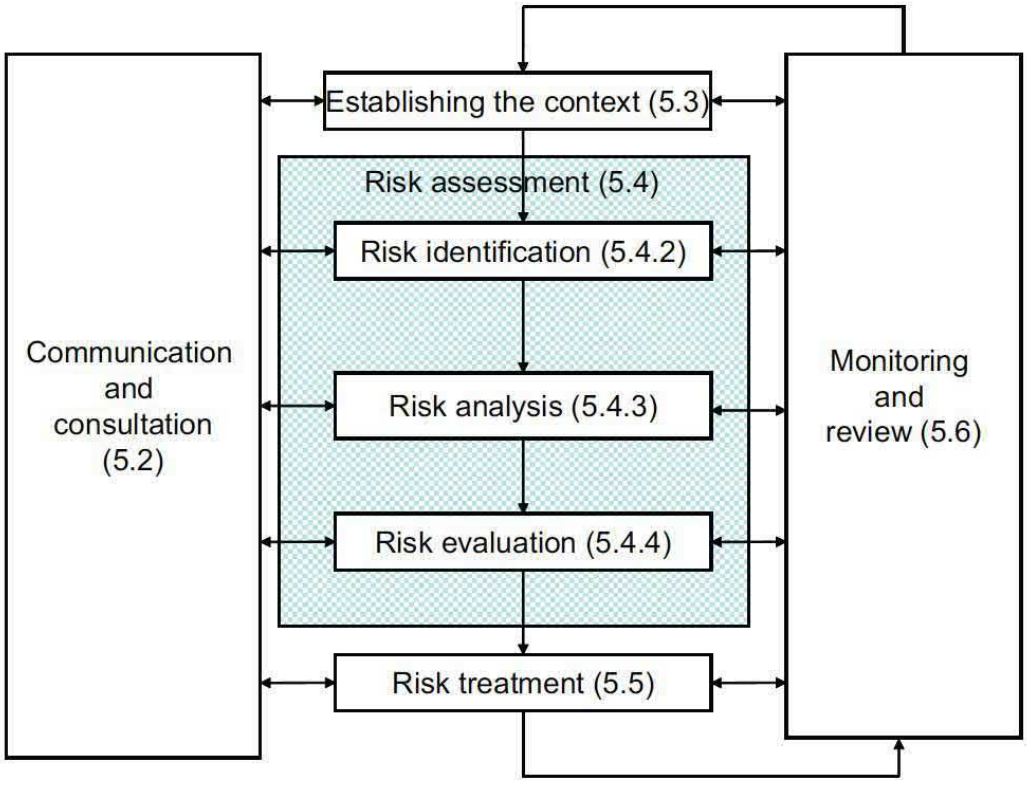


**Figure 10: Risk Management Process (from ISO 31000:2009)**

# 2. Best Practice Rehabilitation

## 2.1 Rehabilitation Guidelines

The rehabilitation guidelines set out by EHP (*Guideline 18: Rehabilitation requirements for mining projects;* EHP 2007b) for areas disturbed by mining specify that the rehabilitated site landforms should be:

- Safe to humans and wildlife,
- Geo-technically stable,
- Geo-chemically stable and non-polluting,
- Able to sustain an agreed post mining land use (see Table 8).

**Table 8: Rehabilitation Guidelines - Guideline 18: Rehabilitation requirements for mining projects, (EHP 2007)**

| OUTCOMES | GOALS | | | |
|---|---|---|---|---|
| | **SAFE** | **NON-POLLUTING** | **STABLE** | **SELF SUSTAINING** |
| **Generally acceptable** | Structurally safe, no hazardous materials<br>Structurally safe, treated hazardous material adequately contained | Runoff and seepage will be good quality water that is unlikely to affect known environmental values | Place wastes below natural land surfaces (i.e. below grade)<br>Places wastes above natural surface with minimal slopes (e.g. less than 5°) | Reinstate original ecosystem<br>Create a different use with enhanced environmental, economic or social values acceptable to stakeholders<br>Return to previous use/condition |
| **May be acceptable** | Structurally safe. Hazardous material adequately contained | Potential for pollution of water that is managed by:<br>– Natural low groundwater connectivity (demonstrated by hydrological studies)<br>– Impervious capping or lining<br>– Store and release capping | Place wastes above ground with moderate slopes | Return to previous use, or different use with reduced environmental, economic or social values (evidence that use is acceptable to stakeholders would be essential |
| **Rarely acceptable** | Uncontained or inadequately contained hazardous materials | Waste disposal facility contains inadequately managed severely contaminated water or water requiring continuing treatment | Place wastes above ground with angle of repose slopes | Unusable, contaminated site that is not adequately managed |

## 2.2 Safe to Humans

When rehabilitating a WRD, it is important to note that a reshaped WRD design must consider the presence of materials that may later cause intractable problems, particularly acid forming, saline or highly alkaline materials. The main goal of rehabilitating domains is the long-term safety of humans and animals, now and in the foreseeable future. An indicator of success is no exposure to or availability of heavy metals and other toxic materials on the rehabilitated domains.

According to EHP's rehabilitation objectives, PJO propose to ensure long-term safety by utilising the following completion criteria:

– Risk assessment to be undertaken on existing structures, high walls and voids, and control measures to restrict access where safety considerations require this. This may include bunding or fencing
– Leaching tests of exposed material meet specified guideline values (using standard protocols such as US EPA Toxic Characteristic Leaching Procedure)
– Surface water quality complies with specified guidelines (ANZECC 2000 and QWQG 2009)
– A site management plan that includes measures for fire reduction and to control woody weeds under the Land Protection (Pest and Stock Route Management) Act 2002

## 2.3 Non-Polluting

In rehabilitating domains, PJO must consider the presence of materials that may later cause pollution, as hazardous leachate may exude from exposed waste materials. Any design must incorporate features to minimise the risks associated with storage of these waste materials. Neutralising or encapsulating techniques are able to manage potentially acid-generating materials.

The requirement for domains to be non-polluting, as set out by EHP, includes a need for polluted water that is contained on site to meet specified criteria relevant to potential contaminants and other toxic materials on the rehabilitated domains.

According to EHP's rehabilitation objectives, PJO propose to ensure non-pollution of the receiving environment by utilising the following completion criteria:

– Ensure water dams and creeks are in line with stock drinking water quality requirements, as outlined in ANZECC 2000,
– Ensure appropriate diversion/containment structures are in place to minimise quantities of polluted water and containing it onsite.

## 2.4 Stable

In order to achieve effective rehabilitation, progressive improvement should be noted in soil structure and soil protection, vegetative cover and development, and stability of erosion features. Continual monitoring verifies habitat self-sustainability and the subsequent ability to tolerate climatic fluctuations.

To determine the success of rehabilitated domains at PJO in terms of stability, EHP outlines the rehabilitation completion criteria to be:

– Vegetation coverage,
– Landform design, and
– Erosion mitigation.

According to EHP's rehabilitation objectives, PJO propose to ensure long-term stability by utilising the following completion criteria:

– Risk assessment to be undertaken on existing structures, high walls and voids, and control measures that will continue to meet agreed requirements put in place upon rehabilitation,
– Foliage cover in accordance with the Rehabilitation Completion Criteria (included in the Environmental Authority) to meet the set values based on the regional assessment of cover requirements,
– Ensure nutrient cycling is occurring through the presence of leaf litter to assist in limiting erosion.

## 2.5 Self-Sustaining

Rehabilitation design must ensure a self-sustaining vegetation cover to meet the agreed post-mine activity plan. EHP outlines all rehabilitated mine areas to maintain sustainable land use through the successful implementation of the appropriate final land use capability score.

According to EHP's rehabilitation objectives, PJO propose to ensure long-term stability by utilising the following completion criteria:

– Soil properties that support and will continue to support the desired land use (pH range of topsoil 5 – 8.5, salinity <0.2% chloride),
– Establish natural vegetation and habitat of key species in line with original vegetation while limiting the abundance of weed species,
– Water bodies to have adequate storage requirements to hold rainfall from an 1:100 ARI event,
– Water contaminants should continue to be monitored until rehabilitation and revegetation considered successful,
– Before using topsoil, it should be determined whether the material contains weeds and hence deemed unreliable for rehabilitation.

# 3. Closure Implementation

## 3.1 Closure Stages

Final mine closure occurs in two distinct stages.

1. Decommissioning: involves removal and appropriate disposal of all infrastructure and contaminated material.
2. Rehabilitation: includes undertaking of specific earthworks to create appropriate landforms and subsequent re-vegetation of those landforms.

After the activity stages of closure a period of maintenance and monitoring occurs. This period can extend for many years to allow for the regeneration of vegetation and rehabilitation performance monitoring to occur. Compliance monitoring with the Environmental Authority is still required during this time.

Closure implementation stages can be applied through both planned and unplanned mine closure. A third option to be considered is the temporary shutdown of operations, in which case the project goes into a state of 'care and maintenance' until further notice.

## 3.2 Planned Closure

Planned closure takes place at the end of mine life, when no further exploitable mineral resource remains. Closure implementation will follow a project schedule outlined in a Post Closure Management Plan that will be submitted to the regulator at least six months prior to cessation of all mining and mineral processing activities. Planned closure may see mineral processing extend for some time after all actual mining ceases. All salvageable equipment and infrastructure will be removed as the miners retreat back out of the mine. All services to the mine workings (including dewatering operations) will cease and all access points and any underground openings will be sealed. An appropriate abandonment bund will be constructed around the entire mine pit.

Once mineral processing ceases, all mine related infrastructure (process plant, workshops, stores, core yards, magazine, laboratory, administration and support buildings) will be decontaminated prior to the dismantling and removal of all salvageable machinery, structures and plant. All remaining infrastructure will be demolished and either sold for scrap or buried on site. Any contaminated soils or water will be identified, assessed and if necessary remediated.

All decontamination work will be done in consultation with the relevant government guidelines and the effectiveness of such work audited by a suitably qualified external consultant. Rehabilitation activities on disturbance domains are commenced to create geotechnically stable, non-polluting landforms. It will only be possible to do the final reclamation works on the decant portion of the TSF after decommissioning, to allow time for dewatering and adequate drying of the tailings such that equipment can safely access the upper tailings surface. All mine landforms are to have water retaining closure designs and encapsulation of any PAF/mineralised material and tailings material. All surfaces are to be rehabilitated and seeded with appropriate seed stock. Where possible, progressive rehabilitation will occur during the operation stage and performance trends will be established well before closure. Rehabilitation performance monitoring will continue until such time as closure criteria have been met and the Final Rehabilitation Report accepted by the regulator.

## 3.3 Unplanned Closure

The unforseen, earlier than expected cessation of mining may happen due to a number of reasons, including market forces and initial overestimation of ore reserves. The closure process followed is similar to that for planned closure, except that many mine waste landforms will not have been constructed to final design.

At PJO, a number of ore and sub-grade ore stockpiles may remain on the ROM and adjacent WRD in the event of unplanned closure. These represent a resource that may in future years have considerable value to other mining companies. The mine pit and underground will also probably still contain potential ore and not be classified as sterile. In the event of an unplanned closure scenario, the processing plant and mining operation may cease operations simultaneously, with the result that all closure related work will need to be done by a third party.

It will be necessary to maintain the mine affected water management system (given the operational approach to water balance management) and basic services until such time as demolition crews are able to salvage equipment and infrastructure. This could add considerable expense to the closure provision and a cost benefit analysis will need to be done as soon after closure as possible, so that a timely decision can be made as to what, if anything, (pumping equipment and pipeline) is worth salvaging within the open pit.

## 3.4 Care and Maintenance

A third closure planning scenario may occur when a mine goes into temporary shut down or 'Care and Maintenance' (C&M). A C&M period may come about for a number of reasons including the possible sale of the operation to a third party. The C&M period may be months or years in duration, where site activities are reduced to a minimum.

It is expected that that following activities would be conducted during the C&M period:

- A risk assessment of the current requirements for the management of environmental aspects,
- The demobilisation of mining fleet,
- Continual operation of the mine affected water management system,
- Fencing off of all mine property, with locked gates to ensure that only official mine vehicles are able to gain access,
- Processing of the remaining ore stockpiles in some instances, in addition to cleaning the ROM Pad, ore bins, conveyor system, crushing and processing plant,
- Flushing and wash down of all areas prior to lubricating machinery,
- Where possible, return of any excess stores, lubricants, fuels, chemicals and spares to suppliers,
- Flushing of all tailings disposal pipelines, storage tanks and bins,
- Reducing fuel storage levels to that required by the remaining skeleton crew,
- Maintenance of buildings and infrastructure, including main access roads, in working order,
- Compliance monitoring and reporting as required by the site's Environmental Authority.

The operation should establish an emergency response action plan, to be initiated if compliance monitoring indicates non-compliance with the terms of the site's EA.

# 4. Stakeholder Management

## 4.1 Stakeholder Consultation Planning

In the event of mine closure, whether that be planned, unplanned or a temporary transition into care and maintenance, there is a palpable effect on project stakeholders that is best managed by the proponent. The operation has a social responsibility beyond that of caring for its own employees. That responsibility can be discharged in the event of mine closure through implementation of a stakeholder consultation plan.

## 4.2 Stakeholder Identification

In order to estimate the impact of mine closure, the first step is identifying the mine's stakeholders. The mine employees and contractors are obvious stakeholders, as are landholders for underlying and neighbouring properties. However mine closure can have further impacts, for instance on local industry and business who relied on the presence of mine workers and their families.

At a high level, the town of Charters Towers is likely to be most heavily impacted by the closure of the PJO mine site.

## 4.3 Stakeholder Tiers

### Stakeholder Ranking

The next step after identifying stakeholders would be to divide them into tiers, using criteria on the frequency and degree of likely impact upon each tier to determine the tier structure. In identifying the tier system, the group can be broken down to the following:

- Tier One Stakeholders
  - Those likely to be impacted most frequently and most heavily.
- Tier Two Stakeholders
  - Those likely to be impacted with less frequency and less severity, but who will still have a high degree of interest in the opportunities and potential outcomes of the project.
- Tier Three Stakeholders
  - Those likely to be impacted infrequently and negligibly affected by the closure of the project.

### Tier One Stakeholders

For the purpose of the closure planning process, identified tier one stakeholders, or interested and affected parties are as follows:

- Staff and contractors of the PJO,
- Title holders across the tenement and on land bordering the tenement,
- Property managers on land across the tenement,
- The traditional owners of the land,
- Local government,

– Local interest groups including agricultural and business organisations such as the chamber of commerce,
– State government departments.

Given the commitment to meaningful engagement with these parties, PJO should aim to communicate specifically tailored information to these tier one stakeholders as a priority. These stakeholders should be sent all relevant information about the impending closure and be invited to participate in focus groups and a closure consultation committee.

These stakeholders will be sent all compulsory information, but should be given the opportunity to opt out of receiving any marketing collateral or general community updates.

### Tier Two Stakeholders

The tier two stakeholder listing includes the broader community around the project. Tier two stakeholders represent a much larger group including:

– Local businesses as individual entities,
– Primary, secondary and tertiary education institutions,
– Local financial institutions,
– Community groups including the Rotary Clubs, Lions Clubs and Country Women's Associations,
– Community engagement officers working with the local councils,
– Voluntary and welfare organisations in the Charters Towers region,
– Providers of services like power and water to the tenement.

Tier two stakeholders should be sent generic information on the impending closure, and given the opportunity to opt in to receiving any marketing collateral and general community updates.

### Tier Three Stakeholders

Tier three stakeholder listing includes state organisations, NGOs and businesses geographically removed from the immediate project region. Communication with tier three stakeholders is flexible, and allows stakeholders themselves to register increased levels of interest and request further information at any time in the consultation process. Similarly, tier two stakeholders who feel sufficiently informed can request less frequent information, or nominate specific areas of focus, moving themselves into tier three for communication strategy purposes.

## 4.4 Consultation Process

The Stakeholder Consultation Register has been developed to record consultation activities undertaken with stakeholder groups and individuals. This register allows for record keeping of stakeholder interests, comments and concerns and records Evolution's response to their comments and concerns. The Closure Communication strategy is detailed within Table 9. It is highly likely that certain aspects of closure will be of more interest to individual stakeholder groups, these have also been identified.

**Table 9: Closure Communication Engagement Strategy for Tier One and Two Stakeholders**

| Stakeholder Group | Proposed Consultation Timing (minimum) | Proposed Consultation Methods | Topics Likely to be Addressed |
|---|---|---|---|
| **Tier One Stakeholders** | | | |
| **Adjacent Farm Properties** | Annually or as requested by the stakeholder | Site/Community meetings<br>One on one meetings<br>Update emails | Erosion<br>Groundwater/surface water management<br>Feral animal control<br>Future land use |
| **Traditional Owners** | Annually, or as requested by the stakeholder | Site/Community meetings<br>One on one meetings<br>Closure Committee<br>Update emails | Erosion and surface water management<br>Groundwater/ surface water management<br>Future land use including impacts on traditional land use |
| **Dept of Environment and Heritage Protection** | Ongoing | Regular review of the Final Land use and Rehabilitation Plan<br>Site Inspections<br>Closure Committee<br>Update emails | Decommissioning<br>Safety<br>Rehabilitation progress and financial assurance<br>Closure criteria<br>Surface water and groundwater management<br>Sustainability<br>Final land use |
| **Charters Towers Council** | Annually, or as requested by the stakeholder | Shire council meetings<br>Site/Community meetings<br>Closure committee<br>Update emails | Future land use<br>Transition to post-mining business<br>Sustainability |
| **Registered interest-Community Groups** | Annually, or as requested by the stakeholder | Shire council meetings<br>Site/Community meetings<br>Closure Committee<br>Update emails | Sustainability<br>Transition to post-mining business<br>Welfare |
| **Tier Two Stakeholders** | | | |
| **Other Community Groups** | On an as-and-when basis (when there is news to be shared) | Community meetings and information sessions<br>One on one meetings | Sustainability<br>Transition to post-mining business |
| **Local Businesses and Services** | On an as-and-when basis (when there is news to be shared) | Community meetings and information sessions<br>One on one meetings | Contracting opportunities<br>Transition to post-mining business |

| | | | |
|---|---|---|---|
| **Other Government Depts and Utility Providers** | On an as-and-when basis (when there is news to be shared) | Community meetings and information sessions<br>One on one meetings | Decommissioning or sustaining use of infrastructure |

The Environment Department is the main contact for stakeholder communications with regards to mine closure. The Department has regular contact with members of the local traditional owners, government departments, local community and farmers.

## 4.5 Employees

Employees will be updated at least one year prior to the closure of the site to ensure that they are provided with the information, support and training to minimise the impact of the closure of the operations. Employee consultation will be managed by the Evolution Mining Human Resources Department. Prior to closure, feedback from the workforce will be collected on:

– Redundancy timing,
– Transfers,
– Closure concerns,
– Re-training,
– Advice on dealing with closure,
– Access to counselling.

The responses to the feedback sessions will form the basis for establishment of communication, training and counselling services. The following areas will be targeted and specific initiatives/tasks proposed for each:

– Communication/Information meetings – either directly with the employees or with their chosen representatives,
– Employee counselling services – to assist personnel in maintaining the effort with respect to safety and productivity until mine closure,
– Career and financial advice – to prepare for work prospects and other opportunities after closure,
– Employee appraisals – to ensure that performance until closure is maintained at the highest level possible,
– Training – to ensure that operating tickets are renewed.

# Final Land Use Objectives and Best Practice Rehabilitation Standards

## 1. Domains, Status, History and Status

### 1.1 Domain List

The site at PJO can be classified into a number of domains that will each require rehabilitation to achieve a pre-set final land use objective. These domains are:

- Open cut pits,
- Underground,
- Waste rock dump (WRD),
- Tailings storage facility (TSF),
- Processing plant (heavy infrastructure),
- Admin, workshops, magazine and stores (light infrastructure),
- Water management,
- Roads, fences, power lines, drains.

A schematic representation of the final landform depicting each domain and the drainage features of the project area can be found in the mapping appendix of this document.

## 2. Status

The rehabilitation and operational status of each domain was assessed over a number of site inspections in 2013. The results of site inspection and status for each domain is detailed below.

### 2.1 Open Cut Pits

#### VERA

- Vera pit has a disturbance footprint of 16.8 ha and was mined in the mid 1990s and contains the portal for the underground mine.
- The final land use of the pit is impacted water storage and as a repository for PAF backfill.
- Mining has ceased in the pit; however, it is still an underground access. The underground active access LOM plan is currently three years. The planned date for completion for the abandonment bund is when the access is no longer required.

#### VENUE/VNU

- Venue/VNU pit has a disturbance footprint of 6.3 ha and was completed in 2013.
- The final land use of the pit is impacted water storage and as a repository for PAF backfill.
- Mining has ceased in the pit.

### CINDY

- Cindy pit has a disturbance footprint of 6.8 ha and has an access portal for the underground mine.
- The final land use of the pit is impacted water storage and as a repository for PAF backfill.
- Mining has ceased in the pit; however, it is still an underground access.

### JANET A

- Janet A pit has a disturbance footprint of 3.75 ha and was mined in 2012.
- The final land use of the pit is impacted water storage and potentially as a repository for PAF backfill.

## 2.2 Underground Operations

- The Pajingo Underground has been in operation since the 1990's. It is expected to continue operations until 2016 under current LOM.
- Once decommissioned, the underground will be plugged with 20m of mine waste and then rebounding groundwater will flood the underground workings and portal area. Vent shafts will be closed through the placement of permanent concrete covers.
- The expected final closure date and completion plugging of the portal and covering of vent shafts is within two years of full mine closure.

## 2.3 Waste Rock Dumps, Including ROM and Stockpiles

### VERA ROM AND WRD

- Vera ROM/WRD has a disturbance footprint of 16.8 ha and waste material has been progressively placed. The original intention for the feature was as a ROM pad; however, subsequent mining has led to additional waste rock being stockpiled onto and adjoining the ROM. The current volumes of waste rock are not known. Although the waste is considered to be NAF there may be insufficient documentary evidence to support this
- The final land use of the rehabilitated landform area is light/intermittent grazing.
- The current closure date for the WRD is LOM closure in 2016.

### VENUE/VNU WRD

- Venue/VNU WRD has a disturbance footprint of 19.2 ha. The disturbance area includes a NAF WRD and a cleared area that previously contained PAF material, which has since been rehandled in to the pit.
- The final land use of the rehabilitated landform area is light/intermittent grazing.
- The cleared area will be ripped, topsoiled and seeded, drainage systems will be implemented to ensure runoff is directed appropriately and erosion is controlled.
- The current closure date for the WRD is 2015.

### CINDY WRD

- Cindy WRD has a disturbance footprint of 8.7 ha. Construction has been completed.
- The final land use of the rehabilitated landform area is light/intermittent grazing.
- The WRD is well revegetated and stable.
- This WRD has been closed and is in the monitoring phase.

### SCOTT LODE WRD

- Scott Lode WRD has a disturbance footprint of 24.2 ha. Construction has been completed.
- The disturbance area includes a NAF and a PAF stockpile on the disturbed top section of the WRD which is currently being considered for use in TSF lift programs at the Scott Lode in-pit TSF.
- Original waste rock dump from the Battle Mountain (Australia) mining of the Scott Lode deposit. Known to have been constructed over the period 1987 to 1992, and composed of oxide and primary (PAF) waste (Newmont, 2007).
- The design of the dump comprised a central core of selectively placed primary waste within basal and perimeter layers of oxide waste and an oxide waste cap and compacted soil cover (Pajingo Gold Mine Waste Rock Dump Lease Relinquishment Site Contamination Assessment, Lloyd Consulting Pty Ltd, 2000).
- Some remediation works have been completed on a number of occasions since 1999.
- The final land use of the partially rehabilitated landform area is light/intermittent grazing.
- The WRD's seepage sumps and drain system are in place and will remain in place to manage surface runoff and seepage from the WRD.
- The WRD has been closed but further maintenance work is required on the batters and final rehandle or in situ rehabilitation for the mine waste stored on the top needs to be completed. Depending on the schedule for further lifts of the TSFs and the impact that has in terms of the use of the stored material, the top of the landform may be rehabilitated in 2015.

### JANET A STOCKPILE

- Placement occurred in 2012. The disturbance area is wholly a PAF stockpile. The material is currently being considered for use in TSF lift programs or will otherwise need to be rehandled in to the Janet A pit by September 2014 according to regulatory commitments.
- The final land use of the rehabilitated footprint area is very light/intermittent grazing in the long term.
- Final rehabilitation of the footprint should occur in 2014.

## 2.4 Tailings Storage Facilities

### TSF 1

- TSF 1 is a traditional paddock style tailings storage facility and has a disturbance footprint of 26.5 ha. Major deposition was completed in 2004 with the facility used on

occasion for small deposition events or excess water evaporation on a periodic basis. The tailings material is generally benign.
– The final land use of the rehabilitated landform area is light/intermittent grazing.
– The TSF is well revegetated and generally stable. There are moderate to large erosion features on one location where drainage concentration from access and drainage berms is of both greater velocity and volumes than the measures can manage.
– This TSF will not be finally closed until after the cessation of operations as it may be utilised as an evaporation pond during the final dewatering and closure of impacted water dams. The erosion features will be repaired and an armoured system installed in 2015.

### Scott Lode In-pit TSF

– Scott Lode TSF is an in-pit TSF and has a disturbance footprint of 25.2 ha. Deposition will continue until the cessation of operations currently forecast for 2016.
– The final land use of the rehabilitated landform area is light/intermittent grazing. The TSF will be sheeted with waste rock to a depth still to be determined, topsoiled and revegetated. A drainage plan is required to manage run on from the high wall and rainfall catchment. Existing clean water diversions will be maintained.
– This TSF will not be finally closed until after the cessation of operations as it may be utilised as an evaporation pond during the final dewatering and closure of impacted water dams. A cover design and drainage plan will be prepared in 2015.

## 2.5 Heavy Infrastructure

### Process Plant

– The Process Plant has a disturbance footprint of 2 ha. Current LOM estimates closure of the plant site in 2017.
– The final land use of the rehabilitated landform area is light/intermittent grazing.
– The Process Plant site will be the subject of a decommissioning plan closer to the time of final closure, which will include a plan for the removal or all mobile plant, infrastructure, salvage, inert waste and contaminated waste. The area will then be reprofiled, with drainage measures installed as required and the site revegetated using the standard methodologies applied throughout the operation.
– This Process Plant is currently operational with closure forecast for 2017. However this is subject to change through altered project economics or the institution of a care and maintenance period.

### Paste Thickener

– The Thickener Plant has a disturbance footprint of 2 ha. Current LOM estimates indicate closure of the Thickener in 2017. There is some possibility that the Thickener Plant may be moved from its current location at the edge of Scott Lode TSF to allow for expansion of the TSF, although this is as yet only conceptual.
– The final land use of the rehabilitated landform area is light/intermittent grazing.
– The Thickener Plant will be the subject of a decommissioning plan closer to the time of final closure, which will include a plan for the removal of all mobile plant, infrastructure, salvage, inert waste and contaminated waste. The area will then be reprofiled, with

drainage measures installed as required and revegetated using the standard methodologies applied throughout the site.
– The Thickener Plant is operational with closure forecast for 2017. However this is subject to change through altered project economics or the institution of a care and maintenance period.

## 2.6 Light Infrastructure

– Light Infrastructure areas have a cumulative disturbance footprint of approximately <10 ha and include administration areas, workshops and stores. Current LOM estimates indicate closure of these areas in 2017.
– The final land use of the rehabilitated landform area is light/intermittent grazing.
– Light Infrastructure will be the subject of a decommissioning plan closer to the time of final closure, which will include a plan for the removal or all mobile plant, infrastructure, salvage, inert waste and contaminated waste. The area will then be reprofiled, with drainage measures installed as require and revegetated using the standard methodologies applied throughout the site.
– Light infrastructure areas are operational with closure forecast for 2017. However, this is subject to change through altered project economics or the institution of a care and maintenance period.

## 2.7 Water Management Infrastructure and Dams

– Impacted water dams have various disturbance footprints as set out in the EA.
– The final land use of the closed dams is water storage.
– Impacted water dams will be the subject of a decommissioning plan closer to the time of final closure which will include a testing of sediments and removal and encapsulation of sediments in exceedance of established NEPM guidelines, construction of spillways, pipes or other overflow mechanisms which are to an approved design standard, removal of, or reprofiling of dam walls and embankment, monitoring of dam seepage or flow discharges at agreed frequencies for agreed water quality parameters.
– Impacted water dams are operational with closure forecast for 2017. However, this is subject to change through altered project economics or the institution of a care and maintenance period. Dams may continue to operate for a period after closure until water quality is demonstrated to meet criteria.

## 2.8 Roads, Fences, Pipelines and Drains

– The final land use of the rehabilitated disturbance area is light/intermittent grazing.
– The areas will be rehabilitated using the standard site techniques of reprofiling, establishing drainage controls where necessary, topsoil application, and seeding with native seed.

# 3. Rehabilitation Objectives

## 3.1 Contemporary Objectives

Contemporary rehabilitation objectives adopted by government (EHP) are proposed for Pajingo. The objectives include ensuring that the rehabilitated land must be to an agreed land use and is:

– Safe to humans, stock and wildlife,
– Non-polluting,
– Stable,
– Able to sustain an agreed post-mining land use.

The definition of 'an agreed land use' is the use of the landform after successful rehabilitation has been achieved. The use of the landform post successful rehabilitation should be agreed to with stakeholders during the closure planning process. The nominated land use can be different for each rehabilitated domain, for example an open pit may have a water storage as the final land use, where as a Waste Rock Dump's land use could be identified as habitat values or light intensity grazing.

A post closure proposed land use and land use classification, in accordance with EHP Guidelines on Land Suitability Classification, has been established for each disturbance area. In accordance with the Environmental Authority, completion criteria have been established for the contemporary rehabilitation objectives.

## 3.2 The Pit

### Post Activity Land Use Objectives

The intended final land use for the pit at PJO is as a residual void acting as water storage. In order to achieve this land use, it is vital that the water in the pit poses no harm to the receiving environment. The safety risk of a water body of this nature also needs to be managed, so the water body poses minimal risk to people, wildlife and stock. Indicative Completion Goals

The pit can be considered successfully rehabilitated to an agreed final land use when:

– Access to the pit is restricted by construction of a bund or fencing that would prevent accidental access to the pit.
– In the case of a person or animal ending up in the water body in the pit, egress from the pit is manageable through reasonable means.
– Drainage systems are successfully directing water with minimal erosion occurring.

### Rehabilitation Design Specifications and Activities

In order to achieve the indicative completion goals for rehabilitating the pit to an agreed final land use, the following actions should take place post operational activity.

Safety bund walls will be constructed around each void from appropriate material to limit access for human and livestock. The safety bund walls will be constructed in accordance with the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland (EPA, 1995). The Guideline requires the bund wall to have a minimum base width of 4m, a minimum height of 2 m and be positioned at least 20m from any area potentially affected by instability of the pit edge. In order to calculate an accurate placement of the bund, the following design specifications should be used: 25° from the toe of the pit wall to the surface when the pit wall is weathered rock, and 45° from the toe of the pit wall to the surface when the pit wall is unweathered rock; plus an additional 10 meters to the pit-side toe of the bund (Figure 11).

Where possible, access slopes into the pit should be retained to allow reasonable egress in the event of accidental immersion in the water body. A fence and signage around the perimeter of the pit may also be installed to restrict entry of wildlife and livestock.

Drainage systems will remain in place or be upgraded where necessary to manage clean surface water runoff around the pit and direct water towards the surrounding natural environment. Seepage from the pits should be directed into the seepage dams. The water level is to remain below freeboard level.

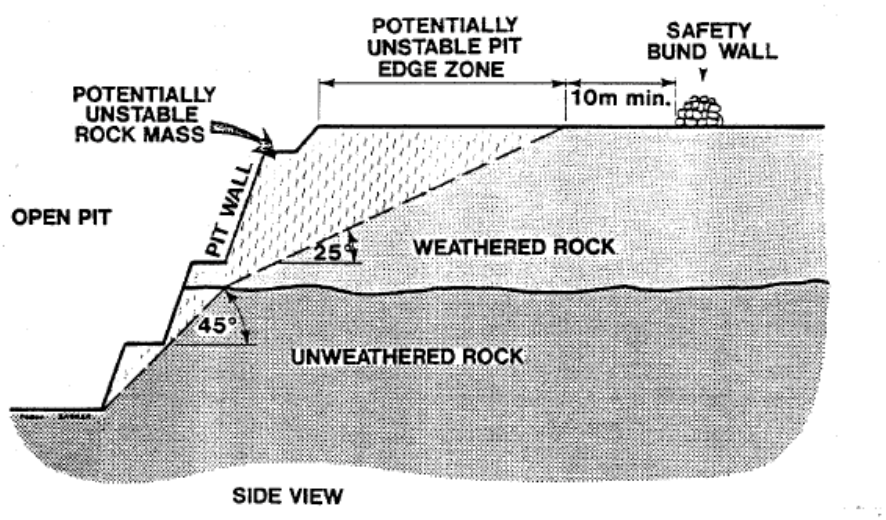


**Figure 11: Safety bund for pit wall in weathered and unweathered rock (DIR WA 1997)**

## Rehabilitation Success Monitoring

In order to ensure that the pit has been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's Guideline 18 Rehabilitation requirements for mining projects:

– Surface water quality should be monitored at regular intervals.
– The slope into the pit should be assessed for integrity and ongoing stability.

– The site should be mapped to include the bund and the residual void and site inspections should take place at acceptable intervals to ensure the integrity of the bund and residual void.

Monitoring of indicators will start as soon as practically possible after decommissioning.

## 3.3 Waste Rock Dumps

### Post Activity Land Use Objectives

The post activity land use objectives for the waste rock dumps are for habitat value with and the possibility of light intensity cattle grazing where the steepness of the slopes allows it.

The steepness of the slopes on the finished landform must be conducive to a geotechnically stable structure, with erosion and sediment control landscaping that ensure erosion rates will not interfere with the achievement of final land use.

### Indicative Completion Goals

– With the exception of landforms that are partially rehabilitated (Scott Lode WRD) the maximum bench intervals should be approximately 10m with a two degree back slope, batters should have a slope of 1V:3H and a height of 10m.
– The berms and batters will be reshaped if required to achieve long term geotechnical stability.
– Drainage measures on tops and batter faces should be designed to ensure long term sustainability. Drainage features will aim to reduce the potential for runoff and seepage from the WRDs and minimise the potential for the pit water level to rise above the regional groundwater level.

### Rehabilitation Design Specifications and Activities

According to EHP's rehabilitation objectives and Pajingo's rehabilitation completion criteria, the waste rock dumps must demonstrate the following to ensure long-term safety:

On decommissioning, the respective WRD will be designed with batters to a slope of 1V:3H, approximately 10m in height. The benches will be approximately 10m with a two degree back slope to promote rain to flow away from the crest and towards the strongest part of the structure. Armour may be used in drains to ensure no unacceptable erosion or seepage occurs. The maximum bench intervals should be no greater than 20m. The aim when reshaping WRDs is to produce slopes with angles, lengths and shapes compatible with the surrounding landscape, suitable for the proposed post-mine land use of light intensity cattle grazing and not prone to an unacceptable rate of erosion. Combinations of acceptable slope angles and satisfactory revegetation usually maintain runoff velocities at roughly constant, non-erosive values.

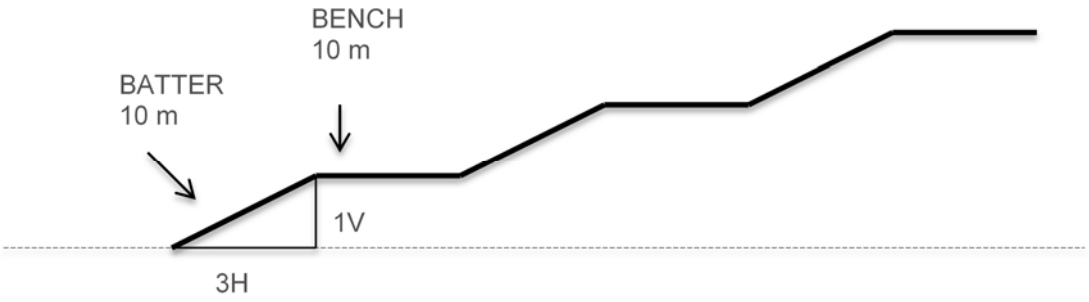


**Figure 12: Cross section of the WRD**

WRDs which contain only NAF rock do not need to be clay capped. A layer of topsoil, or an engineered soil layer then a layer of topsoil will be constructed on the WRD once decommissioned.

WRDs that contain PAF rock will be rehandled to a pit or have an appropriate cap applied. The cap will limit infiltration of surface water into the WRD and minimise the chance of contaminated leachate production. A layer of topsoil, or an engineered soil layer then a layer of topsoil will be constructed on the WRD clay capping.

The top surface of the WRD should be formed into a slightly convex shape, as this assists in reducing infiltration and diversion of the runoff to the outer slopes of the dump.

Each WRD's seepage sumps and drain system will remain in place or be upgraded where necessary to manage surface runoff and seepage from the WRDs.

The drains would be formed on grade and constructed by excavation to flow towards the pit. Drain surfaces would be armoured with strong, benign waste rock. To minimise scouring at the drain discharge area, rock armouring will be placed over a sufficient drain length to dissipate flows.

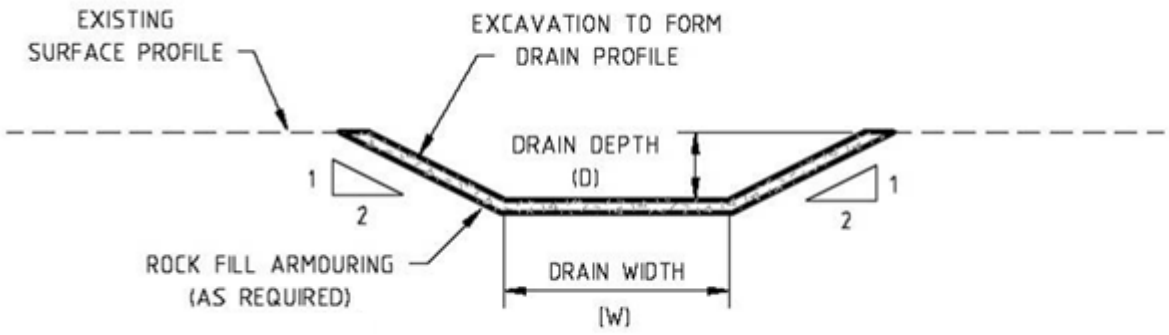


**Figure 13: Sample drainage cross section (Allan Watson Associates 2012)**

### Rehabilitation Success Monitoring

In order to ensure that the WRDs have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18: Rehabilitation requirements for mining projects*:

- Surface water quality should be monitored at regular intervals.
- Stream sediment quality should be monitored at regular intervals.
- Revegetation assessments should be undertaken biannually, once in the wet season and once in the dry season. Revegetation assessments should include:
  - Assessment of vegetation on both slopes and flat areas using the site rehabilitation monitoring methodology,
  - Land suitability assessment,
  - Slope stability analysis including an erosion assessment,
  - Determination of areas impacted by acid mine drainage (AMD) that will require further rehabilitation and revegetation,
- The slopes should be assessed for integrity and ongoing stability.

Monitoring of indicators will start as soon as practically possible after decommissioning.

## 3.4 Tailings Storage Facility

### Post Activity Land Use Objectives

The post activity land use objectives for a TSF is the ability to support habitat values and the possibility of light intensity cattle grazing on flat sections.

The steepness of the embankment slopes on the finished landform must be conducive to a geotechnically stable structure, with erosion and sediment control features that ensure erosion rates will not interfere with the achievement of final land use.

All hazardous material content of the final landform must be managed appropriately to ensure that any runoff of precipitation or seepage from the tailings storage facility poses no harm to the receiving environment or to environmental values.

### Indicative Completion Goals

- The post activity land use capability for the rehabilitated TSFs should be class VI for the top sections, and class VII for embankment slopes.
- The final landform should be geotechnically stable with no unacceptable erosion or seepage.

### Rehabilitation Design Specifications and Activities

In order to achieve the indicative completion goals for rehabilitating the TSFs to an agreed final land use, the following structure design and actions should be implemented post operational activity.

- The structure of the TSF should be constructed with maximum bench intervals no greater than 10m, maximum bench width no wider than 5m.

- The embankment slopes should be reshaped if necessary to achieve long term geotechnical stability and establish adequate drainage to limit ponding.
- The seepage sumps and drain system will remain in place or be upgraded where necessary to manage seepage from the TSF. Interception of any seepage will be redirected through a network of interception drains.
- Drain surfaces would be armoured with strong, benign waste rock. To minimise scouring at the drain discharge area, rock armouring will be placed over a sufficient drain length to dissipate flows.
- Construction of a low permeability cap will be undertaken on decommissioning. The cover design for the TSF will be determined once rehabilitation trials have been completed. The possible TSF cap designs include, 100mm NAF rock, 100m engineered soil/rock layer and 200mm topsoil. The cover will be profiled to prevent ponding and promote clean surface water runoff to discharge to the environment.

The revegetation of the structures should involve ripping to 300mm on flat sections to allow for the establishment of vegetation. Revegetation of embankment slope and top surfaces using available topsoil resources (to 200mm thick where possible) and native, tree and pasture species to meet the final land use classes and original ecosystem. Significant exotic species control should be undertaken to allow native vegetation time to grow and establish, as required under the Land Protection (Pest and Stock Route Management) Act 2002.

### Rehabilitation Success Monitoring

In order to ensure that the TSFs have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18 Rehabilitation requirements for mining projects:*

- Surface water quality should be monitored at regular intervals.
- Stream sediment quality should be monitored at regular intervals.
- An assessment of slope stability should be undertaken.
- There should be an assessment of exposed hazardous material and treatment where required.
- Erosion and sediment control structures should be inspected regularly.
- Revegetation assessments should be undertaken biannually, once in the wet season and once in the dry season. Revegetation assessments should include:
  - An assessment of vegetation on both slopes and flat areas using the site rehabilitation monitoring methodology
  - A land suitability assessment.

Monitoring of indicators will start as soon as practically possible after decommissioning.

## 3.5 Roads and Access Tracks

### Post Activity Land Use Objectives

The intended final land use for road and access tracks at PJO is light intensity grazing. In order to achieve this land use, it is vital that all areas are rehabilitated, with erosion managed and runoff water of a quality that does not present a risk of environmental harm.

### Indicative Completion Goals

- Surfaces should align with natural contours of the land either side.
- If access roads are to remain, these should be done so under written agreement with the landholder and should be left in an appropriate condition.

### Rehabilitation Activities

In order to achieve the indicative completion goals for rehabilitating roads and access tracks to an agreed final land use, the following actions should take place post operational activity.

Higher road surfaces should be minimised to align with the natural contour of the land. Slopes should be minimised to limit erosion potential and water runoff potential. Revegetation work should involve the ripping to 300mm on all sections to allow for the establishment of vegetation. Revegetation should occur using available topsoil resources (to 100mm thick where possible) and native, tree and pasture species to meet the final land use. Significant exotic species control should be undertaken to allow native vegetation time to grow and establish, as required under the Land Protection (Pest and Stock Route Management) Act 2002.

### Rehabilitation Success Monitoring

In order to ensure that the roads and access tracks have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18 Rehabilitation requirements for mining projects*:

- Surface water quality should be monitored at regular intervals.
- Stream sediment quality should be monitored at regular intervals.
- Accumulation of fine sediment in streams downstream of rehabilitated roads should be monitored.
- Erosion and sediment control structures should be inspected regularly.
- Revegetation assessments should be undertaken biannually, once in the wet season and once in the dry season. Revegetation assessments should include:
  - Assessment of vegetation on both slopes and flat areas using approaches specified in the Pajingo Environmental Monitoring Manual,
  - Land suitability assessment.

## 3.6 Workshops and Light Infrastructure Management Areas

### Post Activity Land Use Objectives

The intended final land use for workshops and infrastructure areas at PJO is light intensity grazing. In order to achieve this land use, it is vital that all areas are rehabilitated appropriately, with erosion managed and runoff water of a quality that does not present a risk of environmental harm.

### Indicative Completion Goals

The post activity land use capability for workshop and infrastructure areas at PJO should be class VI unless otherwise agreed to be maintained on the land:

- Surfaces should align with natural contours of the land.
- If any infrastructure is to remain, this should be done so under written agreement with the landholder and should be left in an appropriate condition.
- Otherwise, all infrastructures should be decommissioned and removed from the site Recoverable scrap metal to be recycled.
- Any contaminated soil should be removed appropriately and managed adequately before rehabilitation of these domains take place.
- Drainage systems will remain in place or be upgraded where necessary to manage surface runoff effectively.

## Rehabilitation Activities

In order to achieve the indicative completion goals for rehabilitating workshop and infrastructure areas to an agreed final land use, the following actions should take place post operational activity.

Any contaminated soil from workshop areas will be cleaned up using appropriate spill kits and managed to prevent further environmental harm. Rehabilitation works will commence once the area to be rehabilitated has been verified as being at or below acceptable contamination levels. Where activities have resulted in land contamination, a land contamination assessment should be undertaken in compliance with the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland* (DoE 1998). Where contamination exists, the site management plan should include clean-up options.

All surfaces should be minimised to align with the natural contour of the land. Any slopes should be minimised to limit erosion potential and water runoff potential. Revegetation work should involve the ripping to 300mm on all sections to allow for the establishment of vegetation. Revegetation should occur using available topsoil resources (to 100mm thick where possible) and native, tree and pasture species to meet the final land use. Significant exotic species control should be undertaken to allow native vegetation time to grow and establish, as required under the Land Protection (Pest and Stock Route Management) Act 2002.

## Rehabilitation Success Monitoring

In order to ensure that the workshop and infrastructure areas have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18: Rehabilitation Requirements for Mining Projects*:

- Surface water quality should be monitored at regular intervals.
- Stream sediment quality should be monitored at regular intervals.
- Erosion and sediment control structures should be inspected regularly.
- Revegetation assessments should be undertaken biannually, once in the wet season and once in the dry season. Revegetation assessments should include:
  - Assessment of vegetation on both slopes and flat areas using approaches specified in the Pajingo Environmental Monitoring Manual
  - Land suitability assessment.

Monitoring of indicators will start as soon as practically possible after decommissioning.

## 3.7 Water Management Infrastructure and Dams

### Post Activity Land Use Objectives

The intended final land use for water management infrastructure and dams at PJO are to remain as water storages. In order to achieve this land use, it is vital that the water in the dams poses no harm to the receiving environment. The safety risk of a water body of this nature also needs to be managed, so the water body poses minimal risk to people, wildlife and stock.

### Indicative Completion Goals

The water dams can be considered successfully rehabilitated to an agreed final land use when:

- Dam walls and bypass channels are stabilised with adequate vegetation or rock.
- Erosion does not compromise dam wall integrity.
- In the case of a person or animal ending up in the water body, egress from the dam should be manageable through reasonable means.
- Drainage systems will remain in place or be upgraded where necessary to manage surface runoff effectively.

### Rehabilitation Activities

In order to achieve the indicative completion goals for rehabilitating water dams to the agreed final land use, the following actions should take place post operational activity.

- Sediment dams should be de-silted as necessary with any sediment placed in the pit.
- Where appropriate, dam walls should be re-profiled to allow adequate drainage and limit erosion potential.
- Dam walls and bypass channels should be stabilised by using native vegetation or rock.

### Rehabilitation Success Monitoring

In order to ensure that water dams have been successfully rehabilitated to the designated objectives, the following activities should be carried out, in line with EHP's *Guideline 18: Rehabilitation Requirements for Mining Projects*:

- Surface water quality should be monitored at regular intervals as specified in the Pajingo Environmental Monitoring Manual.
- The slope into the dams should be assessed for integrity and ongoing stability.
- If dam walls and bypass channels are revegetated, revegetation assessment should occur biannually, once in the wet season and once in the dry season. Revegetation assessments should include:
  - Assessment of vegetation on both slopes and flat areas using approaches specified in the Pajingo Environmental Monitoring Manual.

## 3.8 Summary of Rehabilitation Objectives and Control Measures

This section summarises the rehabilitation objectives for the mine domains and outlines the control measures and the basic monitoring to be undertaken to determine if the rehabilitation is successful. Monitoring methods and revegetation completion criteria are described in detail in Section 6.

**Table 10: Rehabilitation objective, control measures and monitoring**

| Rehabilitation objective | Control Measure | Monitoring |
|---|---|---|
| **The Pit** | | |
| Minimise erosion from pit and surrounding area. | Runoff from the area discharges to a stable drainage system. Areas of unacceptable erosion that poses an accident hazard to a walking human or could lead to uncontrolled water discharge from an area are to be reworked and erosion control methods applied. | Surface water monitoring at regular intervals. |
| Access to the pit and water storage facilities is restricted. | A 2m high bund with a 4m base should be constructed approximately 20 metres from the lip of the residual voids to prevent accidental access. Fences and signs established where required. | The site should be mapped to include the bund and the residual void and site inspections should take place at acceptable intervals to ensure the integrity of the bund and residual void. |
| Slope in pit is stable. | Pit slope angles and lengths are designed to acceptable industry standard. | The slope into the pit should be assessed for integrity and ongoing stability. |
| In the case of a person or animal ending up in the water body, egress from the pit is manageable. | Access slopes into the pit should be retained. | The slope into the pit should be assessed for integrity and ongoing stability. |
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor biannually species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Waste Rock Dumps** | | |
| Stability of Waste Rock dumps and no unacceptable erosion. | The maximum bench intervals should be approximately 10m with a 2° back slope, batters should have a slope of 1V:3H and height of 10m. | |
| The berms and batters will be reshaped if required to achieve long term geotechnical stability. | Slope stability analysis including an erosion assessment to ensure integrity and ongoing stability. | |
| No potentially harmful seepage or runoff to the receiving environment. | Drainage measures on tops and batter faces should be designed to ensure long term sustainability. | Surface water quality should be monitored at regular intervals. Stream sediment quality should be monitored at regular intervals. |

| Rehabilitation objective | Control Measure | Monitoring |
|---|---|---|
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor biannually species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Tailings Storage Facility** | | |
| Steepness of the embankment slopes on the TSF must be conducive to a geotechnically stable structure. | The final TSF design should incorporate the following structure specifications:<br>The maximum bench intervals should be no greater than 10m.<br>The maximum bench width no wider than 5m. | Assessment of slope stability at regular intervals. |
| No potentially harmful seepage or runoff to receiving environment. | Interception of any seepage will be redirected through a network of interception drains. | Surface water quality should be monitored at regular intervals. Stream sediment quality should be monitored at regular intervals. Assessment of exposed hazardous material and treatment where required. |
| No unacceptable erosion from TSF. | The embankment slopes should be reshaped if necessary to achieve long term geotechnical stability and establish adequate drainage. | Erosion and sediment control structures should be inspected regularly. |
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor biannually species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Roads and Access Tracks** | | |
| No potentially harmful runoff to receiving environment. | Interception of any seepage will be redirected through a network of interception drains. | Surface water quality should be monitored at regular intervals. Stream sediment quality should be monitored at regular intervals. Accumulation of fine sediment in streams downstream of rehabilitated roads should be monitored. |
| No unacceptable erosion. | Slopes should be minimised to limit erosion potential and water runoff potential. | Erosion and sediment control structures should be inspected regularly. |
| Surfaces should align with natural contours of the land either side. | Higher road surfaces should be minimised to align with the natural contour of the land. | Land suitability assessment. |
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor biannually species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Workshops and Light Infrastructure Areas** | | |

| Rehabilitation objective | Control Measure | Monitoring |
|---|---|---|
| Surfaces should align with natural contours of the land. | All surfaces should be minimised to align with the natural contour of the land. Any slopes should be minimised to limit erosion potential and water runoff potential. | Land suitability assessment Erosion and sediment control structures should be inspected regularly. |
| Removal of infrastructure from site. | Infrastructure should be decommissioned and removed from the site. Recoverable scrap metal to be recycled. | N/A |
| Any contaminated soil should be removed appropriately and managed adequately before rehabilitation is undertaken. | Contaminated soil will be cleaned up using appropriate spill kits and managed to prevent further environmental harm. Contamination assessment and testing to be undertaken to ensure contamination levels are acceptable. | Surface water quality should be monitored at regular intervals. Stream sediment quality should be monitored at regular intervals. |
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor biannually species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |
| **Water Management Infrastructure and Dams** | | |
| Water storages are safe and stable. | Dam walls and bypass channels are stabilised with adequate vegetation or rock. Sediment dams should be de-silted as necessary with any sediment placed in the pit. | Surface water quality should be monitored at regular intervals as specified in the Pajingo Environmental Monitoring Manual. The slope into the dams should be assessed for integrity and ongoing stability. |
| Erosion does not compromise dam wall integrity. | Where appropriate, dam walls should be re-profiled to allow adequate drainage and limit erosion potential. | The slopes should be assessed for integrity and ongoing stability. |
| In the case of a person or animal ending up in the water body, egress from the pit is manageable. | Access slopes into the water body should be retained. | The slopes should be assessed for integrity and ongoing stability. |
| Revegetate area. | Rip surfaces, add topsoil, add mix of native seed. | Monitor biannually species diversity, abundance, composition, projective cover, dry matter production, stocking rates. See section 5 for monitoring methods. |

# 4. Knowledge Gaps and Research Program

The Final Land Use and Rehabilitation Plan is a living document that is based on the current Plan of Operations, EA and best practice rehabilitation techniques. In order to prepare for the closure of the mine, all knowledge gaps must be filled.

Studies required to close knowledge gaps should be undertaken with the operating mine life of each domain in mind. Milestones have been assigned to each study area with priority given to work that is a dependency for any aspect of another study.

Major milestones for the research program include the completion of the hydrological, geotechnical and geochemical investigations in addition to the rehabilitation trials. These investigations and trials would be most effective if completed by late 2015 to early 2016 to allow sufficient time to undertake the studies and to implement the findings into rehabilitation activities at the Pajingo site.

## INVESTIGATION INTO THE FINAL FOOTPRINT OF EACH MINE DOMAIN

The final footprint, volume and characteristics of the waste rock material for Venue/VNU, Scott Lode WRD, Vera WRD and Janet A Stockpile will need to be determined in order to design the final drainage and abandonment bunds and to decide the placement of the PAF waste rock material.

**Milestone timeframe: December 2014**

### SURFACE HYDROLOGY INVESTIGATION

- A surface hydrology investigation will be undertaken on Venue/VNU, Janet A, TSF1, Scott Lode TSF, water storage areas, process plant, thickener and light infrastructure areas.
- The aim of the investigation is to determine: clean and impacted waters drainage area plans, drain and amour/rip rap requirements and pipe or spillway designs for the final closure configuration to meet agreed standards.

Given that the success of rehabilitation is dependent on the ongoing management of water it is imperative that once the final landform footprint is determined, an integrated water management design for the site is developed. This will prevent drainage management conflict between individual domains and well as allowing for the design structures sized appropriately for expected accumulated flow from a number of domains (reducing the chance of drain failure).

**Milestone timeframe: June 2015**

## GEOCHEMICAL INVESTIGATION

- A geochemical study on Scott Lode WRD, Scott Lode TSF and the process plant, thickener and light infrastructure areas will be undertaken.
- The study will identify if there is potential for AMD impacts to cause significant environmental harm and if the contaminant levels in the area are below acceptable levels.

**Milestone timeframe: December 2015**

## REHABILITATION TRIALS

Further research will be undertaken which involves rehabilitation trials at Pajingo. Results from these trials will add to the rehabilitation knowledge already gained from the Cindy WRD rehabilitation at Pajingo. A number of rehabilitation trial methods would be used to find the most effective style of rehabilitation for each site domain, focussing mainly on the TSF, water storage dams and light infrastructure domains in the project area. Over a period of

approximately 12 months a small scale representative area of approximately 1 – 2 hectares would be used to trial a variety of rehabilitation options including cover type and thickness, seed species and proportion of understorey to overstorey species. A 12 month trial will be undertaken so that monitoring of progress can occur over the dry season and wet season.

Trial approaches will be undertaken on the TSF to determine the most effective rehabilitation method. Growth of seed will be investigated using the following substrate:

– TSF material,
– TSF material covered with topsoil,
– TSF material, engineered rock/soil layer and topsoil,
– TSF material, clay capping, engineered rock/soil layer and topsoil.

### Geotechnical Investigation

– A geotechnical investigation should be undertaken on Scott Lode WRD to ensure that the drainage measures are adequate to ensure long term erosional stability.

**Milestone timeframe: June 2016**

### Water Storage Plan – Treatment and Discharge

– Water storage plans for estimates of water volume, which will not be dischargeable and require passive or active treatment will need to be created. The plans should include intended methodologies of water treatment and expected duration of treatment, post closure monitoring locations, frequency and parameters.

**Milestone timeframe: June 2016**

### Decommissioning and Salvage Plan

– A decommissioning and salvage plan for the removal of the process plant, thickener and light infrastructure will be created.

**Milestone timeframe: June 2017**

# 5. Revegetation Activities

## 5.1 Ripping and Topsoil Preparation

All surfaces to be rehabilitated should be ripped to 300mm to increase the success of seeding. Before using topsoil, it should be determined whether the material contains weeds and hence deemed unsuitable for rehabilitation. It should also be determined whether topsoil contains suitable nutrients or whether fertiliser application will be required.

The design criteria for ripping operations are represented in Table 11. The slope of the land determines the spacing between rip lines; this acts to reduce soil erosion and increase plant establishment rates.

**Table 11: Ripping design for surface preparation**

| Slope | Ripping Depth | Tyne Spacing |
|---|---|---|
| **>10%** | 300mm | <1.5m |
| **5-10%** | 300mm | <2.5m |
| **<5%** | 300mm | <5m |

## 5.2 Topsoil Spreading

Topsoil to be used for rehabilitation will be taken from topsoil stockpiles around the Pajingo site. According to the Plan of Operations - Financial Assurance calculations, the approximate amount of topsoil required to rehabilitate the project area is 420,000 $m^3$, assuming a depth of 100mm.

The following treatments are recommended in order to maximise the potential of soils used in the rehabilitation program:

– Topsoil to be spread to a depth of 100 mm to 200 mm at areas being rehabilitated,
– Where required, erosion control methods will be implemented,
– Topsoil to be replaced to locations as near as possible to its point of origin. This will be undertaken to minimise transport costs and maximise the potential for germination from within the soil seed bank.

## 5.3 Contouring

Surface contouring will be undertaken in the preparation of disturbed areas prior to the establishment of vegetation. Surface contouring will minimise erosion and maximise beneficial land use.

## 5.4 Seeding

Re-establishment of vegetation will be based on direct seeding. The plant species in **Error! Reference source not found.** are potential species for PJO rehabilitation and a sub set of these species is used on specific rehabilitation projects based on specific local vegetation types, seed availability and land use factors such as where grazing or woodland land use objectives are more or less prominent in particular settings.

Seeds will be sourced from Greening Australia's Seed Bank or an equivalent provider. The topsoil stockpiled on site may also contain seeds, these seeds will be used where available. The seeds in the stockpiles are native to the area; therefore, their chance of growth is higher than seeds that are not local to the site. Seeds will be spread by hand and watered via water truck, where appropriate.

**Table 12: Potential Rehabilitation Species**

| Family | Species Name | Common Name |
|---|---|---|
| **Tree/Shrub** | | |
| ***Fabaceae*** | *Acacia bidwillii* | Corkwood wattle, Dogwood |
| | *Acacia holosericea* | Candelabra wattle |
| ***Rhamnaceae*** | *Alphitonia excelsa* | Red ash |
| ***Sapindaceae*** | *Atalaya hemiglauca* | Whitewood |
| ***Myrtaceae*** | *Corymbia dallachyana* | Dallachy's gum |
| | *Corymbia erythrophloia* | Variable-barked bloodwood |
| | *Corymbia tessellaris* | Moreton bay ash, Carbeen |
| | *Eucalyptus brownii* | Reid river box |
| | *Eucalyptus crebra* | Narrow-leafed ironbark |
| | *Lophostemon grandiflorus* | Northern swamp mahogany |
| | *Melaleuca leucadendra* | Weeping tea-tree, Weeping paperbark |
| ***Proteaceae*** | *Grevillea striata* | Beefwood, Silver honeysuckle |
| **Grass** | | |
| ***Poaceae*** | *Aristida calycine* | Dark wiregrass |
| | *Aristida latifolia* | Feathertop wiregrass |
| | *Bothriochloa ewartiana* | Desert bluegrass |
| | *Chloris inflate* | Swollen fingergrass |
| | *Dichanthium fecundum* | Curly bluegrass |
| | *Dichanthium sericeum* | Queensland bluegrass |
| | *Heteropogon contortus* | Spear grass |
| | *Themeda triandra* | Kangaroo grass |

Any seeds waiting for use in rehabilitation should be stored in cool, dry conditions and protected from insects. Some seeds may require pre-treatment to enhance or facilitate germination. All direct seeding should take place prior to the wet season to allow for adequate rainfall during the establishment period. Establishment of seedlings should take place in approximately one month with adequate rainfall. Reseeding may be necessary if germination fails in some areas.

The ratio of each species used in the rehabilitation seed mix will be varied based on the rehabilitated land use type for the area. For example, the seed mix for areas being rehabilitated to low intensity grazing would have a higher proportion of grass species than tree species. Whereas, native tree and shrub species would dominate the seed mix for areas to be returned to bushland.

Weed invasion should be controlled by spot spraying during the establishment period to ensure native species are not outcompeted. The Pajingo Weed Management Plan will be

implemented to make sure there is a balance between revegetation initiatives and the management of existing weed species and those established due to land disturbance.

# 6. Rehabilitation Monitoring

A significant component of determining the rehabilitation success of decommissioned sites is to monitor vegetation re-establishment, growth and sustainability. Objectives for revegetation will be monitored by the methods identified in this section. Specific criteria, standards and corrective actions being used to determine rehabilitation success are defined in Table 14.

## 6.1 Revegetation Monitoring Methods

The framework for rehabilitation monitoring will be based on the principles of Ecosystem Function Analysis (EFA). The EFA encompasses the following components, landscape function analysis (LFA), vegetation structure and composition and habitat complexity. EFA will be used to obtain information on the success of rehabilitation by drawing comparisons to control/analogue sites for a variety of target values. Monitoring will be undertaken in both dry and wet seasons annually to capture seasonal variability in growth of vegetation.

Regular vegetation monitoring forms a relevant requirement by EHP to make decisions on the adequacy and sustainability of rehabilitation. EHP's *Guideline 18: Rehabilitation requirements for mining projects* states that monitoring the indicators for an area of progressive rehabilitation should result in a clarification of issues, minimisation of risks and an increasing certainty in the sustainability of the rehabilitation.

As part of PJO's ongoing commitment to environmental management, areas disturbed by mining activity at the Pajingo Mine are progressively rehabilitated. The general objective of rehabilitation is to rehabilitate land to a condition, which is safe, stable and self-sustaining. Vegetation monitoring of these areas is undertaken to establish whether the areas are progressing towards achieving self-sustaining ecosystems and stable environments.

## 6.2 Transect Monitoring

Transects were established in 1999 on rehabilitated and undisturbed control areas of the Pajingo mining leases, as discussed in Mattiske's *Assessment of Rehabilitation Areas*. Where possible, 100m transects were established; however, in some areas, this was not possible due to the constraints of the specific sites (e.g. the transects down the slopes on Scott Lode were slightly less than 100m as the slope ended and changed to undisturbed native vegetation). These transects have been monitored annually since 1999.

Monitoring is undertaken following the wet season (approximately April each year). A total of 32 transects are established at the Pajingo Mine in rehabilitated areas and relatively undisturbed control areas. Transects range in length from 30 to 100 metres and include 1m x 1m quadrats at 5m intervals.

A summary of transects used for quadrat monitoring at Pajingo Mine as shown in Table 13.

**Table 13: Rehabilitation Monitoring Locations - Transects and Quadrats**

| Area | Transect no. | Transect length (m) | Number of quadrats | Topography | Easting (AGD84) | Northing (AGD84) |
|---|---|---|---|---|---|---|
| Cindy | 1 | 30 | 6 | flat | 443427 | 7728985 |
| Cindy | 2 | 30 | 6 | flat | 443374 | 7728975 |
| Cindy | 3 | 35 | 7 | flat | 443323 | 7728968 |
| Cindy | 4 | 45 | 9 | flat | 443277 | 7728949 |
| Cindy | 5 | 40 | 8 | flat | 443230 | 7728941 |
| Cindy | 6 | 30 | 6 | slope | 443254 | 7728937 |
| Cindy | 7 | 40 | 8 | slope | 443301 | 7728949 |
| Cindy | 8 | 50 | 10 | slope | 443353 | 7728962 |
| Cindy | 9 | 55 | 11 | slope | 443402 | 7728971 |
| Cindy | 10 | 100 | 20 | slope | 443483 | 7729000 |
| Cindy | 11 | 100 | 20 | slope | 443439 | 7729018 |
| Scott Lode | 16* | 100 | 20 | flat | 441915 | 7730382 |
| Scott Lode | 17 | 100 | 20 | flat | 441949 | 7730572 |
| Scott Lode | 18 | 100 | 20 | slope | 441936 | 7730833 |
| Scott Lode | 19 | 100 | 20 | flat | 441740 | 7730679 |
| Scott Lode | 20 | 100 | 20 | slope | 441852 | 7730827 |
| Scott Lode | 21* | 100 | 20 | flat | 441937 | 7730263 |
| Scott Lode | 22 | 90 | 18 | slope | 441714 | 7730767 |
| Scott Lode | 23 | 95 | 19 | slope | 441680 | 7730537 |
| Exploration | 12 | 100 | 20 | flat | 443165 | 7728103 |
| Exploration | 13 | 100 | 20 | flat | 443195 | 7727999 |
| Control | 14 | 100 | 20 | flat | 443174 | 7727889 |
| Control | 15 | 100 | 20 | flat | 443590 | 7728280 |
| Control | 24* | 100 | 20 | flat | 441478 | 7730256 |
| Control | 25 | 100 | 20 | slope | 442434 | 7730204 |
| Control | 26 | 100 | 20 | slope | 442435 | 7730270 |
| Control | 27 | 100 | 20 | flat | 443921 | 7728873 |
| Control | 28 | 100 | 20 | flat | 442019 | 7727586 |
| Control | 29 | 100 | 20 | flat | 442134 | 7727617 |
| K dump | 30 | 40 | 8 | Flat | 442129 | 7729974 |
| K Dump | 31 | 44 | 8 | Flat | 442210 | 7729967 |
| K Dump | 32 | 50 | 10 | flat | 442268 | 7729954 |

* Tree plots associated with transect (approx. 25 x 25 metres)

### Quantitative Vegetation Monitoring

Rehabilitation data to be recorded at each transect should include the following parameters:

- Species diversity,
- Species abundance,
- Species composition,
- Tree Density (trees/ha),
- Shrub Density (shrubs/ha),
- Herb / Grass Density (grasses/ha),
- Dry matter production,
- Habitat complexity,
- Number of new recruits,
- Stocking rates,
- Erosion indicators (depth of rills or erosion lines, surface crusting, slopes),
- Photographic records of the site to provide a visual record of the vegetation, erosion, and general appearance of each reference and rehabilitation site over time.

Transect monitoring methodology involves:

- Transects up to 100m in length are to be set up with a measuring tape, marked with a picket at 0m.
- At each 5m interval, 1 x 1m quadrats are formed along the transect. The quadrat should extend towards the right and the end of the transect.
- Within each quadrat the following parameters shall be recorded:
    - Number of individuals of each species present (separated into live and dead). Individuals that are not rooted inside the quadrat shall not include in the count of individuals.
    - Percentage foliage cover (%) of each species present (separated into live and dead). Foliage cover is estimated by eye. Overhanging foliage (e.g. overhanging wattle canopy) shall be included in the estimate of foliage cover.
    - Litter cover (%) and type (e.g. leaves, logs etc.).
    - Bare ground cover (%) observed.

## 6.3 Landscape Function Analysis

Landscape Function Analysis (LFA) is a major component of EFA and will be used to determine how the rehabilitated area is performing when presented with possible disturbance and various climatic conditions. In order to undertake landscape function analysis (LFA), established transects for one sloped site and one flat site within each domain should be studied. *Landscape Function Analysis: Procedures for monitoring and assessing landscapes with special reference to mine sites and rangelands* by Tongway and Hindley is considered a best practice guide for LFA. This document will utilise this procedure for assessing how sustainable the landscape will be over a long period of time. The method for each transect should include:

### Walking the Transect and Identifying Features

- Patches accumulate resources by trapping litter, nutrients, water etc.

– Interpatches are the spaces between patches where nutrients are quickly transported over an area e.g. bare soil.
– A 'healthier' landscape could be considered one with a high patch to inter-patch ratio as little organic material and topsoils are lost to the system.
– Length and width of patches and interpatches within transects should be recorded while walking along measuring tape. The maximum length and width of a patch or interpatch is based on the size of the transect (therefore, a patch width cannot be wider than 10m and the length cannot be longer than 100m).

#### MEASURING PATCH AND INTERPATCH DISTANCES

– Gauging the potential energy that could be caused during a high rainfall event.
– The larger the distance between the patches and inter-patches the more risk of erosion (Hill-Slope assessment).

#### CHARACTERISING THE SOIL SURFACE PROPERTIES (SOIL SURFACE ASSESSMENT OF THE PATCHES AND INTERPATCHES)

– Characteristics include rain-splash protection (vegetative or other protection of the bare soil), perennial vegetation cover, litter cover, cryptogram cover, crust brokenness, erosion type and severity, amount of deposited materials, surface roughness, surface resistance to disturbance, stability following rapid wetting and soil texture.

#### QUANTIFYING VEGETATION COVER

– Using quadrats to quantify vegetation cover, which is explained further in Section 5.5.

#### SCORING HABITAT COMPLEXITY FOR FAUNAL HABITAT POTENTIAL

– Assessing the habitat features of a given area to identify the development of environmental niches provided for vertebrate fauna.
– Habitat as well as vegetation descriptions and condition notes should be recorded.

## 6.4 Tree Plot Monitoring

Adjacent to transects 16 (Scott Lode), 21 (Scott Lode) and 24 (control) additional Tree Plots shall be monitored. Tree plots measure 25m x 25m.

On Scott Lode, each tree plot is immediately to the right of the transect, with the transect forming the left-hand boundary of the plot. The control plot is also positioned on the right-hand side of the transect, although it is separated by about 50m. Pickets are arranged at 10m intervals around the outer perimeter of each plot.

For each tree over 130cm in height, the following parameters shall be recorded:

– Species.
– Height. This is measured from a distance about 10m away from the tree, using an inclinometer.
– Reproductive status of the tree (i.e. whether bearing flowers or fruit).
– Potential cause of any physiological stress (e.g. drought, insect attack etc.);
– Condition. This is visually assessed, using a 5 level scale:

  - Healthy
  - Slightly stressed
  - Stressed
  - Very stressed
  - Dead

For eucalypt species, the following extra data is to be recorded:

- Number of stems
- Condition of each stem
- Diameter of each stem at breast height (DBH) measured using measuring tape.

## 6.5 Photographic Monitoring

Photographic monitoring will be undertaken as part of the rehabilitation monitoring plan. Photographs provide a record of the conditions of the rehabilitated areas and allow for qualitative comparisons of the site over the years of rehabilitation. Photos should be taken approximately 1.5m above the ground, with one photo taken of each transect line and one photo of a representative quadrat from each transect line.

## 6.6 Statistical Analysis

During rehabilitation monitoring, all observations and parameters are to be recorded in the field. A report summarising the monitoring data and statistical analysis is to be prepared by the consultant discussing the results in relation to progress towards the final rehabilitation criteria and provide recommendations for improvements or changes in management practices to move towards these final criteria.

- Statistical analysis for the quadrats along the transects include;
  - Species diversity is calculated by using total density, i.e. live + dead, with introduced or weed species excluded:
    - Species richness (no. of species per quadrat);
    - Shannon-Wiener diversity (H′), calculated using the formula:

$$H' = -\sum p_i \ln p_i,$$

Where $p_i$ is the proportion of the total number of individuals occurring in species i.

- Comparisons between the parameters are to be made using an analysis of variance (ANOVA) to determine significant differences. Species that are recorded in more than 30% of transects are to have their total densities (live + dead) compared between rehabilitation and control areas.
- Species composition is to be compared between rehabilitation and control areas using the Bray-Curtis index of similarity ($IS_B$), which determines the similarity of different communities based on the species present as well as their relative abundance. The index is calculated according to the formula:

$$IS_B = \frac{2(jN)}{(aN + bN)},$$

where aN = the number of individuals in community A

bN = the number of individuals in community B

jN = the number of individuals common to both communities.

Similarity ranges from 0 for communities with no species in common, to 1 for communities with identical species in identical abundance. Similarity is to be calculated using total density (live + dead) of native and weed or introduced species.

Statistical analysis for the tree plot establishment and monitoring shall be based on tree height and DBH measures compared between the rehabilitation and control plots using analysis of variance (ANOVA) for significant differences. Comparisons of tree stress between rehabilitation and control plots are also to be made using the Kruskal-Wallis test (SYSTAT 7.0.1) which is the non-parametric analogue of a one-way analysis of variance.

## 6.7 Water and Stream Sediment Monitoring

The monitoring locations, frequencies and specification of analysis requirements are set out in the current Environmental Authority with detailed procedures prescribed in the Pajingo Environmental Monitoring Manual.

Monitoring activities will occur in a similar fashion to the operational period, however frequency of monitoring will be reduced according to the level of data and trend analysis required.

## 6.8 Rehabilitation Success Criteria

Rehabilitation success of the Pajingo mine site will be determined by achieving the rehabilitation goals set out in this plan. The criteria, standards and corrective actions being used to determine rehabilitation success are defined in Table 14 to Table 16.

**Table 14: EA Rehabilitation Completion Criteria for 1-2 years**

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Has the area been ripped? (<0.5m depth?) | All ripping should be on the contour to minimise water runoff and soil erosion | Minimal uncontrolled water runoff or soil erosion. | Areas of unacceptable erosion (i.e. That which poses an accident hazard to a walking human or could lead to uncontrolled water discharge from an area) to be reworked and erosion control methods applied. |

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Does runoff from the area discharge to a stable drainage system? | Runoff from the area discharges to a stable drainage system. | Runoff leaves the area by a stable drainage system. | As above. |
| Is there adequate cover of topsoil or other nominated material? | Soil should be spread across the whole rehabilitated area. Areas less than 0.5 ha not receiving soil are acceptable provided these areas do not exceed 10% of the rehabilitated area. | Soil is spread over a minimum of 90% of the rehabilitated area. | Soil combined with additional seed/fertiliser may be used in disturbed areas where topsoil unavailable. |
| Are there adequate densities of both Eucalypt and acacia sp. In comparison with reference sites? | Rehabilitated areas must have plant density that will meet proposed land use. | An average of > 500 stems per ha to be present at 1-2 years, of which at least 10% are Eucalypt. | Rehabilitated areas not meeting the standard will be reseeded. |
| Is there an adequate legume content (understory)? | Areas to have an average of one legume/m2. Areas up to 0.5 ha not meeting the standard are acceptable provided these areas do not exceed 10% of the rehabilitated area. | An average of >1 legume/m2 based on establishment monitoring (1 to 2 years) including Acacias. | Areas will be scarified and seeded with legumes. |
| Is there an adequate grass (understory) content? | Areas to have an average of one grass/m2. Areas up to 0.5 ha not meeting the standard are acceptable provided these areas do not exceed 10% of the rehabilitated area. | An average of > 1 grass/m2 based on establishment monitoring (1 or 2 years). | Areas will be scarified and seeded with grass. |
| Is there appropriate species richness? | Areas to have a representative number of control site species present. | Minimum of 25% of reference sites species based on establishment monitoring. | Areas may need to receive additional seed. Sites to be scarified and seeded. |
| Is weed invasion a problem for establishment of native species? | Area must show evidence that weed competition is not restricting long term stability in rehabilitation areas. | No noxious weeds present on area. Less than 25% of the cover is from non-declared weeds. | Identify treatments available to correct situation. |
| If the area discharges water off-site is the water quality adequate? | Discharges off-site should be low in salts and suspended solids. | Water quality to meet livestock watering (ANZECC) guidelines. | Sumps to remove suspended solids prior to discharge may be required. |

**Table 15: EA Rehabilitation Completion Criteria for 5 - 7 years**

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Is there appropriate species richness? | Areas to have both overstorey and understorey species. | Minimum of 25% of species numbers of control site species based on establishment monitoring. | Areas may need to receive additional seed. Use of a scarifier will depend on the location of the area and potential damage caused to other areas in gaining access. |
| Is the vegetation showing resilience to stress? | Vegetation shows resilience to stresses such as Insect attack and drought. | Less than 20% of perennials are showing severe physiological signs of stress at the mid period monitoring. | Treatments to be determined as required (may include thinning or reseeding). |
| Is recruitment occurring? | Some freely seeding species (such as grasses, legumes and other understorey species) have seeded and new recruits are evident. | New recruits are occurring from 60% of the understorey species. Areas of up to 0.5 ha not meeting the standard are acceptable provided they do not exceed 50% of the area. | Treatment if required to be determined on an as needs basis. Drought or other factors may affect recruitment. |

**Table 16: EA Rehabilitation Completion Criteria for >7 years**

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Are there adequate numbers of Acacia and Eucalypt? | Numbers need to be adequate to meet the designated land use. | Minimum of 50 stems per ha with average height > 1.5m. | A thinning may be required by burning off or by clearing practices. |
| Is there appropriate species richness? | Areas to have a representative number of control site species present. | Minimum of 25% of control species richness based on late period monitoring. | Areas may need to receive additional seed. Sites to be scarified and seeded. |
| Is there appropriate species richness? | Areas to have both overstorey and understorey species. | Minimum of 25% of species numbers of control site species based on establishment monitoring. | Areas may need to receive additional seed. Use of a scarifier will depend on the location of the area and potential damage caused to other areas in gaining access. |
| Is recruitment occurring? | Freely seeding species (such as grasses, legumes and other understorey species) and infrequent seeders (such as eucalypts and acacias) have seeded and new recruits are evident. | At least 30% of trees monitored are seedlings (1.3m high) and recruitment is occurring on at least 60% of the area. Areas of up to 0.5 ha not meeting the standard are acceptable. | Treatment if required to be determined on an as needs basis. Drought or other factors may affect recruitment. |

| Criteria and Intent | Guidelines for Acceptance | Standard | Corrective Action |
|---|---|---|---|
| Has erosion on the site caused unacceptable access problems of turbid water run-off? | Areas need to be stable and surface vegetated. There should be no signs of subsidence. | Area stable and covered with soil and plants. | Areas of erosion and slumping may need treatment. |
| Are there adequate stocking rates of over and understorey species capable of withstanding a burn or wildfire? | Area has a range of sizes and ages for over and understorey species showing a functioning ecosystem. | The site is capable of being burnt in mosaic pattern or a method conducive to good vegetation management. | Silvicultural treatment of flattening of understorey may be considered. |
| Is the vegetation showing resilience to stress? | Vegetation shows resilience to stresses such as insect attack and drought. | Less than 20% of perennials are showing severe physiological signs of stress at the mid period of monitoring. | Treatments to be determined as required (may include thinning or reseeding). |
| Are insects preferentially attacking the area? If so, is insect damage causing adverse impact on the health of the plant? | An assessment should be made as to the extent of any insect damage (crown or bow damage) and determine whether the rehabilitation is being selectively attacked in the region? Is a treatment warranted? | Less than 20% of perennials are showing severe physiological signs of stress at the late period of monitoring. | Carry out corrective action where a treatment is required. |
| Are there any weed problems requiring treatment? | There are no declared weeds on the area. Other weeds do not dominate the area. | Annual basal and aerial spraying of weeds to be undertaken as per the following guidelines: - Dalrymple Shire Council weed management plan - DNR Land protection branch guidelines - Landcare weed control initiatives. | Spray or grub areas that do not meet standard. |

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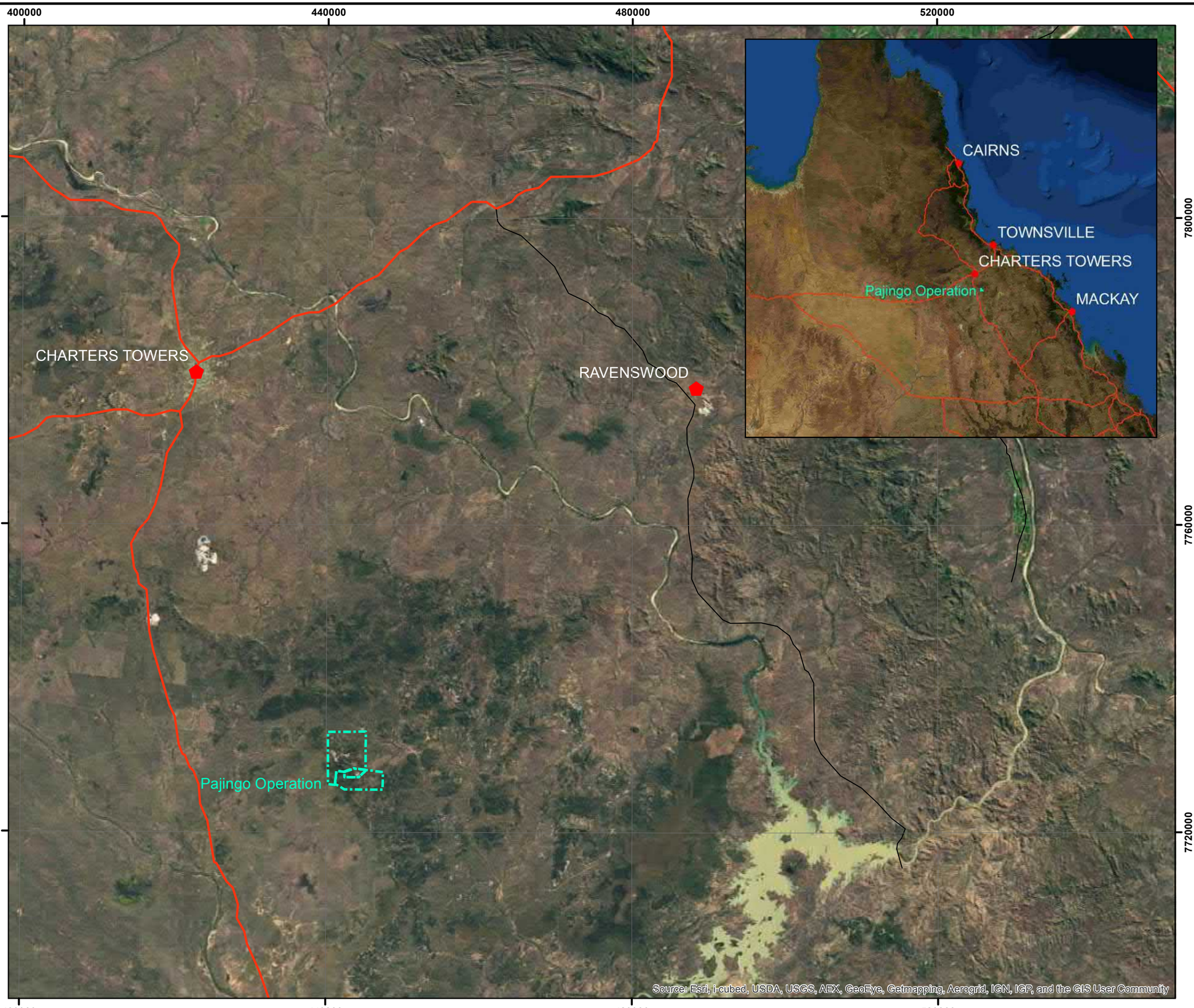
# Appendices

## A. Appendix - Maps




northern resource consultants

# LOCATION OF PAJINGO OPERATION

N
W E
S

0 10 20 Kilometres

Scale: 1:500,000

## Legend

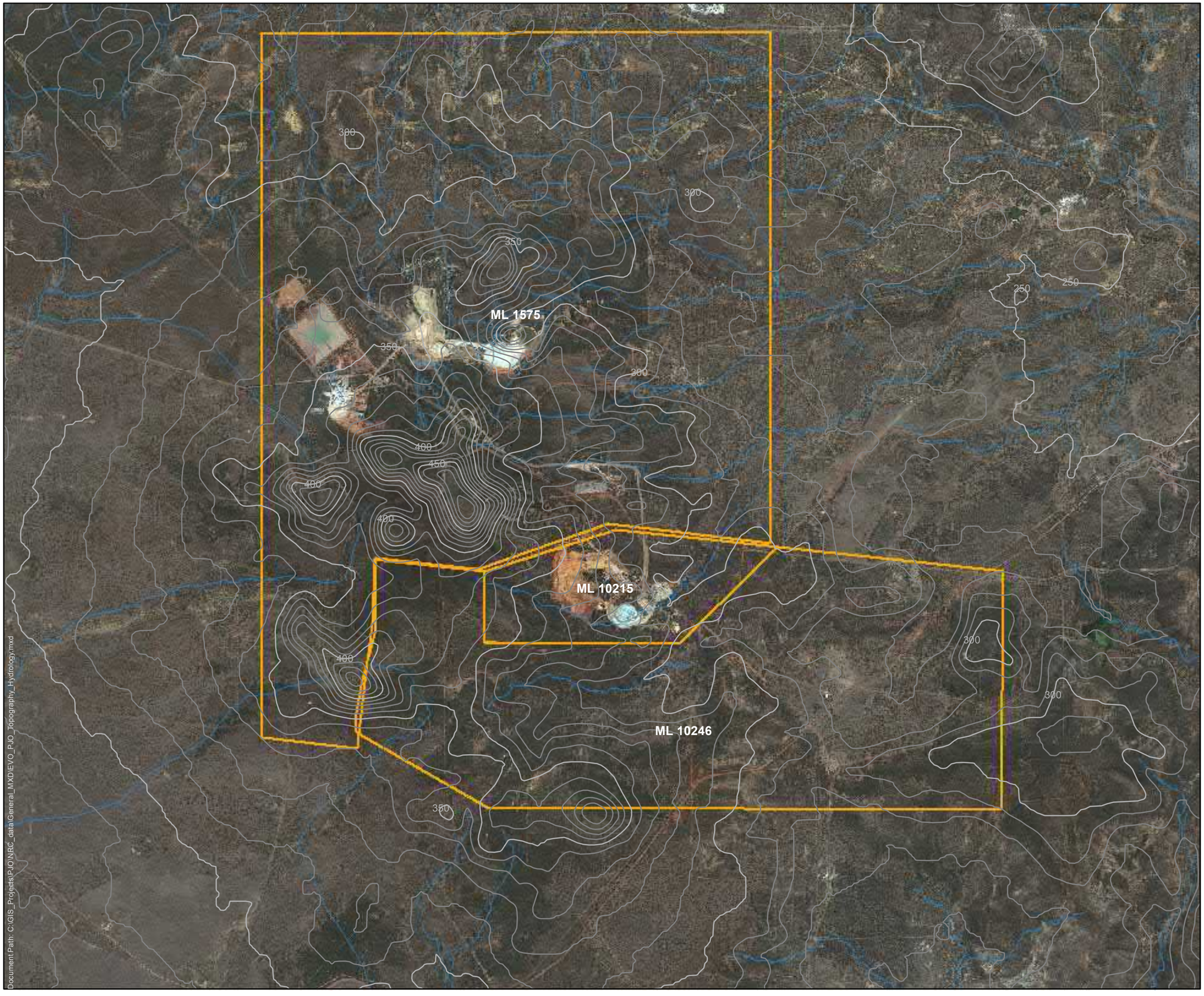
- Mine Lease
- Towns
- Highways
- Main Roads

Notes:

Date: 15/01/2014
Datum: GDA 94 UTM 55K
Produced by: MF
Reference:
NRC_PJO_0114_FLURP

# PAJINGO OPERATIONS EVOLUTION MINING

## TOPOGRAPHY AND HYDROLOGY




**Legend**

- Mine Lease
- Watercourse

**Contours (10m)**

- Index Contour
- Intermediate Contour

500 250 0 500
Meters

N

Scale: 1:35,000 at A3

Notes:

Base Image supplied by Evolution Mining.
Disturbance within ML10215 is from QLD Globe (© State of Queensland 2012) capture date 26/07/2012 and superimposed over base image.
Mine Lease boundary extracted from ml.shp, from IRTM© State of Queensland 2012.
Hydrology from: IQ_VM_WATERCOURSE_MAP_100K_250K.shp© State of Queensland 2012.
Contours from: IQ_QLD_10MCONT_CHARTERS_TOW.shp © State of Queensland 2012.

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 25/03/2014

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Document Path: C:\GIS_Projects\PJO\NRC_data\General_MXD\EVO_PJO_Topography_Hydrology.mxd

# PAJINGO OPERATIONS EVOLUTION MINING

## SITE FEATURES

442000 444000

7730000

7728000

Scott Lode WRD (Rehabilitated)
Sams Dam
Scott Load WRD (Active)
ROM
Waste Rock Dump
TSF1
A Lode Dam
Laydown/ Storage
Scott Load Pit (TSF)
Scott Lode Pit
K-DUMP
Raw Water Dam
Suicide Dam
P-DUMP
Offices
Offices
Processing Plant
ROM
ML 1575
Cindy WRD
Low Grade Ore Stockpile
Helipad
Cindy Workshop
Cindy Pit
Nancy North Pit - Proposed
Nancy Dam
Nancy Dewatering Dam
Nancy Pit
Venue North WRD
Venue Pit
VNU Pit
Vera Workshop
Orchid Pit
ML 10215
Venue South WRD
Vera Pit
WRD - PAF
WRD - NAF
Vera Silt Trap
Vera ROM and WRD Dam
Low Grade Ore Stockpile
ML 10246

### Legend

- Mine Lease
- Roads

**Drainage**

- Clean Water
- Site Water

**Site_Features**

- Dam/ Water Storage
- Open Cut Mines
- WRD and Stockpiles
- Infrastructure
- TSF

200 100 0 200
Meters

N

Scale: 1:15,000 at A3

Notes:

Base Image supplied by Evolution Mining.
Disturbance within ML10215 is from QLD Globe (© State of Queensland 2012) capture date 26/07/2012 and superimposed over base image.
Mine Lease boundary extracted from ml.shp, from IRTM© State of Queensland 2012.

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 27/03/2014

nrc
northern resource consultants

Document Path: C:\GIS_Projects\PJO\NRC_data\FLUR\PEVO_PJO_Site_Features.mxd

# Appendix C:

## Wildnet Online Species List

# WildNet Records
## Conservation Significant Species List

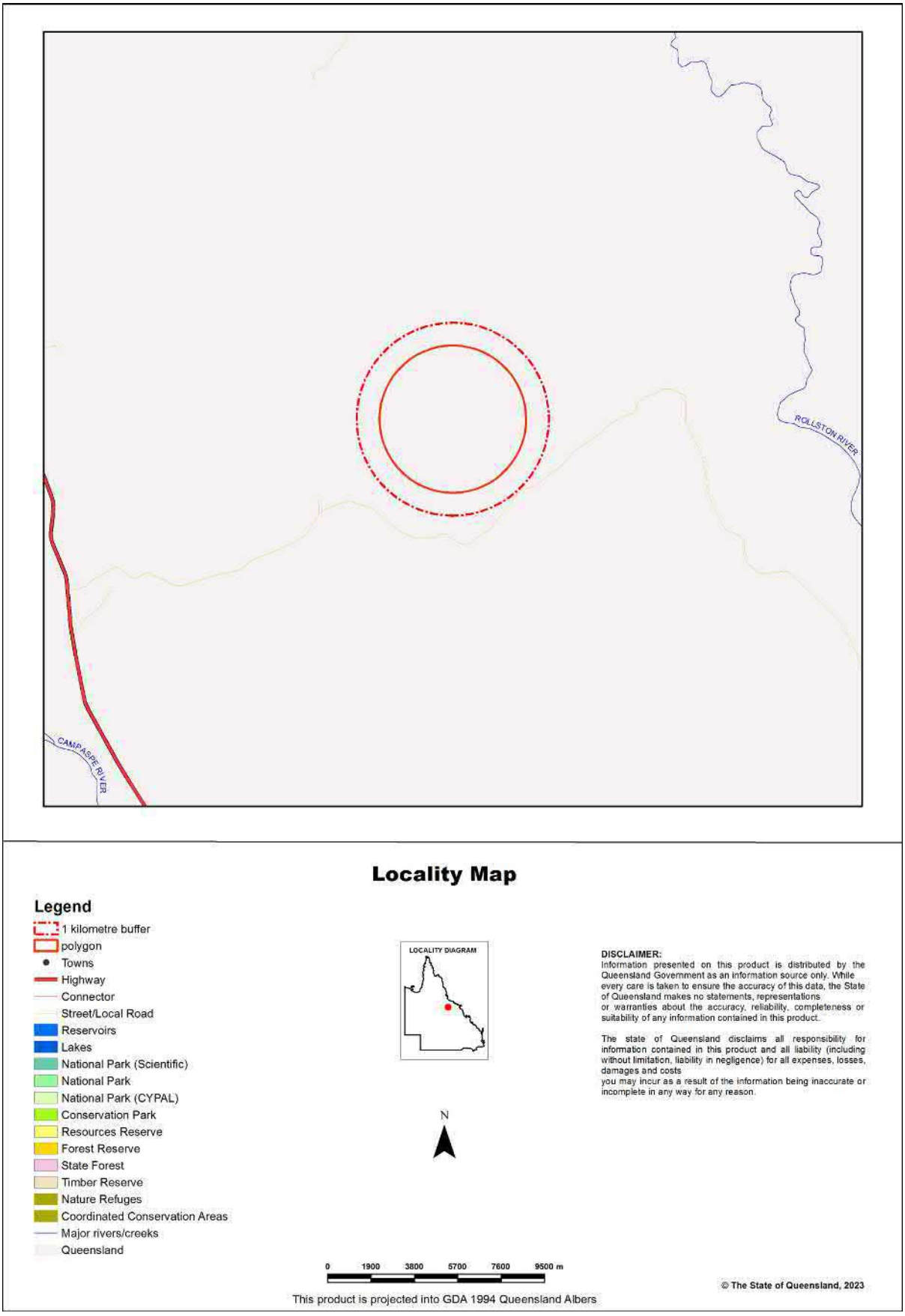
For the selected area of interest 3257.58ha Custom Geometry

Current as at 28/03/2023

WildNetCSSpeciesList

Queensland Government

## Map 1. Locality Map



## Summary Information

The following table provides an overview of the area of interest Custom Geometry.

**Table 1. Area of interest details**

| | |
|---|---|
| Size (ha) | 3,257.58 |
| Local Government(s) | Charters Towers Regional |
| Bioregion(s) | Brigalow Belt, Desert Uplands |
| Subregion(s) | Cape River Hills, Cape - Campaspe Plains |
| Catchment(s) | Burdekin |

**Protected Area(s)**
No estates or reserves are located within the area of interest.

**World Heritage Area(s)**
No World Heritage Areas are located within the area of interest.

**Ramsar Area(s)**
No Ramsar Areas are located within the area of interest.

## Conservation Significant Species List

**Introduction**

This report is derived from a spatial layer generated from the WildNet database managed by the Department of Environment and Science. The layer which is generated weekly contains the WildNet wildlife records that are not classed as erroneous or duplicate, that have a location precision equal to or less than 10000 metres and do not have a count of zero.

Conservation significant species are species listed:

- as threatened or near threatened under the Nature Conservation Act 1992;
- as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* or
- migratory species protected under the following international agreements:
  - Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
  - China-Australia Migratory Bird Agreement
  - Japan-Australia Migratory Bird Agreement
  - Republic of Korea-Australia Migratory Bird Agreement

The WildNet dataset is constantly being enhanced and the taxonomic and status information revised. If a species is not listed in this report, it does not mean it doesn't occur there and listed species may also no longer inhabit the area. It is recommended that you also access other internal and external data sources for species information in your area of interest (Refer Links and Support).

Table 2 lists the species recorded within the area of interest and its one kilometre buffer.

**Table 2. Conservation significant species recorded within the area of interest and its one kilometre buffer**

| Taxon Id | Kingdom | Class | Family | Scientific Name | Common Name | NCA | EPBC | Specimens | Records | Last record |
|---|---|---|---|---|---|---|---|---|---|---|
| 16237 | Plantae | Equisetopsida | Santalaceae | *Santalum lanceolatum* | None | SL | None | 0 | 1 | 21/06/2016 |

**Taxon Id:** Unique identifier of the taxon from the WildNet database.

**NCA:** Queensland conservation status of the taxon under the *Nature Conservation Act 1992* (Least Concern (C), Critically Endangered (CR), Endangered (E), Extinct (EX), Near Threatened (NT), Extinct in the Wild (PE), Special Least Concern (SL), and Vulnerable (V)).

**EPBC:** Australian conservation status of the taxon under the *Environment Protection and Biodiversity Conservation Act 1999* (Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Vulnerable (V), and Extinct in the Wild (XW)).

**Specimens:** The number of specimen-backed records of the taxon.

**Records:** The total number of records of the taxon.

**Last record:** Date of latest record of the taxon.

## Links and Support

Other sites that deliver species information from the WildNet database include:

- Species profile search - access species information approved for publication including species names, statuses, notes, images, distribution maps and records
- Species lists - generate species lists for Queensland protected areas, forestry areas, local governments and areas defined using coordinates
- Biomaps - view biodiversity information, including WildNet records approved for publication, and generate reports
- Queensland Globe - view spatial information, including WildNet records approved for publication
- Qld wildlife data API - access WildNet species information approved for publication such as notes, images and records etc.
- Wetland*Maps* - view species records, survey locations etc. approved for publication
- Wetland*Summary* - view wildlife statistics, species lists for a range of area types, and access WildNet species profiles
- WildNet wildlife records - published - Queensland - spatial layer of WildNet records approved for publication generated weekly
- Generalised distribution and densities of Queensland wildlife - Queensland species distributions and densities generalised to a 10 km grid resolution
- Conservation status of Queensland wildlife - access current lists of priority species for Queensland including nomenclature and status information
- Queensland Confidential Species - the list of species flagged as confidential in the WildNet database.

Please direct queries about this report to the WildNet Team.

Other useful sites for accessing Queensland biodiversity data include:

- Useful wildlife resources
- Queensland Government Data
- Atlas of Living Australia (ALA)
- Online Zoological Collections of Australian Museums (OZCAM)
- Australia's Virtual Herbarium (AVH)
- Protected Matters Search Tool

## Disclaimer



# Appendix D:

## Matters of State Environmental Significance Report

Queensland Government

**Department of Environment and Science**

Environmental Reports

# Matters of State Environmental Significance

For the selected area of interest
Custom Geometry

# Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

# Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

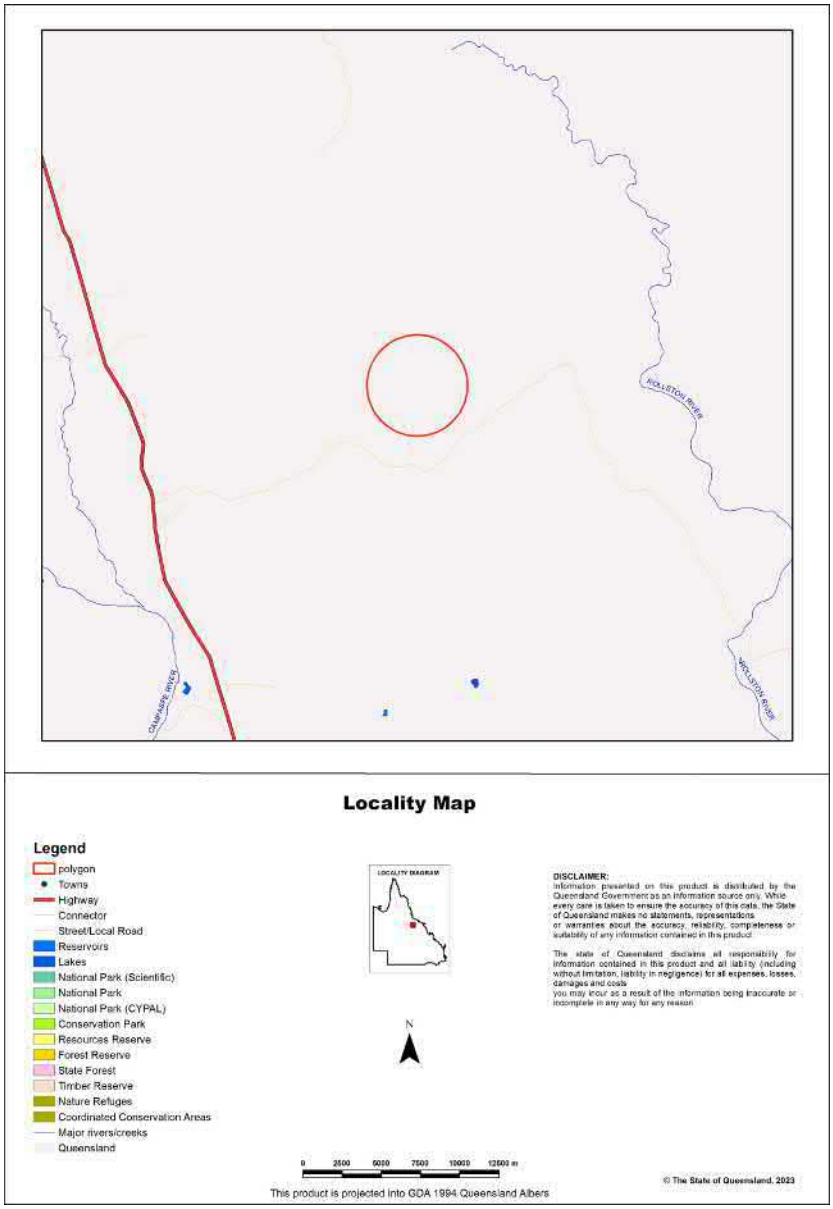
# Table of Contents

# Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

**Table 1: Summary table, details for AOI Custom Geometry**

| | |
|---|---|
| Size (ha) | 3,257.58 |
| Local Government(s) | Charters Towers Regional |
| Bioregion(s) | Brigalow Belt, Desert Uplands |
| Subregion(s) | Cape River Hills, Cape - Campaspe Plains |
| Catchment(s) | Burdekin |



# Matters of State Environmental Significance (MSES)

## MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;

- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;

- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;

- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;

- Regulated vegetation under the *Vegetation Management Act 1999* that is:

    • Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;

    • Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;

    • Category R areas on the regulated vegetation management map;

    • Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;

    • Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;

- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;

- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Queensland Wetland Environmental Values under the Environment Protection Regulation 2019;

- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;

- Legally secured offset areas.

## MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

**Table 2: Summary of MSES present within the AOI**

| | | |
|---|---|---|
| 1a Protected Areas- estates | 0.0 ha | 0.0 % |
| 1b Protected Areas- nature refuges | 0.0 ha | 0.0 % |
| 1c Protected Areas- special wildlife reserves | 0.0 ha | 0.0 % |
| 2 State Marine Parks- highly protected zones | 0.0 ha | 0.0 % |
| 3 Fish habitat areas (A and B areas) | 0.0 ha | 0.0 % |
| 4 Strategic Environmental Areas (SEA) | 0.0 ha | 0.0 % |
| 5 High Ecological Significance wetlands on the map of Referable Wetlands | 0.0 ha | 0.0 % |
| 6a High Ecological Value (HEV) wetlands | 0.0 ha | 0.0 % |
| 6b High Ecological Value (HEV) waterways | 0.0 km | Not applicable |
| 7a Threatened (endangered or vulnerable) wildlife | 0.0 ha | 0.0 % |
| 7b Special least concern animals | 0.0 ha | 0.0 % |
| 7c i Koala habitat area - core (SEQ) | 0.0 ha | 0.0 % |
| 7c ii Koala habitat area - locally refined (SEQ) | 0.0 ha | 0.0 % |
| 7d Sea turtle nesting areas | 0.0 km | Not applicable |
| 8a Regulated Vegetation - Endangered/Of concern in Category B (remnant) | 0.0 ha | 0.0 % |
| 8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth) | 0.0 ha | 0.0 % |
| 8c Regulated Vegetation - Category R (GBR riverine regrowth) | 27.58 ha | 0.8% |
| 8d Regulated Vegetation - Essential habitat | 0.0 ha | 0.0 % |
| 8e Regulated Vegetation - intersecting a watercourse | 41.0 km | Not applicable |
| 8f Regulated Vegetation - within 100m of a Vegetation Management Wetland | 0.0 ha | 0.0 % |
| 9a Legally secured offset areas- offset register areas | 0.0 ha | 0.0 % |
| 9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation | 0.0 ha | 0.0 % |

## Additional Information with Respect to MSES Values Present

### MSES - State Conservation Areas

**1a. Protected Areas - estates**

(no results)

**1b. Protected Areas - nature refuges**

(no results)

**1c. Protected Areas - special wildlife reserves**

(no results)

**2. State Marine Parks - highly protected zones**

(no results)

**3. Fish habitat areas (A and B areas)**

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

### MSES - Wetlands and Waterways

**4. Strategic Environmental Areas (SEA)**

(no results)

**5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values**

(no results)

**6a. Wetlands in High Ecological Value (HEV) waters**

(no results)

**6b. Waterways in High Ecological Value (HEV) waters**

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

### MSES - Species

**7a. Threatened (endangered or vulnerable) wildlife**

Not applicable

**7b. Special least concern animals**

Not applicable

**7c i. Koala habitat area - core (SEQ)**

Not applicable

**7c ii. Koala habitat area - locally refined (SEQ)**

Not applicable

**7d. Wildlife habitat (sea turtle nesting areas)**

Not applicable

**Threatened (endangered or vulnerable) wildlife habitat suitability models**

| Species | Common name | NCA status | Presence |
|---|---|---|---|
| *Boronia keysii* | | V | None |
| *Calyptorhynchus lathami* | Glossy black cockatoo | V | None |
| *Casuarius casuarius johnsonii* | Sthn population cassowary | E | None |
| *Crinia tinnula* | Wallum froglet | V | None |
| *Denisonia maculata* | Ornamental snake | V | None |
| *Litoria freycineti* | Wallum rocketfrog | V | None |
| *Litoria olongburensis* | Wallum sedgefrog | V | None |
| *Macadamia integrifolia* | | V | None |
| *Macadamia ternifolia* | | V | None |
| *Macadamia tetraphylla* | | V | None |
| *Melaleuca irbyana* | | E | None |
| *Petaurus gracilis* | Mahogany Glider | E | None |
| *Petrogale persephone* | Proserpine rock-wallaby | E | None |
| *Pezoporus wallicus wallicus* | Eastern ground parrot | V | None |
| *Phascolarctos cinereus* | Koala - outside SEQ* | E | None |
| *Taudactylus pleione* | Kroombit tinkerfrog | E | None |
| *Xeromys myoides* | Water Mouse | V | None |

**For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.*

**Threatened (endangered or vulnerable) wildlife species records**

(no results)

**Special least concern animal species records**

(no results)

**Shorebird habitat (critically endangered/endangered/vulnerable)**

Not applicable

**Shorebird habitat (special least concern)**

Not applicable

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

*Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)*

To request a species list for an area, or search for a species profile, access Wildlife Online at:

https://www.qld.gov.au/environment/plants-animals/species-list/

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals, Map 3b - MSES - Species - Koala habitat area (SEQ)** and **Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)** for an overview of the relevant MSES.

## MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

https://environment.ehp.qld.gov.au/regional-ecosystems/

**8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)**

Not applicable

**8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)**

Not applicable

**8c. Regulated Vegetation - Category R (GBR riverine regrowth)**

| Regulated vegetation map category | Map number |
|---|---|
| R | 8156 |

**8d. Regulated Vegetation - Essential habitat**

Not applicable

**8e. Regulated Vegetation - intersecting a watercourse****

A vegetation management watercourse is mapped as present

**8f. Regulated Vegetation - within 100m of a Vegetation Management wetland**

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

**MSES - Offsets**

**9a. Legally secured offset areas - offset register areas**

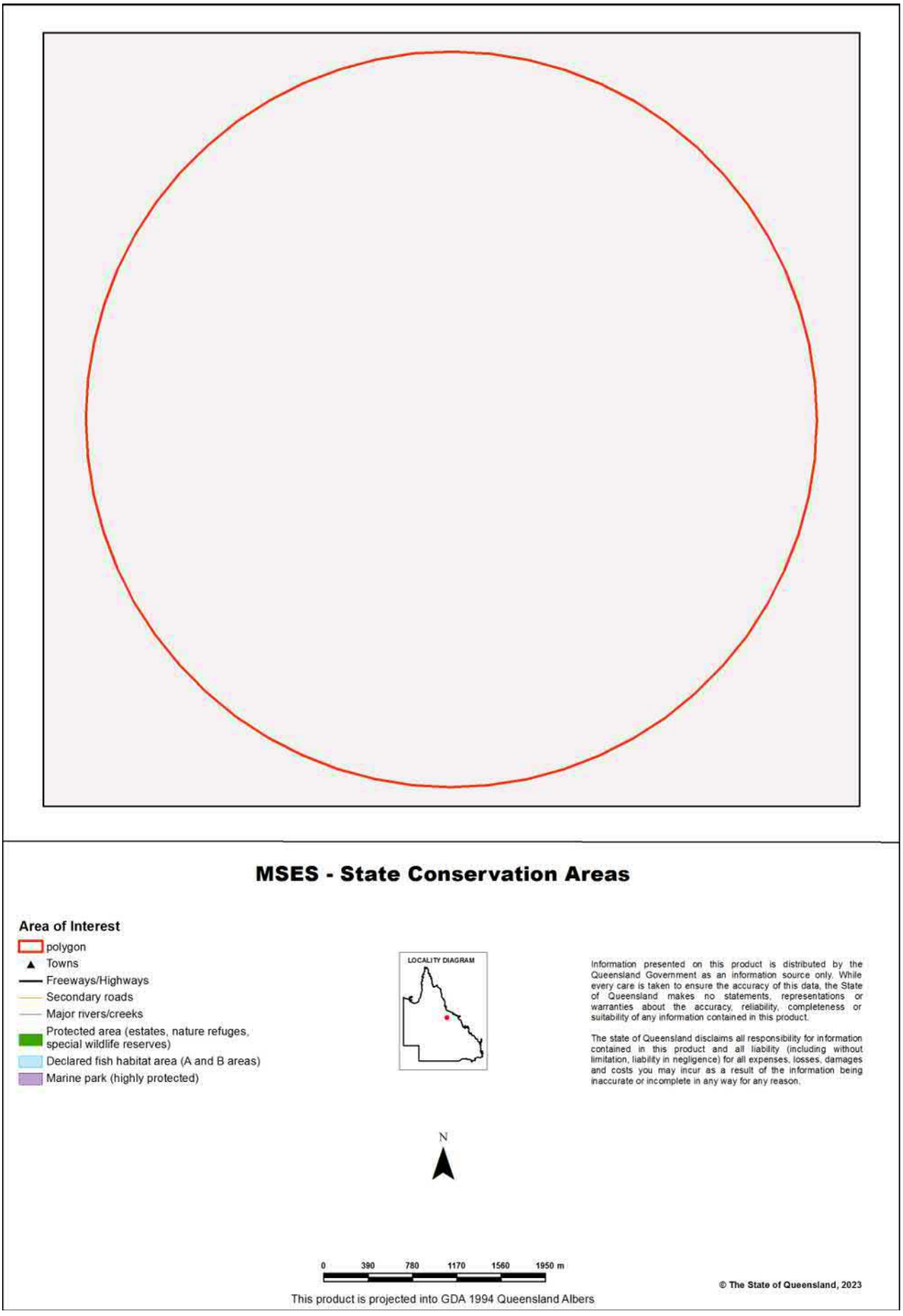
(no results)

**9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation**

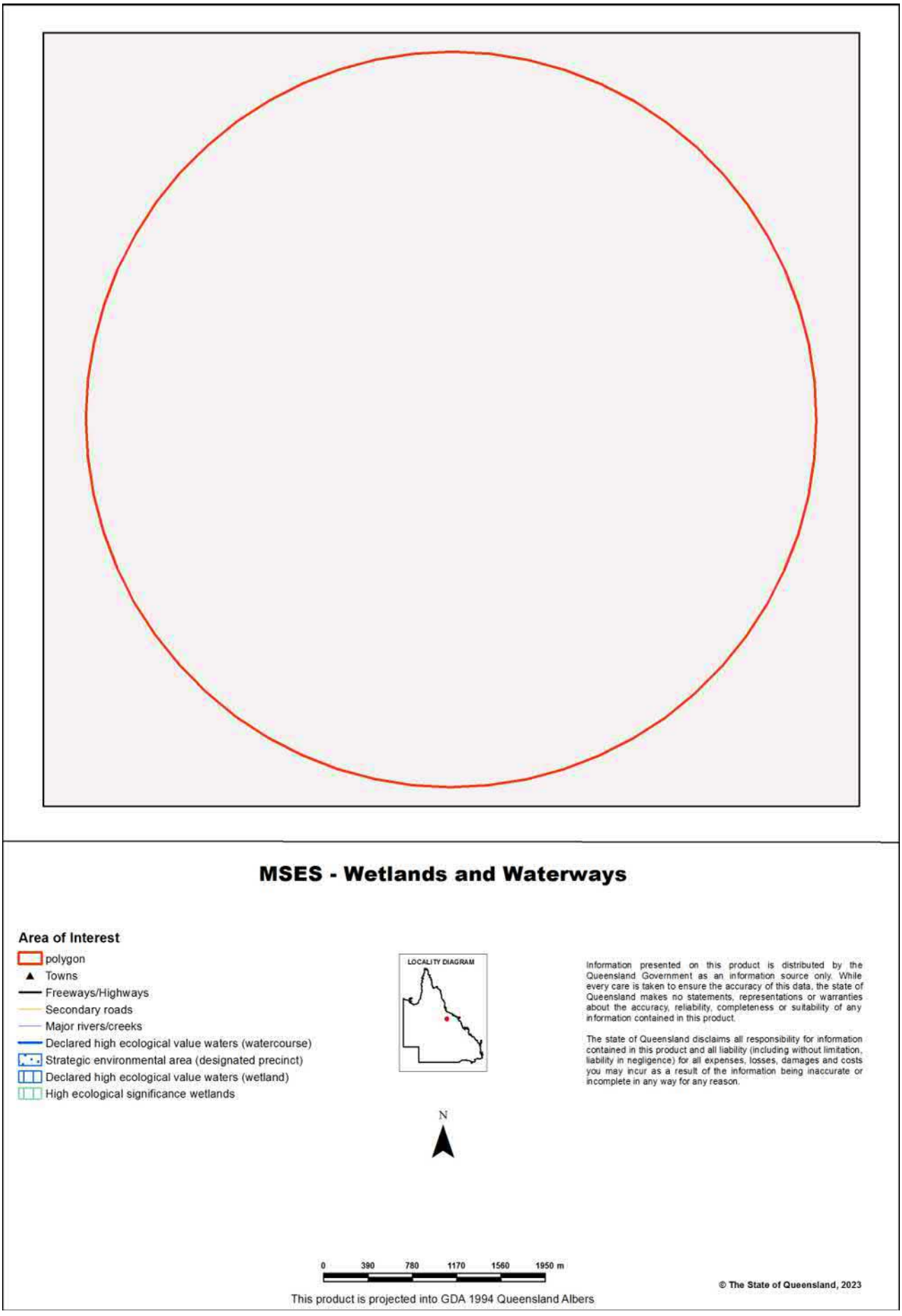
(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

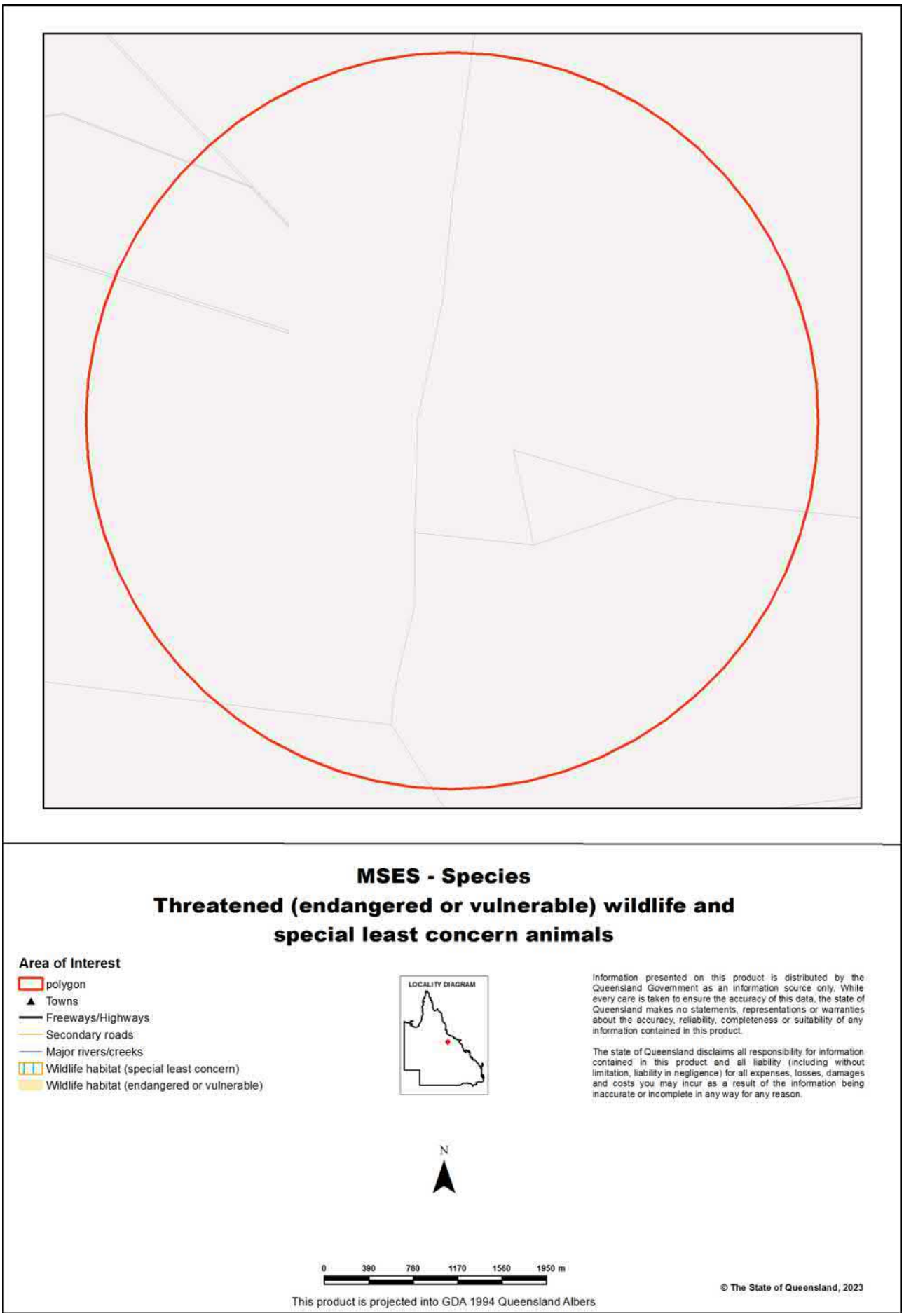
## Map 1 - MSES - State Conservation Areas



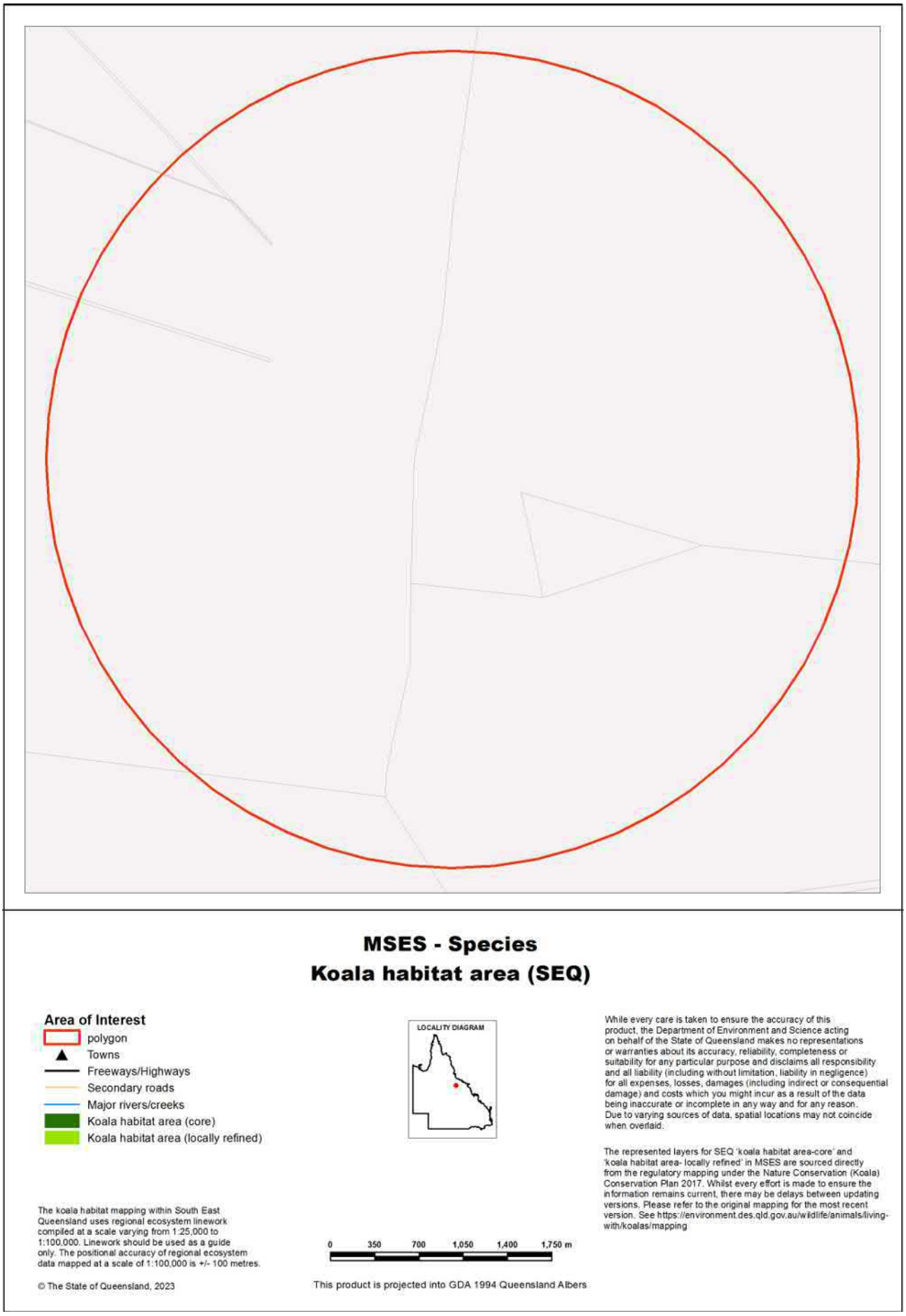
## Map 2 - MSES - Wetlands and Waterways



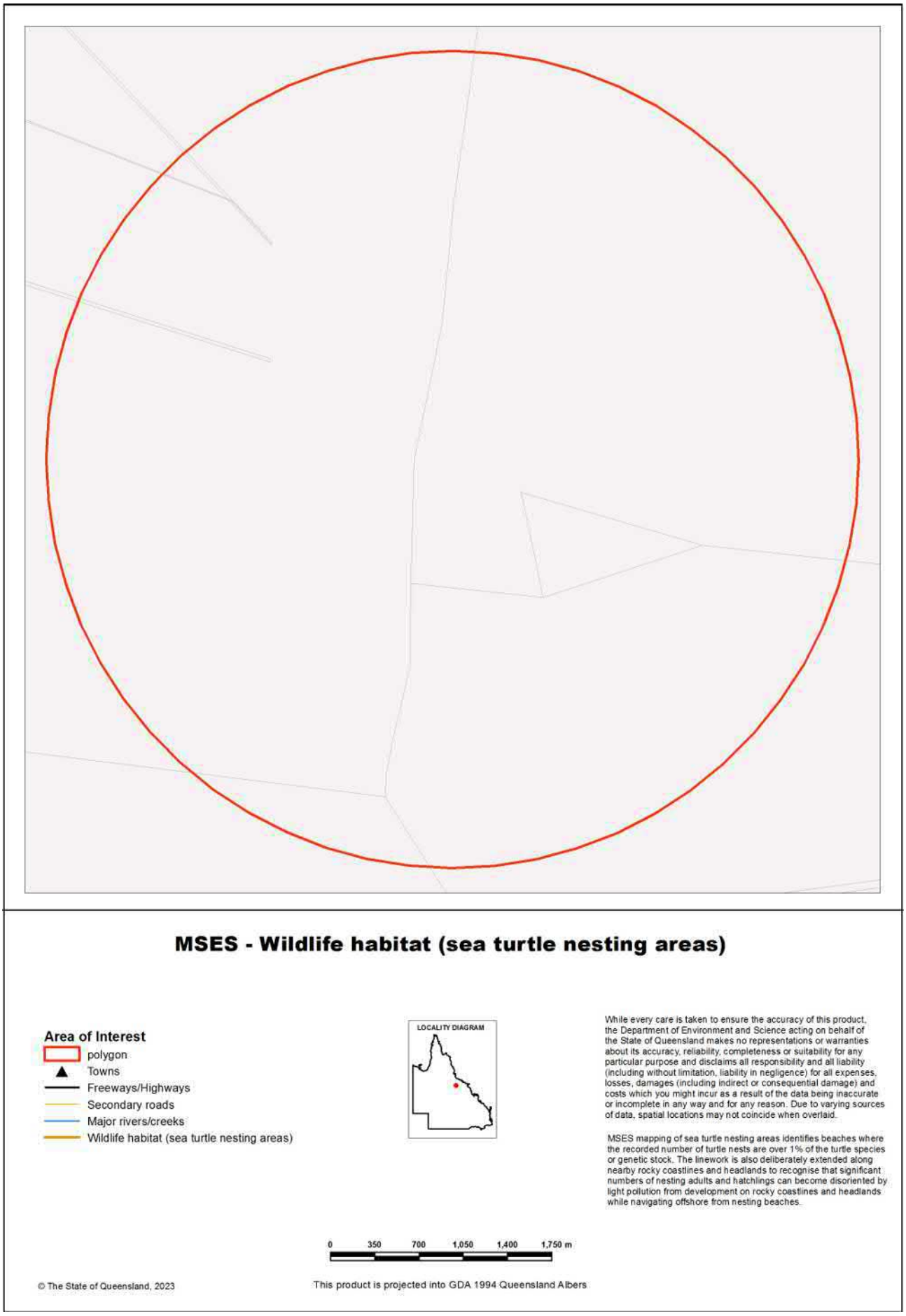
## Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



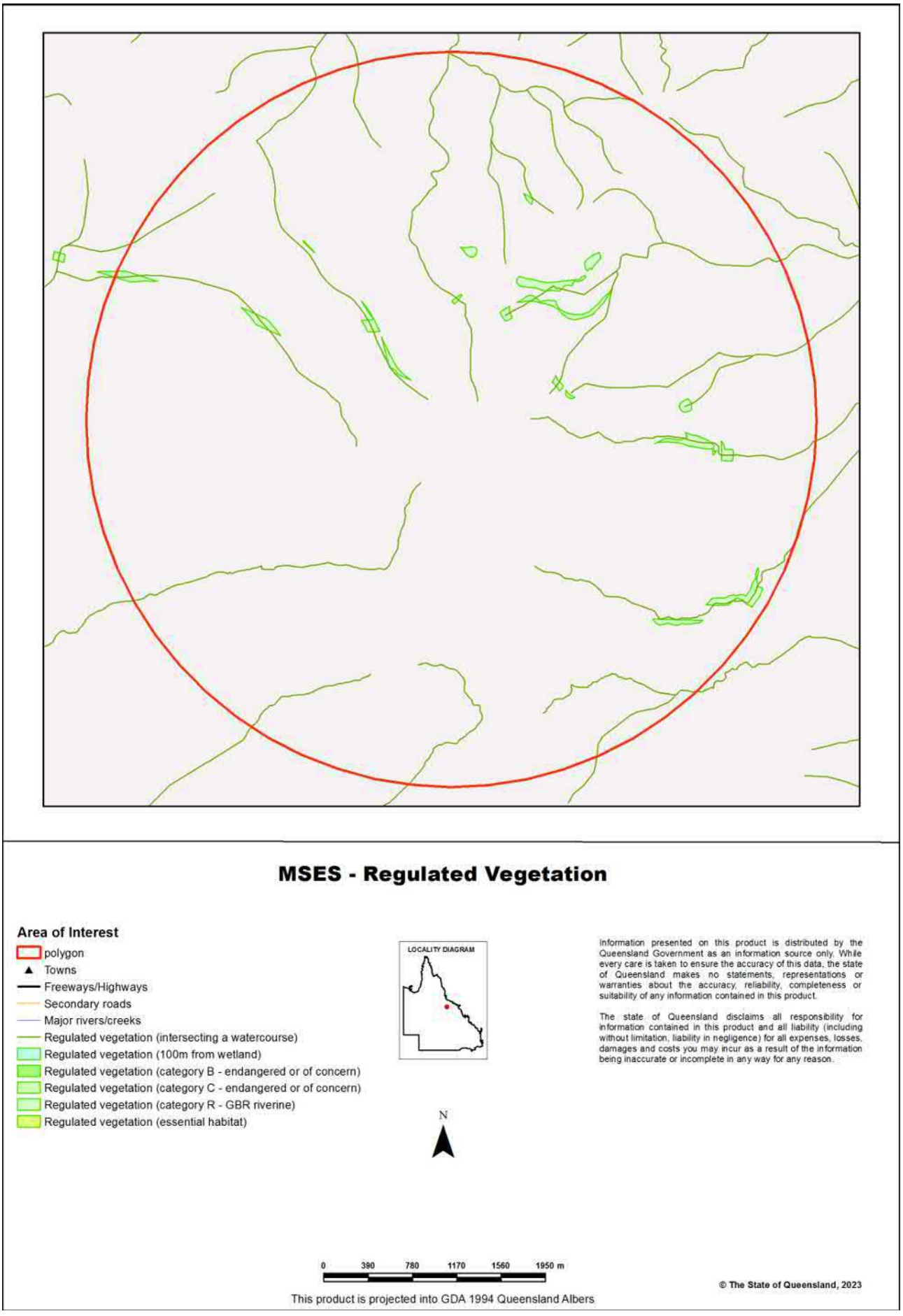
## Map 3b - MSES - Species - Koala habitat area (SEQ)



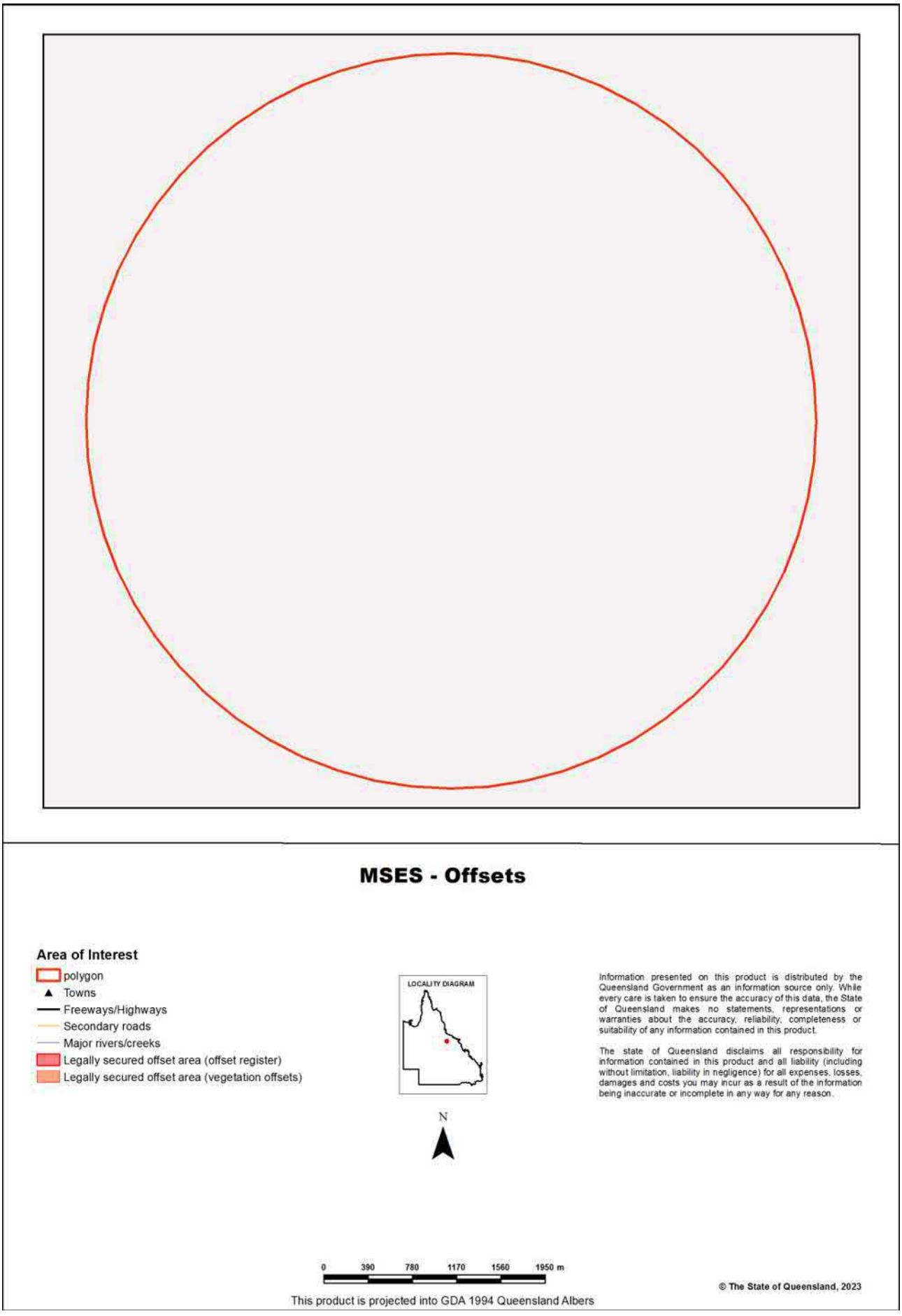
## Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)



## Map 4 - MSES - Regulated Vegetation



## Map 5 - MSES - Offset Areas



# Appendices

## Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html .

## Appendix 2 - Source Data

**The datasets listed below are available on request from:**

http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

| **MSES layers** | **current QSpatial data (http://qspatial.information.qld.gov.au)** |
|---|---|
| Protected Areas-Estates, Nature Refuges, Special Wildlife Reserves | - Protected areas of Queensland<br>- Nature Refuges - Queensland<br>- Special Wildlife Reserves- Queensland |
| Marine Park-Highly Protected Zones | Moreton Bay marine park zoning 2008 |
| Fish Habitat Areas | Queensland fish habitat areas |
| Strategic Environmental Areas-designated | Regional Planning Interests Act - Strategic Environmental Areas |
| HES wetlands | Map of Queensland Wetland Environmental Values |
| Wetlands in HEV waters | HEV waters:<br>- EPP Water intent for waters<br>Source Wetlands:<br>- Queensland Wetland Mapping (Current version 5)<br>Source Watercourses:<br>- Vegetation management watercourse and drainage feature map (1:100000 and 1:250000) |
| Wildlife habitat (threatened and special least concern) | - WildNet database species records<br>- habitat suitability models (various)<br>- SEQ koala habitat areas under the Koala Conservation Plan 2019<br>- Sea Turtle Nesting Areas records |
| VMA regulated regional ecosystems | Vegetation management regional ecosystem and remnant map |
| VMA Essential Habitat | Vegetation management - essential habitat map |
| VMA Wetlands | Vegetation management wetlands map |
| Legally secured offsets | Vegetation Management Act property maps of assessable vegetation.<br>For offset register data-contact DES |
| Regulated Vegetation Map | Vegetation management - regulated vegetation management map |

## Appendix 3 - Acronyms and Abbreviations

| | |
|---|---|
| AOI | - Area of Interest |
| DES | - Department of Environment and Science |
| EP Act | - *Environmental Protection Act 1994* |
| EPP | - Environmental Protection Policy |
| GDA94 | - Geocentric Datum of Australia 1994 |
| GEM | - General Environmental Matters |
| GIS | - Geographic Information System |
| MSES | - Matters of State Environmental Significance |
| NCA | - *Nature Conservation Act 1992* |
| RE | - Regional Ecosystem |
| SPP | - State Planning Policy |
| VMA | - *Vegetation Management Act 1999* |

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