PROGRESSIVE REHABILITATION AND CLOSURE PLAN
VULCAN COMPLEX PROJECT
Tenure number: ML700060

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1 INTRODUCTION

The Vulcan Complex Project (the Project) is a new small-scale coal-mining operation proposed by Vitrinite Pty Ltd (Vitrinite). This Progressive Rehabilitation and Closure Plan (PRC Plan) is to accompany a site-specific application for an environmental authority (EA) to undertake the Environmentally Relevant Activities (ERA’s) associated with the Project. This PRC Plan has been developed in accordance with Sections 126C and 126D of the Environmental Protection Act 1994 and to meet the requirements specified in the Queensland Government’s Progressive Rehabilitation and Closure Plans Guideline (DES, 2019).

This PRC Plan comprises two main components. The rehabilitation planning component (Sections 1 to 9) provides information on the characteristics of the site, legislative requirements, stakeholders, post-mining land use, rehabilitation goals, rehabilitation methodology, risk assessment and monitoring program. The PRCP schedule component (Section 10) provides a final site design and a detailed schedule of progressive rehabilitation activities including rehabilitation milestones.

This PRC Plan presents Vitrinite’s strategy for managing Project activities in a way that maximises the progressive rehabilitation of the land to a stable condition, as well as specifying the condition to which Vitrinite will rehabilitate the land before the EA is surrendered.

1.1 Project Location

The Project is located in the Bowen Basin, Queensland. It lies adjacent to Saraji Road, 33 kilometres (km) south-southeast of Moranbah and 34 km north-northwest of Dysart (Figure 1-1). It falls within the jurisdiction of the Isaac Regional Council.

The Project is located immediately south and west of an existing, large-scale coal operation, the Peak Downs mine.

1.2 Site Description

1.2.1 Resource Tenures

The Project will be carried on MLA700060 (Figure 1-1).

1.2.1 Topography

The Project lies on plains and foot slopes along the eastern edge of the Harrow Range. The Harrow Range (immediately west of the Project) is generally 100-170 metres (m) higher than the surrounding plain. The plain itself slopes gently towards to the east, and varies in elevation from 270 mAHD in the west to 250 mADH in the east (Figure 1-2).
1.2.2 Climate

The Project area is subtropical, with hot summers and mild winters. The nearest Bureau of Meteorology (BoM) weather stations are Mount Lebanon (29 km northwest) and Seloh Nolem (29 km east), both of which are currently closed. The nearest active weather station is Moranbah Airport (35 km north-northwest), which only commenced operations in 2012. Given the inconsistency of locally available data for discerning long-term average weather patterns, the Queensland Department of Environment and Science’s SILO database was used for estimating average rainfall on site. The SILO database uses mathematical interpolation to fill temporal and spatial data gaps from BoM’s weather stations. Based on data generated for the SILO grid point -22.35, 148.20, the mean and median annual rainfall for the Project is 590.6 millimetres (mm) and 575.1 mm, respectively. However, this varies widely between years: standard deviation = 204.2, range = 275.5 to 1,152.7 mm. On average, 70% of the annual rainfall occurs between November and March (Figure 1-3).

![Average weather conditions at the Project. Green bars refer to the mean (dark) and median (light) monthly rainfall over the past 50 years, as interpolated in the SILO database (Bureau of Meteorology 2019) for the SILO grid point -22.35, 148.20. Mean monthly maximum (red) and minimum (blue) temperatures over the past 50 years come from the Clermont Post Office meteorological station.](image)

1.2.3 Geology

The geology of the Project area is influenced by its position within the Bowen Basin, one of Queensland’s largest depositional zones, formed through a period of rifting and subsidence lasting from the Early Permian to the Mid-Triassic. The area surrounding the project is dominated by clastic sedimentary rocks of marine and lacustrine origin, including sandstones, mudstones, siltstones and coal (Geoscience Australia 2019). Rock strengths range from extremely-low-strength weathered sandstone to high-strength fresh sandstone.

The solid geology of the region includes the:

- Morambah Coal Measures – Permian, comprising coal and inter-seam material composed of sandstone, shale, siltstone with minor clay stone; and
• Back Creek Group – Early to Late Permian, comprising quartzose to lithic sandstone, conglomerate, siltstone, carbonaceous shale and coal. Occurs beneath the Moranbah Coal Measures, and outcrops to the west of the disturbance footprint.

The Permian sediments are covered by a thin veneer of unconsolidated to semi-consolidated Cainozoic sediments (Tertiary to Quaternary alluvium and colluvium):

• Qr – Qr - (QLD) (Qr) – Quaternary clay, silt, sand, gravel and soil with colluvial and residual deposits; and
• TQa – QLD (TQa) – Late Tertiary to Quaternary poorly consolidated sand, silt, clay, minor gravel and high level alluvial deposits.

Across the Project area, the uppermost stratum is generally a highly weathered regolith comprising a heterogeneous distribution of fine to coarse-grained sand, clay, sandstone and claystone. These are either Tertiary sediments or a weathered profile that had developed during the Tertiary on Permian strata (hydrogeologist.com.au 2020). The base of weathering typically extends to depths of 5 to 45 mbgl (metres below ground level), where the unweathered Moranbah Coal Measures commence. In the vicinity of the Project, the cumulative thickness of coal appears to be between 5 m and 15 m. The Project intends to mine the lower seams of the Moranbah Coal Measures (the ALEX and Dysart Lower-Lower (DLL) coal seams).

Outcropping to the west of the Project is the basal section of the Moranbah Coal Measures, a sequence of sandstones and siltstones, with imbedded coal. The ALEX coal seam lies near the top of this sequence, just below the base of weathering. It is of high quality and low ash content, and is approximately 1 m thick. It overlies resistant, quartzose, medium to coarse-grained sandstone, locally referred to as the Mesa Sandstone due to the characteristic mesa plateaus that have formed in the region. At its base, the Mesa Sandstone grades into the Mesa Siltstone.

The DLL coal seam lies immediately below the Mesa Siltstone. It lies near the base of the Moranbah Coal Measures. The DLL consists of a 2.5-m-thick seam with four plies, and contains moderate to high-ash; good-quality coal. An additional and separate 1-m-thick coal ply beneath the main seam plies, results in a total coal thickness within the target sequence of approximately 3.5 m.

Beneath the Moranbah Coal Measures are the Exmoor and Blenheim formations of the Back Creek Group. The top of the Exmoor formation is characterised by prominent, coarse-grained, siliceous boulder sandstone in outcrop, whilst the top of the Blenheim Formation is characterised by fossiliferous and worm-burrowed sandstone.

No igneous intrusions have been encountered within the Project area to date in either drilling or field mapping exercises. However, neighbouring mining operations (the north and far west of EPC1234 and EPC1729) have localised basalt dykes and potential sills within their leases.

A conceptual diagram of the main geological units is shown in Figure 1-4, and representative stratigraphy of the Project area is shown in Figure 1-5.
Figure 1-4 West-to-east conceptual geological model of the project area (hydrogeologist.com.au 2020)

Figure 1-5 Representative stratigraphy of the Project area (hydrogeologist.com.au 2020)
1.2.4 Hydrology

The Project is located within the ‘Isaac western upland tributaries’ area of the Isaac River sub-basin, which in turn forms part of the Fitzroy Basin. The Project is located in the headwaters of the Boomerang Creek catchment.

The Project area contains several ephemeral tributaries of Boomerang Creek, and all drain towards the east (Figure 1-6):

- North Creek;
- Middle Creek; and
- Boomerang Creek (main channel);

These creeks converge before joining the Isaac River 21 km east of the Project. The Isaac River ultimately flows into the Fitzroy River, which empties into Keppel Bay near Rockhampton. These ephemeral creeks have limited flow, typically only after heavy rainfall events. Flows typically last for less than a fortnight after heavy rain events.

An un-named tributary traverses the north of the MLA area, which drains most of the MLA area east of the existing flood levee. This tributary flows beneath Saraji Road and the Norwich Park branch railway, before discharging into the Peak Downs ML, where it feeds existing highly modified water storages. This tributary will be diverted as part of the Project, to allow access to the underlying coal. The tributary will be reinstated post-mining by constructing a drainage corridor through backfilled spoil as shown in Section 1.3.2. A new culvert crossing will be constructed under the realigned Saraji Road just upstream of the existing railway culverts. This will connect to the existing channel and utilise the existing railway culverts. The typical pre-mining dimensions of this tributary through the Project area are:

- channel bed widths of 2 m to 5 m;
- channel top widths of 10 m to 25 m;
- channel depths 0.5 to 1 m; and
- overbank floodplain widths of 20 m to 50 m.

An existing drainage diversion already exists within the MLA area, along the western edge of the flood levee and draining into North Creek to the south of the MLA. This diversion and levee were built in the 1970s to allow the construction of a tailings dam within the Peak Downs operations. The existing drainage diversion and its functionality will not be modified as part of the Project.

North Creek flows through the south-eastern corner of the MLA area, where it has the following dimensions:

- channel bed widths of 3 m to 5 m;
- channel top widths of 10 m to 30 m;
- channel depths 1 to 2 m; and
- overbank floodplain widths of 50 m to 150 m.

North Creek will not be modified as part of the Project.

In accordance with Section 126D(3) of the Environment Protection Act 1994, any voids situated wholly or partly within a flood plain must be rehabilitated to a PMLU with a stable condition. While no voids or NUMAs are proposed for the Project, flood plain modelling was undertaken as part of baseline assessments, to inform Project planning of flood risks during operations and rehabilitation. This flood plain modelling revealed that small parts of the disturbance footprint for the Project occur within a flood plain (Figure 1-7). Note that this map shows the flood plain according to pre-mining conditions; for models of how the flood plain is expected to change as the Project develops, refer to Appendix A.
There are no stream flow data currently available for Boomerang Creek and its tributaries. The collection of water quality data has also been restricted by very infrequent flows within local waterways. One round of baseline water quality testing has been undertaken (February 2020) at three collection points—one point on the northern un-named tributary (where this enters the MLA area), one point on North Creek (downstream from the existing diversion) and one point on Middle Creek (WRM 2020). This revealed that the following parameters exceeded water quality objectives specified by the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*:

- Electrical conductivity;
- Turbidity;
- Total hardness as CaCO₃;
- Sulphate as SO₄;
- Sodium;
- Ammonia as N;
- Nitrogen (total);
- Phosphorous (total);
- Dissolved Oxygen;
- Aluminium (filtered);
- Copper (filtered);
- Manganese (filtered); and
- Zinc (total).

Given the small amount of sampling possible over the past 12 months, regional water quality data has been used to develop water quality objectives until sufficient local data is available (WRM 2020).

### 1.2.5 Hydrogeology

In the vicinity of the Project, all geological formations yield low volumes of groundwater and hence would not typically be classified as aquifers in most hydrogeological settings. However, as individual lithological units within these formations have higher hydraulic conductivities than the intervening units, and groundwater in these formations is to be assessed for the determination of impact, they are referred to as aquifers for the purposes of this plan.

The following geological formations may contain groundwater (hydrogeologist.com.au 2020):

1) Quaternary alluvium: Confined to discrete channels in the beds of existing waterways. Alluvial sediments are unsaturated and disconnected laterally.

2) Tertiary sediments and weathered regolith: Silts and clays, which comprise the bulk of the regolith overlying the coal measures, are densely compacted, hard and generally dry. Sand and gravel lenses embedded within the regolith are permeable but have low hydraulic conductivity and limited lateral and vertical extent. These have a potential to represent unconfined to confined aquifers, depending on location.

3) Permian coal measures: The ALEX and DLL coal seams are poor aquifers of low hydraulic conductivity. They are confined above and below by low-permeability regolith and sedimentary rocks. Nevertheless, these represent the largest and uppermost aquifers across most of the Project area.

4) Back Creek Group: This formation of sandstones, siltstones and shale forms a largely impervious layer beneath the DLL coal seam aquifer. However, the Back Creek Group also contains narrow coal seams that can act as poor aquifers.

Groundwater is between 2 m and 30 m deep within the Project area but generally between 5 m to 30 m deep in the area of the proposed open pit. There are areas on the northern and southern Project boundaries with depth to groundwater less than 5 m. Due to the depth to groundwater, aquatic groundwater-dependent ecosystems are absent from most of the local land surface. A small extent of possible groundwater-dependent terrestrial vegetation occurs where the groundwater is 5 to 20 m deep (*Figure 1-8*), which is out of reach of most plant’s roots, but within reach of some species. Hydrogeologist.com.au (2020) has developed a numerical groundwater flow model of the survey area and
broader region to predict the effects of the Vulcan Complex Project on local groundwater levels. The drawdown predicted from the project is limited in geographic extent (up to 3,000 m to the northeast toward existing mining) and magnitude (up to 10 m). The zone of drawdown does contain some potential GDEs, but only within the clearing footprint. No remnant vegetation outside the clearing footprint is found within the zone of drawdown. In summary, negligible impacts to GDEs are predicted to result from the Vulcan Complex Project, beyond that which will occur due to vegetation clearing.

Fault zones can influence groundwater transmission rates and flow directions; however, there are no known fault zones in or near the Project. Within the coal measures, groundwater largely flows along the bedding planes of the coal seams. In general, groundwater flows from the west to the east, mimicking the surface water drainage pattern (hydrogeologist.com.au 2020). The low hydraulic conductivity and small storage of local aquifers means that their levels have remained largely unaffected by 40 years of dewatering at mines just 600 m away.

The pH of local groundwater is neutral to slightly acidic (hydrogeologist.com.au 2020). Salinity levels, however, are relatively high; groundwater is brackish to saline (electrical conductivity of 2,700 to 11,700 µS/cm) (hydrogeologist.com.au 2020). This conductivity is driven mostly by high concentrations of sodium and chloride (with moderate bicarbonate in some samples), consistent with it being sodic water of marine origin. This groundwater is generally unsuitable for irrigation, but it may be used in limited quantities as water for livestock. Conductivity above 7,463 µS/cm is associated with declines in animal health if consumed for prolonged periods (ANZG 2018). All groundwater on site fails to meet guidelines for drinking water suitability for humans. Overall, groundwater on site has no or limited value for most uses, with the exception of limited stock watering and potential industrial purposes related to mining.
1.2.6 Soil

The Report on Lands of The Isaac-Comet Area (Story et al. 1967), mapped at a scale of 1:500,000, indicates the Project area contains the following land system units:

- **Carborough Land System**: The Carborough Land System is characterised by mountains and hills with broken and dissected local relief ranging between 30 m to 400 m. Structural benches and cliffs are common landforms with severe weathering occurring in some areas. This mountainous land system has formed shallow coarse-textured rocky soils. A small area of the Carborough Land System is also characterised by lower slopes and hills and alluvial flats with a local relief between 10 m to 60 m. Texture-contrast soils have formed in these areas and possess thick sandy topsoil. Geology in this land system is comprised of partly weathered quartz sandstone.

- **Cotherstone Land System**: The Cotherstone Land System is characterised by hills and prominent strike ridges as well as gentler undulating terrain associated with low indefinite strike ridges and colluvial foot slopes. The more prominent strike ridges possess a local relief varying between 10 m to 30 m and have developed shallow coarse-textured to rocky soils. The gentler undulating terrain has a local relief of less than 15 m and is associated with texture-contrast soils with a sandy upper-horizon. The geology in this land system is weathered Permian sandstone and shale.

- **Monteagle Land System**: The Monteagle Land System is predominantly characterised by low-lying plains and colluvial foot slopes with local relief generally below 6 m. This land system is associated with texture-contrast soils composed of a thick sandy topsoil and neutral to strongly alkaline subsoils. Geology in this land system is comprised of undissected Tertiary sandstones and clays.

Mapping at a scale of 1:100,000, based on soil surveys undertaken on site, revealed three soil management units (SMUs) within the Project MLA area (Figure 1-9). These are described below.
Crocodile SMU

This unit contains shallow, rocky soils associated with hill slopes and plateau. It is the dominant soil management unit immediately west of the MLA area, but occupies less than 1 ha of the MLA area. Soils are classed as arenic rudosols. Soil textures grade from surface loams to loamy sands with depth. Soils often contain rock material with little to no pedologic development throughout the solum. The Crocodile SMU belongs to the Carborough land System and the Back Creek Geological Group.

The Crocodile SMU is strongly acidic throughout the solum with only a minor increase in pH at depth. It has very low salinity. Soils in this SMU are non-sodic and not dispersive (Emerson Class 7 or 8). The topsoil is dominated by sand (52%) and gravel (30%), with 10% silt and 8% clay. This coarse texture limits the soil’s water-holding capacity and extractable nutrient levels, with soils being deficient in phosphorus, nitrates, sulphates, copper and zinc.

The Crocodile SMU typically has the following soil profile:

The surface soil (A11/A11r/A12) is a black to very dark greyish brown (10YR2/1, 10YR3/2) sand to sandy loam with loose to weak polyhedral structure with some profiles containing moderately strong to strong sub-angular rock material. The soil unit has a field pH of 4.5–5.5, demonstrating an abrupt to clear change to;

The lower surface soil (A2r) is not a common horizon observed for this SMU. It is a dark brown (10YR3/3) loamy sand with an abundance (comprising 50–90% of this horizon) of moderately strong coarse fragments approximately 2–6 cm in diameter. It has loose structure and a field pH of 5.5 to 5.0. Gradual change to;

The subsoil (B2w/B2r) is a dark greyish to reddish brown (10YR3/2, 2.5YR2.5/4) loamy sand to clay loam with weak to moderate polyhedral structure. It can contain rounded to angular coarse fragments which make up <10% of the horizon. This horizon has a field pH of 4.5 to 5.5, with a gradual change to; and

The lower profile (C) contains either consolidated or unconsolidated partly weathered rock material that appear to have originated from underlying sandstone and siltstone with some profiles possessing an overlying transitional horizon (B3r). Depending on the rock material present, this horizon can range from dark red to light yellow-brown colour.

Limpopo SMU

This is a brown texture-contrast soil unit. This soil management unit comprises 96% of the MLA area. Soils are classed as brown sodosols. Soil textures grade from sands to clay sands in the surface soils to light clays in deeper horizons. The Limpopo SMU belongs to the Monteagle land System and the Back Creek Geological Group.

The Limpopo SMU has a moderately acidic soil profile (pH 5.5-5.6). Salinity levels are very low. Sandy surface soils are non-sodic and not vulnerable to dispersion. However, clay subsoils (below 0.5 m) are sodic and susceptible to dispersion. The topsoil is dominated by sand (79%) with 8% silt and 10% clay. This texture may be at risk of slumping. Soils are deficient in phosphorus, nitrates, potassium, copper, zinc and boron.
The Limpopo SMU typically has the following soil profile:

The **surface soil** (A11, A12) is brown to a dark-brown (7.5YR4/4, 7.5YR3/3) sand to loamy sand with a loose structure. It has a field pH that ranges between 5 and 6, with a clear to gradual change to;

The **lower surface soil** (A2 or A2e) is a brown to greyish brown (7.5YR4/4, 10YR5/2) with some profiles within this soil unit displaying bleaching in this horizon (A2e). Predominant textures observed in this horizon range from sandy loams to sandy clay loams with a loose to weak polyhedral structure and a field pH of 6. Clear to gradual change to; and

The **subsoil** (B21w, B22w) includes dark yellowish brown to a dark greyish brown (10YR4/4, 10YR4/2) clayey or sandy loams and light clays clay with weak to moderate strength polyhedral structure. Mottling was often observed in this horizon with colours ranging between red, orange and yellow. This horizon has a field pH of 5.5 to 7.

**Zambezi SMU**

This unit contains grey texture-contrast soils, with a sandy surface and clay subsoil. Within the MLA area, this soil management unit is confined to the vicinity of North Creek. Lower horizons display diffuse orange to yellow mottles. Soils are classed as grey sodosols. The Zambezi SMU belongs to the Cotherstone Land System and the TQa geological formation (late-Tertiary to Quaternary poorly consolidated alluvium).

The Zambezi SMU has a slightly acidic (pH 6.4 to 6.7) topsoil (to 0.3 m deep), which becomes progressively alkaline with depth (to pH 9 at >0.8 m depth) and mildly acidic (pH = 6) subsoil. Salinity levels are low throughout the soil profile. The subsoil is strongly sodic and the risk of dispersion is high below 0.3 m depth (Emerson Class 2). The topsoil is dominated by sand (77%), with 14% silt, 9% clay and <1% gravel. It has a loose to weak platy structure, and low organic matter content (2%). Soils are deficient in nitrates, sulphates, phosphorus, copper and zinc.

The Zambezi SMU typically has the following soil profile:

The **surface soil** (A11/A12) is dark brown to very dark greyish brown (7.5YR2.2.5/5, 10YR3/2) coarse-grained loamy sand with loose to very weak platy structure. It has a field pH of 5.5 to 7, with a clear to abrupt change to;

The **lower surface soil** (A2/A2e) is a brown to greyish brown (7.5YR5/4, 10YR5/2) loamy sand, with some profiles displaying this as a bleached horizon with loose single-grained structure and a field pH of 6 to 7.5. Clear to abrupt change to; and

The **lower subsoil** (B2w) is a light grey to grey (10YR7/2, 7.5YR6/1) clayey loam sand to silty clay loam with moderate polyhedral structure. This horizon has a field pH of 7 to 9.
1.2.7 Land Stability

All soil units contained within the Project MLA area are sandy-textured with poor water- and nutrient-holding capacity (AARC 2020). This causes them to support a relatively modest grass cover (usually 20-25%, as assessed in the late wet season: METServe 2020). Furthermore, while topsoils in all local soil management units are relatively stable, subsoils in the most widespread unit (Limpopo) are dispersive and prone to erosion (AARC 2020). Consequently, the land is predisposed to ongoing stability issues in its pre-mining state, and gully erosion is widespread along minor drainage lines in the western half of the MLA area, where grazing intensity is highest (Figure 1-10).

Figure 1-10  Satellite imagery showing extensive gully erosion in heavily grazed portions of the Project MLA area

Slopes within the Limpopo soil management unit are generally less than 10%, which assists in maintaining stability. However, slopes may exceed 30% in certain areas within the Limpopo soil unit (refer Section 6.1). Slopes of up to 50% are frequent in the Crocodile soil management unit (along the western boundary of the Project), but extensive rock outcropping and heavy vegetation cover in these areas protect against erosion (refer Section 6.1), and gully erosion was scarce on this soil management unit.

1.2.8 Vegetation

Four regional ecosystems occur in the Project MLA area. All four occur (mostly as regrowth) within the proposed disturbance footprint (Table 1-1; Figure 1-11). 1.9% of the disturbance footprint comprises remnant vegetation, 31.7% comprises high-value regrowth and the majority (66.4%) comprises cleared pastures. No threatened plant species have been recorded or are likely to occur within the Project disturbance footprint (METServe 2020).

Heavy grazing was a notable feature of the Project MLA area. This manifested through the altered composition of the understorey vegetation (Fensham et al. 1999; Walker et al. 2006). Native perennial grasses were scarce, while introduced pasture grasses (especially Cenchrus ciliaris, Bothriochloa pertusa, Melinis repens and Urochloa mosambicensis) dominated, along with native annual species (e.g., Allotropis cimicina, Setaria surgens, Dactyloctenium radulans, Perotis rara) (METServe 2020). Across all vegetation sampling sites assessed within the broader region, weeds made up an average of half the understorey biomass, although this varied by regional ecosystem (Table 1-1).
**Table 1-1 Regional ecosystems present within the Project footprint. Data extracted from METServe (2020)**

<table>
<thead>
<tr>
<th>Regional Ecosystem</th>
<th>BVG*</th>
<th>Short description</th>
<th>VM class†</th>
<th>Biodiv. Status‡</th>
<th>Mean weed dominance§</th>
<th>Mean canopy cover¶</th>
<th>Mean grass cover</th>
<th>Mean herb cover</th>
<th>Mean bare ground</th>
<th>Area to be disturbed (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.3.25</td>
<td>16a</td>
<td><em>Eucalyptus camaldulensis</em> forest fringing drainage lines.</td>
<td>LC</td>
<td>OC</td>
<td>86.7%</td>
<td>90.0%</td>
<td>43.3%</td>
<td>15.3%</td>
<td>7.7%</td>
<td>0</td>
</tr>
<tr>
<td>11.5.9</td>
<td>18b</td>
<td><em>Eucalyptus crebra</em> and other <em>Eucalyptus</em> spp. and <em>Corymbia</em> spp. woodland on Cainozoic sand plains and/or remnant surfaces.</td>
<td>LC</td>
<td>NC</td>
<td>39.9%</td>
<td>49.5%</td>
<td>23.3%</td>
<td>6.4%</td>
<td>32.3%</td>
<td>0</td>
</tr>
<tr>
<td>11.10.3</td>
<td>24a</td>
<td><em>Acacia shirleyi</em> or <em>Acacia rhodoxylon</em> open forest on coarse-grained sedimentary rocks. Crests and scarp.</td>
<td>LC</td>
<td>NC</td>
<td>11.3%</td>
<td>63.2%</td>
<td>25.8%</td>
<td>1.9%</td>
<td>16.8%</td>
<td>4.3</td>
</tr>
<tr>
<td>11.10.7</td>
<td>12a</td>
<td><em>Eucalyptus crebra</em> woodland on coarse-grained sedimentary rocks</td>
<td>LC</td>
<td>NC</td>
<td>36.8%</td>
<td>54.5%</td>
<td>19.9%</td>
<td>3.2%</td>
<td>35.3%</td>
<td>0</td>
</tr>
<tr>
<td>Non-remnant</td>
<td>-</td>
<td>Cleared pasture, +/- scattered trees or young regrowth</td>
<td>-</td>
<td>-</td>
<td>92.0%</td>
<td>18.9%</td>
<td>55.3%</td>
<td>3.7%</td>
<td>26.8%</td>
<td>149.0</td>
</tr>
</tbody>
</table>

*BVG = broad vegetation group
†VM class = classification under the Vegetation Management Act 1999: E = endangered, OC = of concern, LC = least concern.
‡Biodiversity status relates to environmentally sensitive areas under the Environmental Protection Act 1994: E = endangered, OC = of concern, NC = no concern at present.
§Mean percentage of the understorey vegetation within each regional ecosystem that comprises non-native species (pasture grasses and weeds).
¶Canopy cover is the combined foliage projective cover of all woody vegetation (trees and shrubs).
1.2.9 Significant Species

Field surveys of a 6,552-hectare (ha) area surrounding and including the Project MLA detected 40 species of mammal, 133 species of bird, 35 species of reptile, 14 species of frog and 423 species of vascular plants. Among this biodiversity are five species that constitute matters of state and/or national environmental significance (MSES and MNES, respectively). An additional three species that constitute MNES or MSES are likely to utilise the survey area in some capacity, while a further 17 species are possible inhabitants or visitors (Table 1-3).

Potentially significant impacts to three species (Koala *Phascolarctos cinereus*, Squatter Pigeon *Geophaps scripta scripta*, and Short-beaked Echidna *Tachyglossus aculeatus*) may arise as a result of the Project. In order to reduce the long-term impacts of the project on each of these species, their ecological requirements have been taken into account during the planning of post-mining land uses and rehabilitation methodology. A summary of the ecological requirements of these three species are provided below.

**Koala**

Koalas inhabit open forests and woodlands containing species that are known food trees. Within the Isaac Regional Council area, primary food trees consist of *Eucalyptus camaldulensis* and *Eucalyptus tereticornis*, while secondary food trees include *Eucalyptus brownii*, *Eucalyptus coolabah*, *Eucalyptus ochrophloia*, *Eucalyptus orgadophila*, *Eucalyptus populnea* and *Eucalyptus crebra* (Australian Koala Foundation 2015). The two species with an asterisk are found naturally within the Project MLA area.

Three habitat classes (primary, secondary and marginal) have been mapped across the Project MLA area and adjacent areas. These habitat classes are defined as per Table 1-2.

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Regional Ecosystems</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Habitat</td>
<td>Remnant 11.3.25</td>
<td>Dominated by primary food trees; abundant large trees; high subsoil moisture; abundant shady <em>Melaleuca</em> for shelter.</td>
</tr>
<tr>
<td>Secondary Habitat</td>
<td>Regrowth 11.3.25</td>
<td>As for primary habitat, but trees are less favoured due to their smaller size.</td>
</tr>
<tr>
<td></td>
<td>Remnant 11.5.9 or 11.10.7.</td>
<td>Dominated by secondary food trees; moderate density of large trees</td>
</tr>
<tr>
<td>Marginal Habitat</td>
<td>Regrowth 11.5.9 or 11.10.7.</td>
<td>Dominated by secondary food trees; large trees (&gt;30 cm diameter at breast height) are absent.</td>
</tr>
<tr>
<td>Non-habitat</td>
<td>Remnant or regrowth 11.10.3 or cleared areas.</td>
<td>Primary food trees absent. Secondary food trees comprise less than 10% of the canopy.</td>
</tr>
</tbody>
</table>

While the Project will avoid impacts to primary habitat for the Koala, loss of some secondary and marginal habitat is predicted. The reestablishment of secondary food trees on rehabilitated land is expected to reduce long-term impacts of the Project on the Koala.

**Squatter Pigeon**

Squatter Pigeons inhabit a wide range of open forests to sparse open woodlands and scrub, primarily on sandy or gravelly soils, supporting a patchy understorey of grasses and herbs, mixed with areas of bare ground. Squatter Pigeons are not dependent on remnant vegetation, and readily feed on some introduced pastures (METServe 2020). A moderate intensity of grazing is beneficial to the species, as it creates favourable open patches of ground for foraging. Nevertheless, Squatter Pigeons require some degree of tree cover, and based on data gathered from 60 records of Squatter Pigeons across the region containing the Project, a minimum Normalised Differential Vegetation Index of 0.125 (measured across a 1-ha cell in the late dry season) was required for the habitat to be suitable for the species (METServe 2020). Post-mining land uses that are conducive to the long-term conservation of Squatter Pigeons on rehabilitated land (e.g., native habitats or cattle grazing) are preferred. Likewise, the species’ ecological needs (e.g., density of tree cover) were considered during the development of completion criteria.

**Short-beaked Echidna**

Short-beaked Echidnas inhabit all types of vegetation contained within the Project MLA area, including cleared pastures. Their chief ecological requirement is a supply of ants and termites on which to feed. Post-mining land uses that support populations of ants and termites, as well as provide a moderate amount of vegetation cover for protection from weather and predators, will facilitate the long-term conservation of the species on site.
Due to the unspecific habitat needs of Short-beaked Echidnas, it is expected that any rehabilitated sites that support other species of conservation significance (i.e., Koalas and/or Squatter Pigeons) will also be suitable for echidnas. The species is therefore not considered further when planning post-mining land uses or appropriate completion criteria.
### Table 1-3 Species of national or state environmental significance flagged by databases as being potentially present in the local region

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Species</th>
<th>Common Name</th>
<th>EPBC status</th>
<th>NC status†</th>
<th>Habitat requirements</th>
<th>Presence in survey area‡</th>
<th>Significant Impact‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird</td>
<td>Geophaps scripta scripta</td>
<td>Squatter Pigeon</td>
<td>V</td>
<td>V</td>
<td>Open grassy woodland with areas of bare ground, on land zones 3, 5 and 7.</td>
<td>C</td>
<td>Y</td>
</tr>
<tr>
<td>Mammal</td>
<td>Phascolarctos cinereus</td>
<td>Koala</td>
<td>V</td>
<td>V</td>
<td>Vegetation communities containing large food trees (<em>Eucalyptus</em> spp.), especially near watercourses.</td>
<td>C</td>
<td>Y</td>
</tr>
<tr>
<td>Mammal</td>
<td>Tachyglossus aculeatus</td>
<td>Short-beaked Echidna</td>
<td>-</td>
<td>SL</td>
<td>Cosmopolitan habitat usage; anywhere termites can be found.</td>
<td>C</td>
<td>Y</td>
</tr>
<tr>
<td>Mammal</td>
<td>Petauroides volans</td>
<td>Greater Glider</td>
<td>V</td>
<td>V</td>
<td>Tall, old-growth eucalypt forest with tree hollows.</td>
<td>C</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Rhipidura rufifrons</td>
<td>Rufous Fantail</td>
<td>M</td>
<td>SL</td>
<td>Dense woody vegetation, including vine thickets, paperbark forests and rainforest.</td>
<td>C</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Apus pacificus</td>
<td>Fork-tailed Swift</td>
<td>M</td>
<td>SL</td>
<td>Almost exclusively aerial, foraging on flying insects above all habitat types.</td>
<td>L</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Gallinago hardwickii</td>
<td>Latham’s Snake</td>
<td>M</td>
<td>SL</td>
<td>Freshwater wetlands with well-vegetated muddy edges.</td>
<td>L</td>
<td>N</td>
</tr>
<tr>
<td>Reptile</td>
<td>Denisonia maculata</td>
<td>Ornamental Snake</td>
<td>V</td>
<td>V</td>
<td>Gilgais on heavy clay soil, especially where <em>Acacia harpophylla</em> grows.</td>
<td>L</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Rostratula australis</td>
<td>Australian Painted-snipe</td>
<td>E</td>
<td>V</td>
<td>Freshwater wetlands with well-vegetated muddy edges.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Reptile</td>
<td>Acanthophis antarcticus</td>
<td>Common Death Adder</td>
<td>-</td>
<td>V</td>
<td>Forested areas with deep leaf litter and/or abundant rocks.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Erythrotriorchis radiata</td>
<td>Red Goshawk</td>
<td>V</td>
<td>E</td>
<td>Large tracts of undisturbed forest, especially near the ecotone between rainforests, melaleuca swamps and open eucalypt woodlands. Within the survey area, it is most likely in densely forested riparian habitats.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Reptile</td>
<td>Egernia rugosa</td>
<td>Yakka Skink</td>
<td>V</td>
<td>V</td>
<td>Potentially any vegetated habitat with fallen timber or rocks. There are no nearby records, but habitat is available locally.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Grass</td>
<td>Aristida annua</td>
<td>Annual Wiregras</td>
<td>V</td>
<td>V</td>
<td>Open eucalypt woodlands and pastures ranging from sandy loams to basalt-derived clay. The survey area lies outside the known distribution of the species; the most northern record is 35 km south.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Calidris acuminata</td>
<td>Sharp-tailed Sandpiper</td>
<td>M</td>
<td>SL</td>
<td>Estuarine and freshwater wetlands with extensive shallow, muddy margins.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Cuculus optatus</td>
<td>Oriental Cuckoo</td>
<td>M</td>
<td>SL</td>
<td>Primarily coastal forest and woodland. Rarely moves inland west of the coastal ranges.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Gelochelidon nilotica</td>
<td>Gull-billed Tern</td>
<td>M</td>
<td>SL</td>
<td>Primarily a coastal species. Can occur over inland lakes.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Monarcha melanopsis</td>
<td>Black-faced Monarch</td>
<td>M</td>
<td>SL</td>
<td>Typically associated with rainforest. Migrating individuals may utilise dense riparian vegetation in a transient capacity.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Bird</td>
<td>Myiagra cyanoleuca</td>
<td>Satin Flycatcher</td>
<td>M</td>
<td>SL</td>
<td>Tall wet forests of the coast and nearby ranges. Vagrant individuals may occasionally occur inland, where they are most likely in denser forests (e.g., along waterways).</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Taxon</td>
<td>Species</td>
<td>Common Name</td>
<td>EPBC status*</td>
<td>NC status†</td>
<td>Habitat requirements</td>
<td>Presence in survey area</td>
<td>Significant Impact‡</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------</td>
<td>----------------------</td>
<td>--------------</td>
<td>------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Bird</td>
<td>Plegadis falcinellus</td>
<td>Glossy Ibis</td>
<td>M</td>
<td>SL</td>
<td>Shallow, marshy edges of large freshwater wetlands.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Mammal</td>
<td>Macroderma gigas</td>
<td>Ghost Bat</td>
<td>V</td>
<td>E</td>
<td>Primarily coastal ranges, where large cave systems occur near extensive forests.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Reptile</td>
<td>Furina dunnalli</td>
<td>Dunmall’s Snake</td>
<td>V</td>
<td>V</td>
<td>Strongly associated with Acacia harpophylla and cracking clay soils. The nearest record</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Reptile</td>
<td>Lerista allanae</td>
<td>Allan’s Lerista</td>
<td>E</td>
<td>E</td>
<td>Inhabits root systems of grass tussocks growing on black clay soils.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Grass</td>
<td>Dicanthium queenslandicum</td>
<td>King Blue-grass</td>
<td>E</td>
<td>V</td>
<td>Grasslands or open woodland on clay soils, with low grazing pressure.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Mammal</td>
<td>Dasyurus hallucatus</td>
<td>Northern Quoll</td>
<td>E</td>
<td>LC</td>
<td>Rugged escarpments in wetter forested areas.</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Grass</td>
<td>Dicanthium setosum</td>
<td>Hairy Bluegrass</td>
<td>V</td>
<td>LC</td>
<td>Grasslands or open woodland on clay soils, with low grazing pressure.</td>
<td>P</td>
<td>N</td>
</tr>
</tbody>
</table>

†Status under the Nature Conservation Act 1992: E = endangered, V = vulnerable, SL = special least concern, LC = least concern.
‡Presence within the broader survey area encompassing the Project ML: C = presence confirmed, L = likely to be present, P = possibly present.
§Is a significant impact likely to arise from the Project?: Y = yes, N = no.
1.2.10 Pre-mining Land Use

The land within the Project MLA area is zoned as Rural under the Isaac Regional Council Planning Scheme. The lot containing the Project (lot 10, SP208611) is a Land Lease with an industrial purpose, and most of the lot contains operational areas of the Peak Downs Mine. The land has an agriculture land class of C2 (land suitable for grazing on native pastures on lower fertility soils) or C3 (land suitable for light grazing on native pastures in accessible areas, and includes steep land), in accordance with the Guidelines for Agricultural Land Evaluation in Queensland (DSITI and DNRM 2015). The pre-mining land use is primarily low-intensity cattle grazing. A total of 98% of the proposed project footprint has been formerly cleared of its natural vegetation; the remaining 2% comprises native remnant vegetation with an understorey that has been highly modified by grazing (see Section 1.2.8). The dominant land use adjacent to the Project (to the north and east) is coal mining.

The Project MLA area does not contain areas of regional interest (priority living areas, priority agricultural areas, strategic cropping land and strategic environmental areas) protected under the Regional Planning Interests Act 2014.

Saraji Road, a public, sealed roadway administered by Isaac Regional Council, passes through the Project MLA area. This serves an annual average of 2,270 vehicles per day (as surveyed in 2019: GTA Consultants 2020).

A railway line managed by Aurizon runs immediately inside the eastern boundary of the MLA area. A flood levee constructed by BHP Billiton/Mitsubishi Alliance (BMA) (owners of the Saraji and Peak Downs Mines) runs through the centre of the MLA area. Neither the railway corridor nor the flood levee will be disturbed by the Project.

A number of small industrial compounds also exist on the site. These provide supporting infrastructure to a number of commercial operations that utilise small portions of the proposed MLA area.

Vitrinite has been granted an Environmental Authority (EA0002054) and a Mineral Development Licence (MDL3039) to permit extraction of a bulk sample of coal from within the proposed footprint of the Project. Prior to commencement of the Project, Vitrinite will extract up to 600 kilotonnes (kt) of high-quality coking coal from the bulk sample pit for testing by a number of international coal consumers. The waste rock dump required for the initial stages of the Project will be developed as an extension of the bulk sample dump. The bulk sample is planned to commence in 2020 and to run for 9-12 months while the Project is subject to environmental authority and mining lease application processes. While disturbance resulting from the bulk sample is not considered part of the Project (this has already been approved), rehabilitation of the bulk sample footprint forms part of this PRC Plan, as this footprint is incorporated into the operations of the Project.

Land Suitability Ratings

An assessment of land suitability for cattle grazing has been undertaken by AARC (2020), in accordance with the Guidelines for Agriculture Land Evaluation in Queensland (DSITI and DNRM 2015) and Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland – Land Suitability Assessment Techniques (DME 1995). This assessment took into account water availability, nutrient deficiency, soil physical factors, salinity, rockiness, microrelief, pH, exchangeable sodium percentage, wetness, water erosion, flooding and vegetation regrowth. The results of this assessment are shown in Table 1-4. Sandy soils on the plains (Limpopo and Zambezi) had a land suitability class of 4 (marginal land for grazing). Sandstone escarpment areas of the Crocodile soil management unit had a class of 5 (unsuitable for grazing) (Figure 1-12). Class 4 land is categorised as marginal for grazing improved pastures, although it is largely considered suitable for grazing native pastures of variable quality. Class 5 land is unsuitable for any form of pasture improvement and is limited to low productivity grazing of native pastures. Class 5 land may require destocking in poor seasons.
Table 1-4 Summary of pre-mining land suitability limitations for cattle grazing within the Project MLA area (AARC 2020)

<table>
<thead>
<tr>
<th>Limitation</th>
<th>Crocodile</th>
<th>Limpopo</th>
<th>Zambezi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water availability</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Nutrient deficiency</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Soil physical factors</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Salinity</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Rockiness</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Microrelief</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>pH</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ESP</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wetness</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Water erosion</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Flooding</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Vegetation Regrowth</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Overall Suitability Rating</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 1-12 Cattle grazing land suitability classes within the Project area (from AARC 2020)
Although not proposed as a PMLU, a similar land suitability assessment has been undertaken for the land’s potential for rain-fed broadacre cropping (Table 1-5). This revealed that the majority of the MLA area has a land suitability class of 4 (unsuitable for rain-fed broadacre cropping with severe limitations) (Figure 1-13).

Table 1-5 Summary of land suitability limitations for rain-fed broadacre cropping within the Vulcan MLA area

<table>
<thead>
<tr>
<th>Limitation</th>
<th>Crocodile</th>
<th>Limpopo</th>
<th>Zambezi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water availability</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Nutrient deficiency</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Soil physical factors</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Soil workability</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Salinity</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Rockiness</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Microrelief</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wetness</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Topography</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Water erosion</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Flooding</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Overall Suitability Rating</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 1-13 Rain-fed broadacre cropping land suitability classes within the Project area (from AARC 2020)
Based on the land suitability assessments summarised above, the soil management units present on site have been assigned the agricultural land classifications listed in Table 1-6.

### Table 1-6: Agricultural land classes (AARC 2020)

<table>
<thead>
<tr>
<th>Soil Management Unit</th>
<th>Land Class</th>
<th>Class Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crocodile</td>
<td>C3</td>
<td>Pasture Land – Land suitable for light grazing on native pastures in accessible areas, and includes steep land.</td>
</tr>
<tr>
<td>Limpopo</td>
<td>C2</td>
<td>Pasture Land – Land suitable for grazing on native pastures on lower fertility soils.</td>
</tr>
<tr>
<td>Zambezi</td>
<td>C3</td>
<td>Pasture Land – Land suitable for light grazing on native pastures in accessible areas, and includes steep land.</td>
</tr>
</tbody>
</table>

1.2.11 Land Holders

Landholders listed in Table 1-7 currently manage land on which the Project is to take place.

### Table 1-7: Land tenure and real property descriptions for the project

<table>
<thead>
<tr>
<th>Lot/Plan</th>
<th>Land holder</th>
<th>Tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saraji Road</td>
<td>Isaac Regional Council</td>
<td>Road Parcel</td>
</tr>
<tr>
<td>Lot 26 on CNS125</td>
<td>Aurizon</td>
<td>Lands Lease</td>
</tr>
<tr>
<td>Lot 10 on SP208611</td>
<td>BHP Billiton/Mitsubishi Alliance (BMA)</td>
<td>Lands Lease</td>
</tr>
</tbody>
</table>

1.3 Relevant Activities

#### 1.3.1 Project Description

The Project is a small-scale coal mine that will extract approximately 6 Mt of run-of-mine (ROM) hard coking coal at a rate of up to 1.95 Mtpa. Coal extraction will occur via a single open-cut pit. Truck-and-shovel mining operations will be employed to develop the pit. The coal will be hauled to a run-of-mine pad and processed using a dry crushing and screening mobile plant (including Sorterra screening). Once crushed and screened, coal will be placed on the ROM stockpile for haulage. Rejects from the crushing and screening process will be stockpiled separately and placed within the relevant active dump. There are no coal-washing activities, facilities or storage of processed wastes proposed as part of the Project. Coal will be trucked off site for toll washing at a nearby facility between Moranbah and Coppabella on the Peak Downs Highway. Each truck will transport approximately 70 tonnes of coal, with an anticipated average of 80 truck movements per 24 hours each way. Haulage will operate 24 hours a day on a 7-day roster.

A small out-of-pit waste-rock dump will be established prior to commencing in-pit dumping activities that will continue for the life of the operation. Ancillary infrastructure, including a ROM pad, Mine Infrastructure Area (MIA), offices, roads and surface water management infrastructure will be established to the west and south of the open cut. The MIA will include heavy vehicle workshops and park-up, equipment laydown areas and project offices and facilities. An explosives magazine will be established to the north-west of the out-of-pit dump, away from operational areas and critical infrastructure. This will be accessed via an existing track from the northern end of the out-of-pit dump.

The MLA area contains an existing flood levee and rail line, neither of which will be modified or affected by the Project. The realignment of the existing Saraji Road and services infrastructure to the eastern boundary of the MLA area, adjacent to the existing rail easement, is proposed (Figure 1-14). The re-alignment will occur within the lease; however, the connection back to the existing alignment of Saraji Road to the north will extend off the lease and will be subject to a separate approvals process.
In-pit dumping will fill the majority of the pit during operations with the remaining final void to be backfilled upon cessation of mining, resulting in the establishment of a low waste rock dump landform over the former pit area. The initial ex-pit waste rock dump will be rehabilitated in-situ.

Approval has previously been granted to extract a bulk sample of coal from the MLA area (see Section 1.2.10). It is Vitrinite’s intention, subject to favourable testing of the bulk sample coal and the successful approval of the Project, to retain part of the bulk sample void to facilitate commencement of the VCP. Similarly, the ex-pit waste rock dump required for the initial stages of the Project will be developed as an extension of the bulk sample out-of-pit dump.

Due to the swelling of re-deposited overburden, the in-pit dump will extend up to approximately 15 m above the surrounding ground level, and batters will have a slope to a maximum of 15%. A central plateau will drain to the west (for more detail, refer to Section 6.1).

An assessment of waste rock geochemistry has concluded that the waste rock does not propose a significant risk of generating acidic, saline or metalliferous drainage, and no selective handling and treatment measures are considered required or proposed.

The peak operational workforce is anticipated to comprise 116 positions. It is anticipated that less than a quarter (approximately) of this workforce would be present on site at any one time due to shift and roster arrangements and the inclusion of off-site haulage positions in this total. It is assumed that approximately half the workforce will commute daily from Moranbah, while the other half will commute from Dysart. There would be two 12-hour shifts per day, with crews operating on a 7-days-on, 7-days-off roster.
The Project will operate for approximately four years. It will develop from the bulk sample project, which will commence in 2020 and run for 9-12 months while the Project is undergoing environmental authority and mining lease application processes. The project will comprise 3 years of mining and a fourth year of rehabilitation works.

1.3.2 Water Management

Surface water management infrastructure will be established progressively to divert clean water around operational areas and to manage runoff from disturbed areas (WRM 2020). A series of drains and bunds will be established to direct runoff to sediment control structures. A mine water dam will be constructed as a water supply for dust suppression. This will also receive any accumulated pit water that requires dewatering. Groundwater modelling indicates that the amount of pit dewatering required is expected to be negligible (hydrogeologist.com.au 2020). This is due to the small size and low conductivity of any aquifers intercepted by the open cut pit. The water management infrastructure in place in and around the final landform once land becomes available for rehabilitation is shown in Figure 1.15. This water management infrastructure includes the following:

- Two diversion drains to collect water from the undisturbed catchment to the west of the Project area and divert it around the out-of-pit dump to the existing drainage diversion;
- During operations, a gravity drain will be constructed between the existing flood protection levee and the pit, draining north towards SD6 and Diverted Dam 1 (DD1). It will be designed to convey at least a 1% AEP (1 in 100-year ARI) flow event. As the pit progresses to the north, the sections of the levee that are no longer required for pit flood protection will be replaced by the overburden dump and rehabilitated. This will allow the progressive staging of drainage from the in-pit dump to drain to Sediment Dam 6 (SD6). The functionality of this levee may be built into proposed haul road designs which would negate the need for a separate levee structure;
- The diverted water dam DD1 will be constructed in Stage 2 to collect water from an undisturbed catchment (catchment area of approx. 56.8 ha) adjacent to the pit. In addition, DD1 may potentially provide some level of flood protection for the pit during the final year of operations;
- Temporary bunds, drains and re-contouring to the north of the pit progression will prevent runoff and flood waters from flowing into the pit. These will be designed to convey at least a 5% AEP (1 in 20-year ARI) flow event. These drainage features will be mined through as the pit progresses northwards and may be implemented to delay the requirement for DD1;
- Eight ‘Type D’ sediment basins, designed to contain 85th percentile 5-day rainfall volumes; and
- Sediment control measures (e.g., catch drains, check dams, grass swales and sediment traps) to be built into the design of haul roads.

The benign nature of waste rock material to be stored on site means that few surface water and groundwater contaminants with the potential to impact environmental values are expected. The chief contaminant that requires management is sediment/turbidity, which will be managed via the installation of sediment ponds, fed by drainage lines that gather mine-affected water. Salts are also potentially more elevated in runoff from active mining areas than from natural landscapes (WRM 2020).

The water management strategy at the Project is based on the following objectives (WRM 2020):

- To maintain separation between up-catchment water and mine-affected water;
- To capture mine-affected runoff (e.g. mine industrial area, haul road/ROM pad runoff), and store and reuse this as mine water supply;
- To divert water runoff from upstream catchments around the active mining area;
- To limit external catchment runoff draining into pits;
- To manage sediment from disturbed catchment areas (e.g. out-of-pit waste rock emplacements, cleared/pre-strip areas) by using erosion and sediment control measures prior to release offsite; and
• To manage any mine-affected water releases to the receiving environment in accordance with environmental release conditions.

There are four pathways through which water from the Project can enter the receiving environment:

• dewatering overflows from sediment dams;
• overflows from mine-affected water dams and the open cut pit;
• runoff from diverted water catchments; and
• runoff from rehabilitated catchments.

A computer-based operational simulation water balance model has been developed for the Project (WRM 2020). Due to the changing infrastructure over the Project’s short lifespan, separate models were developed to represent two separate Project scenarios or stages. These models were used to assess the performance of the water management system. The models revealed that the combined volumes of the mine water dams are not expected to exceed their full storage volume under the natural range of environmental conditions at the Project. Some redistribution of water to MWD1 from the other smaller mine water dams will be required. Some controlled discharges may be required in wet years (the wettest 5th percentile) in order to empty runoff draining into the open cut pit. Consistent with the IECA guidelines (2008), sediment dams do not provide 100% containment for captured runoff. Hence overflows will occur from sediment dams when rainfall exceeds the design standard. Under median weather conditions, up to 15ML/yr are expected to be released from sediment dams, whereas in wet years (the wettest 10th percentile), up to 120 ML/yr may be released (WRM 2020). The release of water within sediment dams is expected to slightly elevate the salt content of Boomerang Creek (downstream) with moderate releases (0.54 ML/d), but have no effect on downstream water with large releases (39 ML/d), due to the greater dilution factor associated with heavier rain events (WRM 2020). Salinity levels in spilled water are forecast to remain below the low-flow water quality objective for the Isaac River sub-basin as specified in the Environmental Protection (Water) Policy 2009.

Overall, the risk and expected harm of releasing mine-affected water to the general environment is low. The downstream receiving waters are heavily modified and have been diverted through the Peak Downs operations. Controlled releases of mine water are not proposed. Furthermore, groundwater assessments predict a negligible need for groundwater management, a coal-handling-and-processing plant is not proposed, and dump runoff quality is expected to be suitable for release to the receiving waters (following sediment removal). Any potential releases of contaminants to the receiving waters from mine water dams are unlikely to have an adverse effect.

When a sediment dam catchment is successfully rehabilitated, and water quality monitoring of the runoff has established that it is within acceptable limits, the sediment dam and associated drainage infrastructure will be decommissioned. Surface runoff and seepage from the rehabilitated catchment will be allowed to shed directly to the receiving environment. When the drainage corridor is rehabilitated, DD1 will be decommissioned. DD1 will remain until this time to allow in-stream vegetation to establish before receiving upstream catchment flows.
Figure 1-15: Water management infrastructure for the final landform (post-mining) (WRM 2020)
2 LEGISLATIVE REQUIREMENTS AND GUIDELINES

2.1 Mineral Resources Act 1989

Resource activities are regulated through a ‘resource authority’ under the Mineral Resources Act 1989. This provides resource companies with the right to enter land and undertake the approved activity. Under section 107(10) of this act, a mining claim can only be surrendered once improvement restoration (i.e., returning the tenement to substantially the same condition it was in before mining) has been carried out and the relevant environmental authority has been surrendered.

2.2 Environmental Protection Act 1994

The Environmental Protection Act 1994 (EP Act) is the principal legislation for protecting environmental values potentially affected by the resource industry in Queensland. The EP Act grants the Queensland Government the power and means to assess, approve and prescribe conditions on proposed mining projects.

The EP Act requires that all areas of disturbed or undisturbed land within the relevant mining tenure be rehabilitated to a post-mining land use (PMLU), or managed as a non-use management area (NUMA). Section 125(1)(n) of the EP Act requires a proposed PRC plan to accompany site-specific EA applications for a mining activity. Sections 126C and 126D stipulate the requirements for PRC plans and PRCP schedules, respectively.

Under the EP Act, the Queensland Government is responsible for the issuing of an environmental authority (EA) to carry out a mining activity and approval of a draft PRCP schedule for a proposed PRC plan. Under section 172(4) of the act, if the PRCP schedule is refused, the EA application must also be refused. Under sections 426(1) and 431A of the act, an applicant is unable to undertake any relevant activities until an EA with a PRCP schedule is approved. The EA and PRCP schedule includes all conditions imposed on the authority and schedule. The EP Act also prescribes the requirements for surrendering an EA, including the preparation of final rehabilitation reports and post-mining management reports.

2.3 Mineral and Energy Resources (Financial Provisioning) Act 2018

In Queensland, the Mineral and Energy Resources (Financial Provisioning) Act 2018 regulates a financial provisioning scheme for reducing potential risks to the Government in the event an EA holder fails to meet their environmental and rehabilitation obligations. This act also amended the EP Act to require mining companies to develop PRC plans.

2.4 Progressive Rehabilitation and Closure Plans Guideline

This guideline, prepared by the Queensland Government Department of Environment and Science, contains information to assist applicants in developing a PRC plan as part of a site-specific EA application for a new mining activity. The administering authority must consider this guideline when making a decision about a PRCP schedule under section 176A of the EP Act.

2.5 Rehabilitation Requirements for Mining Resource Activities

This guideline has been prepared by the Queensland Government Department of Environment and Science to assist mining companies to propose acceptable rehabilitation outcomes and strategies. The administering authority must consider this guideline when making a decision about a PRCP schedule under section 176A of the EP Act.

2.6 Environment Protection and Biodiversity Conservation Act 1999

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the Australian Government's key piece of legislation protecting matters of national environmental significance. Actions that will or are likely to impact matters of national environmental significance require approval from the Environment Minister under the EPBC Act. Any conditions attached to this approval that pertain to rehabilitation of the site after mining must be adhered to under the EPBC Act.
3 STAKEHOLDER ENGAGEMENT

3.1 Stakeholder Consultation Plan

A Stakeholder Engagement Plan that complies with section 126C(1)(c)(iv) of the EP Act was prepared to guide stakeholder engagement activities associated with project planning, the environmental approvals process and the development of the PRC Plan. This Stakeholder Engagement Plan has been submitted to DES as part of the site-specific EA application supporting information.

Given that the proposed PMLUs seek to re-establish for the most part, the current site land uses, the key stakeholders for rehabilitation of the site were deemed to be:

- BHP Billiton/Mitsubishi Alliance (BMA), landholder of Lot 10 on SP208611 and manager of the Saraji and Peak Downs Mines;
- Aurizon, manager of the Norwich Park branch railway; and
- Isaac Regional Council, manager of Saraji Road.

For the purposes of the PRC Plan, BMA was considered to be the primary stakeholder as the underlying landholder and downstream neighbour of the project. Other stakeholders, including the Department of Environment and Science and the Department of Natural Resources, Mines and Energy have also been consulted.

In accordance with section 126C(1)(c)(iv) of the EP Act, the Stakeholder Engagement Plan also discusses ongoing stakeholder engagement during progressive rehabilitation and closure. Given the small scale and short duration of the Project (all rehabilitation works to be completed within 5 years), and the proposal to return the land to its pre-mine land use, it is considered unlikely that stakeholder perspectives on PMLU’s will change significantly during the course of progressive rehabilitation.

3.2 Stakeholder Consultation Register

A stakeholder consultation register that complies with section 126C(1)(c)(iii) of the EP Act is appended to the Project Stakeholder Engagement Plan that has been submitted as part of the site-specific EA application. Stakeholders have been engaged on the plan for the mine, PMLUs, areas of disturbance, rehabilitation and management methods, progressive rehabilitation and closure timeframes.
POST-MINING LAND USE

The Project’s MLA area hosted five land uses prior to the Project. Four of these five land uses are proposed as post-mining land uses (PMLUs) once operations cease:

- low-intensity cattle grazing;
- public road;
- railway used for coal transport; and
- flood levee constructed to protect neighbouring coal mines.

The fifth pre-mine land use (not proposed as a PMLU) comprises small areas of the MLA utilised for commercial operation supporting infrastructure. It is anticipated that these facilities will be relocated to facilitate the proposed Project activities and that once established in an appropriate alternative location, subsequent relocation to return to the site would be unfavourable.

Most of the MLA area will have a PMLU of low-intensity grazing. Where supported by available soils, locally native plant species are to be incorporated into the planting mixes where grazing is the proposed PMLU, to create pastoral land that partly restores habitat values for threatened fauna (namely, the Squatter Pigeon and Koala) impacted by the Project.

In accordance with Part 3 of the *Environmental Protection (Rehabilitation Reform) Amendment Regulation 2019*, a PMLU of low-intensity grazing:

- is viable, having regard to the use of land in the surrounding region;
- is consistent with how the land was used before a mining activity was carried out on the land;
- is consistent with a use of the land permitted under the Planning Act; and
- will deliver, or aim to deliver, a beneficial environmental outcome.

The locations of these PMLUs are described within the PRCP schedule (Section 10.1). Through in-pit dumping of overburden, no voids will remain on site after mining. No non-use management areas (NUMAs) are proposed.

Based on previous studies, grazing is an achievable PMLU in the Bowen Basin (Bisrat et al. 2004). To achieve the proposed PMLU, rehabilitated land should have a land suitability class of at least 4 (marginal land for grazing), which was the land suitability class on site prior to mining (see Section 1.2.10).

The railway and flood levee PMLU’s are existing pre-mine land uses that will not be affected by the Project and will therefore not be subject to any rehabilitation activities.

The realigned Saraji Road will be established very early on in the Project. Construction and commissioning of the new road infrastructure will effectively establish the PMLU from the outset. Therefore, significant rehabilitation activities to achieve the PMLU are not anticipated. Agreements for the ongoing management and maintenance of the road will be in place prior to its construction.

Other PMLUs considered in place of “low-intensity grazing” included “native vegetation communities” (regional ecosystems 11.5.9 and 11.10.3), “forestry” (hardwood *Eucalyptus* plantations) and “agriculture” (dryland cropping), but the limited topsoil materials and high cost of creating a productive growing medium with the materials available limit the feasibility of the latter two options (see Section 4.3 for an assessment of each option).

4.1 Accordance with Stakeholders’ Requests

Through the consultation process undertaken for the development of this PRC Plan, all relevant stakeholders expressed support for the proposed Project PMLUs.

4.2 Regulatory Constraints

There are relatively few regulatory constraints on the proposed land use on the Project MLA. These are discussed below.
4.2.1 Isaac Regional Planning Scheme

Under the draft Isaac Regional Planning Scheme, the Project is located in a “Rural” zone. The implications of this zoning are not yet developed for the draft plan. However, the Broadsound Shire Planning Scheme, which remains in force until the Isaac Regional Planning Scheme is developed, defines uses suitable for “Rural” zones as including grazing, farming, forestry, aquaculture and extractive industries. These defined uses are consistent with the PMLUs proposed for the Project.

4.2.2 Mackay, Isaac and Whitsunday Regional Plan

The Queensland Government, via their Mackay, Isaac and Whitsunday Regional Plan, maps the Project in a “regional landscape and rural production area”, which includes land used for agriculture, water catchment, traditional uses, conservation areas and native forests. The proposed PMLUs are consistent with these planned land uses.

The area to the west of the Project MLA area is mostly mapped as being of “high ecological significance”, while the MLA area itself mostly lacks ecological significance under the Mackay, Isaac and Whitsunday Regional Plan. This plan aims to minimise the impact of development on such areas of high ecological significance, and a PMLU that is compatible with restoring many of the original environmental values is consistent with this regional plan.

4.3 Assessment of Options

A PMLU of “road reserve” is the only reasonable option for the Saraji Road corridor, as it will endure throughout and beyond the project life. Likewise, the two pre-existing land-uses that will be undisturbed by the Project (railway line and flood levee) will remain as PMLUs. However, four potential PMLUs were assessed as part of planning for the remainder of the Project disturbance area. These included:

1) Low-intensity cattle grazing with low- to medium-density of native trees;
2) Native vegetation communities (regional ecosystems 11.5.9 and 11.10.3);
3) Hardwood (e.g., Corymbia citriodora) plantation forestry; and
4) Dryland cropping.

These PMLUs were selected because they are land uses consistent with the Isaac Regional Planning Scheme and the Mackay, Isaac and Whitsunday Regional Plan.

In order to compare the relative merit of each PMLU option, a scoring system was applied across ten cost/benefit criteria, in accordance with the Progressive Rehabilitation and Closure Plans Guideline (Table 4-1). This awarded a score of 1-5 for each consideration (cost/benefit), with the sum of all scores across considerations used to compare PMLU options. Even though different rehabilitation areas have slightly different rehabilitation methods and milestones, they are assessed together due to their similar constraints.

This assessment revealed that low-intensity grazing was the most appropriate PMLU for the Project (Table 4-1). There are other reasons, not considered in Table 4-1, why forestry and cropping are higher risk options for the Project. In Queensland, plantation forestry is largely limited to coastal regions, and the performance of plantations is untested within the Isaac Regional Council area. Cropping is also considered to be higher risk, given the dispersive subsoils across most of the Project area (see Section 1.2.6). Regular cultivation of the topsoil is likely to expose these subsoils to erosion, with irreversible outcomes.

According to the Rehabilitation Requirements for Mining Resource Activities v2.01, optimal PMLUs are those highest up in the following hierarchy:

1) avoid disturbance that will require rehabilitation;
2) reinstate a “natural” ecosystem as similar as possible to the original ecosystem;
3) develop an alternative outcome with a higher economic value than the previous land use;
4) reinstate previous land use (e.g. grazing or cropping);
5) develop lower value land use; or
6) leave the site in an unusable condition or with a potential to generate future pollution or adversely affect environmental values.

The favoured PMLU, low-intensity grazing, falls 4th on this hierarchy. The 2nd and 3rd PMLUs in the hierarchy were assessed as options in Table 4-1, but were ranked as slightly less desirable due to a combination of the site’s physical and chemical constraints and/or economic benefits.
Table 4-1  
Assessment of PMLU options for the Project

<table>
<thead>
<tr>
<th>Considerations</th>
<th>PMLU Options*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low-intensity grazing</td>
</tr>
<tr>
<td>Physical constraints</td>
<td>4</td>
</tr>
<tr>
<td>Chemical constraints</td>
<td>4</td>
</tr>
<tr>
<td>Available materials</td>
<td>4</td>
</tr>
<tr>
<td>Relative cost</td>
<td>4</td>
</tr>
<tr>
<td>Economic benefits for the community or landholder</td>
<td>4</td>
</tr>
<tr>
<td>Environmental benefits</td>
<td>3</td>
</tr>
<tr>
<td>Social value (recreation, public amenity, employment)</td>
<td>2</td>
</tr>
<tr>
<td>Compatibility with surrounding land uses</td>
<td>5</td>
</tr>
<tr>
<td>The land use before mining commenced</td>
<td>5</td>
</tr>
<tr>
<td>Compatibility with planning instruments under the Planning Act 2016</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total Score</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

*For each consideration, each PMLU option is awarded a relative score (1-5), where 5 is feasible/desirable and 1 is prohibitive/undesirable. The sum of the scores across all considerations was used to compare the favourability of each option.

4.4 Statutory Constraints to be Imposed

Due to the lack of NUMAs and reactive overburden material, and the fact that the final landform will generally resemble the surrounding landscape, few statutory constraints are expected to be imposed on future land managers of the Project area. Given that vegetation cover will be important to the minimisation of erosion on sloping landforms, limits on stocking rates are considered appropriate. Any restrictions on the future stocking rates are to be described in the Post-mining Management Report (see Section 9.6) and imposed through a Site Management Plan, to be adopted by future land managers of the site. This is to be confirmed following pasture development and performance monitoring.
5 REHABILITATION GOALS

Under section 176A(3)(c)(i) of the Environmental Protection Act 1994, mined land must be rehabilitated to a stable condition. Land is in a stable condition, as defined in section 111A of the Environmental Protection Act 1994, if: (a) the land is safe and structurally stable, (b) there is no environmental harm being caused by anything on or in the land; and (c) the land can sustain a post-mining land use. These three components of stability are the general rehabilitation goals for all areas disturbed by mining in Queensland. They have been developed from the ecologically sustainable development policy framework, especially in relation to intergenerational equity, polluter pays principle, protection of biodiversity, and maintenance of essential ecological processes.

5.1 Rehabilitation Objectives, Indicators and Completion Criteria

A clearly defined set of rehabilitation objectives has been developed for each PMLU proposed for the Project. For each objective, one or more rehabilitation indicators (measurements of progress towards the rehabilitation objectives) are proposed. These indicators are designed to be auditable against completion criteria, which act as targets for the rehabilitation process. Each completion criterion is applied to the PRCP Schedule as a milestone criterion for the later stages of rehabilitation (Section 10.3.1). The full list of rehabilitation objectives, indicators and completion criteria is shown in Table 5-1. For details about how each indicator is to be measured, refer to Section 9.

Table 5-1 Rehabilitation objectives, indicators and completion criteria

<table>
<thead>
<tr>
<th>ID</th>
<th>Rehabilitation Objective</th>
<th>Rehabilitation Indicator</th>
<th>Assessment Timing</th>
<th>Completion Criteria</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMLU A: Low-intensity cattle grazing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>Land is to be stable</td>
<td>The “stability index” generated by Landscape Function Analysis (Tongway and Hindley 2004).</td>
<td>Sites are to be monitored at the time of planting and then every two years for 10 years after planting.</td>
<td>The forecast sigmoidal curve, fitted to the data, demonstrates a predicted plateau at a value that is equivalent to or exceeds the target value, defined by the range observed in analogue sites that have not been mined.</td>
<td>This methodology has been widely applied to rehabilitated mine sites across Australia, and is strongly correlated with soil aggregate stability (Tongway and Hindley 2004).</td>
</tr>
<tr>
<td></td>
<td>Percentage cover of rock, woody debris, litter, grasses and herbs within a 10 m x 50 m plot.</td>
<td>Late wet season (February-May), every two years for 10 years after planting.</td>
<td>Percentage groundcover between 50% and 96%.</td>
<td>A percentage cover of &gt;50% protects slopes from erosion (Loch 2000; Waters 2004; Carroll et al. 2010). Excessive groundcover inhibits the recruitment of trees and shrubs, and a maximum value of 96% cover was observed within reference sites in stable, unmined vegetation communities (METServe 2020).</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Land is to be non-polluting</td>
<td>Levels of contamination present following remediation efforts that take place after infrastructure decommissioning and removal.</td>
<td>Prior to the commencement of topsoil placement.</td>
<td>A site suitability statement prepared by an approved auditor is to conclude that land is not contaminated and is suitable for any use.</td>
<td>This indicator requires assessment to achieve rehabilitation milestone 2, but does not need to be re-assessed at rehabilitation completion unless a new source of potential contamination occurs (e.g., a hydrocarbon spill).</td>
</tr>
<tr>
<td></td>
<td>Water quality at permanent monitoring locations downstream of the project.</td>
<td>Annually, following rain events.</td>
<td>Surface water in downstream monitoring locations is to remain within site specific water quality monitoring limits, once established.</td>
<td>Site specific surface water quality triggers will be established over time and present the most accurate measure of effect on water quality.</td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>Rehabilitation Objective</td>
<td>Rehabilitation Indicator</td>
<td>Assessment Timing</td>
<td>Completion Criteria</td>
<td>Justification</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------</td>
<td>--------------------------</td>
<td>-------------------</td>
<td>--------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>A3</td>
<td>Koala food trees are to have a similar dominance within rehabilitated vegetation communities as they did in vegetation present on site prior to mining.</td>
<td>Proportion of the total basal area of woody vegetation at the site that comprises <em>Eucalyptus crebra</em>, <em>Eucalyptus populnea</em> or <em>Eucalyptus camaldulensis</em>.</td>
<td>Sites are to be monitored six and ten years after planting.</td>
<td><em>Eucalyptus crebra</em> and/or <em>Eucalyptus populnea</em> are to constitute ≥21% of the total basal area of woody vegetation on sand plains. <strong>AND</strong> <em>Eucalyptus camaldulensis</em> is to constitute ≥33% of the total basal area of woody vegetation along Ripstone Creek and North Creek.</td>
<td>Relative dominance of Koala food trees is based on secondary site data gathered from nine sand plain reference sites and three riparian reference sites (METServe 2020).</td>
</tr>
<tr>
<td>A4</td>
<td>Density of woody vegetation within rehabilitated areas is to be sufficient for Squatter Pigeons.</td>
<td>The mean Normalised Difference Vegetation Index (NDVI) calculated using Landsat imagery captured following at least two months without rain (e.g., late dry season).</td>
<td>Sites are to be monitored at the time of planting and then every two years for 10 years after planting.</td>
<td>Rehabilitated areas are to have a mean NDVI between 0.1240 and 0.1778 <strong>AND/OR</strong> Squatter Pigeons are observed within rehabilitated areas (e.g., during site visits for other monitoring).</td>
<td>Ecological surveys of the local region found that Squatter Pigeons are confined to vegetation with a density that falls within the range of NDVI values used as the completion criterion (METServe 2020).</td>
</tr>
<tr>
<td>A5</td>
<td>Weeds listed under the <em>Biosecurity Act</em> are not to exceed densities typically present in ungrazed, grazed landscapes within the MLA area and neighbouring areas.</td>
<td>Percentage cover within a 10 m × 50 m plot.</td>
<td>Between February and April, every two years for 10 years after planting.</td>
<td>Rehabilitated areas are to have ≤0.2% cover of <em>Parthenium hysterophorus</em> <strong>AND</strong> rehabilitated areas are to have ≤0.1% cover of <em>Harrisia martinii</em> <strong>AND</strong> Any other weeds listed under the <em>Biosecurity Act</em> are to be present in densities of &lt;1 individual per hectare.</td>
<td>Completion criteria are based on the densities of each weed recorded during ecological surveys of the region prior to mining (METServe 2020). As weed densities vary by soil type, only data from soil types present within the MLA area are incorporated into the completion criteria.</td>
</tr>
<tr>
<td>A6</td>
<td>Pasture is to be as productive within rehabilitated areas as in neighbouring unmined areas within the same soil management unit.</td>
<td>Pasture mass (t/ha) of ungrazed plots.</td>
<td>Sites are to be monitored at the end of the growing season (April-May) six and ten years after planting.</td>
<td>Rehabilitated areas are to have a pasture mass that is not statistically significantly different (with adequate sampling to detect ≥10% difference between groups) from unmined areas within the same soil management unit measured at the same time.</td>
<td>Pasture mass is the standard unit of productivity used widely in the grazing industry (Cayley and Bird 1996).</td>
</tr>
<tr>
<td>A7</td>
<td>The species richness of grasses that make up the pasture in rehabilitated areas is to be as high as in neighbouring unmined areas within the same soil management unit.</td>
<td>Species richness (number of species) of grasses contained within a 10 m × 50 m plot.</td>
<td>Sites are to be monitored soon after planting (Feb-Apr) and then every two years for 10 years after planting.</td>
<td>The species richness of plots in rehabilitated areas is to equal or exceed the 10th percentile among equivalent plots in reference sites on the same soil management unit.</td>
<td>Because the relative densities of each species are expected to differ between rehabilitated and reference sites due to differences in grazing history (reference sites are all grazed), species richness is favoured as an indicator over indices of diversity (the latter incorporate relative abundance).</td>
</tr>
<tr>
<td>ID</td>
<td>Rehabilitation Objective</td>
<td>Rehabilitation Indicator</td>
<td>Assessment Timing</td>
<td>Completion Criteria</td>
<td>Justification</td>
</tr>
<tr>
<td>----</td>
<td>---------------------------</td>
<td>--------------------------</td>
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<td>--------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>B1</td>
<td>Design and construction in accordance with agreed conditions.</td>
<td>Isaac Regional Council (IRC) assessment.</td>
<td>At the completion of all works within the realigned road reserve.</td>
<td>Fulfilment of all conditions of the agreement with IRC for the construction and commissioning of Saraji Road.</td>
<td>The Saraji Road realignment will be undertaken during the operational phase of the Project, and comprises infrastructure to remain on site after the Project is completed. As such, there are no specific rehabilitation requirements other than to construct and commission the realigned road infrastructure in accordance with conditions specified in an agreement between Vitrinite and IRC.</td>
</tr>
</tbody>
</table>
6 REHABILITATION METHODOLOGY

6.1 Landform Design

6.1.1 Overview
The final landform design has sought to limit the project final landform footprint whilst maximising usage of open pit disturbance areas. This has resulted in the majority of mine waste being stored in pit with a small ex-pit waste rock dump required to facilitate initial mining activities. Due to waste rock swell factors following blasting and handling, the in-pit waste rock dump will fill the void and extend to between 10 and 15m above the pit crest. This will result in a low, continuous landform over the length of the former pit, with a low ex-pit dump to the west (Figure 6-1 and Figure 6-2). In places, the final landform will be slightly lower than the pre-mining landform (see Figure 6-3). The outer batters will be shaped to a maximum of 15% and will contain surface water management measures to drain water from the land form plateau to the surface water drainage features at surface.

The pit will be backfilled progressively, utilising a combination of paddock dump and end-tipping techniques. Dump lifts are generally anticipated to be low, enhancing rapid material settlement. Placed waste shaping and profiling will be completed with bulldozers. Final landform geometry will be surveyed progressively to maintain adherence to the final landform and surface water management design. Sub-soil, rock mulch and topsoil will be spread with bulldozers and will be the subject of depth and distribution survey and quality control monitoring.

All other mining activities will result in limited change to the pre-mining topography and hence all areas excluding the in-pit dump and the ex-pit dump will resemble the pre-mining landform. No Non-Use Management Areas (NUMAS’s) are proposed.

Figure 6-1 Final Landform - view from the north east
6.1.2 Cover Design

Geochemical characterisation of overburden has demonstrated that no waste rock to be produced through the Project has the potential for acid mine drainage, neutral metalliferous mine drainage or saline mine drainage (RGS 2020). Due to the benign nature of all waste rock material on site, no low permeability (air and water) cover system is considered required or proposed.

Despite no need for a cover that protects waste rock from oxidation, overburden will be placed in such a way to facilitate vegetation re-establishment. Following the return of waste rock to the mined pit, at least 300 mm of subsoil
(removed from the pits prior to mining and stockpiled (Section 6.2.4) is to be spread over the rock (Figure 6-4). This will enhance the water-holding capacity of the soil and provide a more favourable growing environment for vegetation. Given the vulnerability of local subsoils to dispersion, some waste rock will be mixed with the subsoil (approximate ratio of rock to subsoil of 1:3), to provide protection from erosion, in the event that overlying topsoil becomes eroded. Topsoil will then be spread over the subsoil/rock mix at a depth of 250 mm to provide a favourable medium for plant establishment. Note that this cover design varies slightly between rehabilitation areas due to material availability and rehabilitation requirements (Table 6-1).

![Figure 6-4](https://example.com/figure6-4.png)

**Figure 6-4**  Cover design to optimise plant growth

<table>
<thead>
<tr>
<th>Rehabilitation Area</th>
<th>Deviation from standard cover design</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA1: Out-of-pit dump</td>
<td>Topsoil is to be placed directly on waste rock without an intermediate layer of subsoil.</td>
<td>Insufficient subsoil material is available at an appropriate stage of project development to apply this to the Out-of-pit Dump.</td>
</tr>
<tr>
<td>RA2: In-pit dump</td>
<td>None</td>
<td>N/A</td>
</tr>
<tr>
<td>RA3: Infrastructure</td>
<td>Topsoil is to be placed directly onto prepared disturbed surfaces.</td>
<td>No waste rock or subsoil is to be removed from these areas and therefore these remain intact.</td>
</tr>
<tr>
<td>RA4: Dams and sediment ponds</td>
<td>Land is to be reformed prior to the deposition of topsoil. No waste rock or subsoil is added, beyond what is already contained within the dam walls.</td>
<td>There is to be minimal disturbance to the soil profile at dams once reforming has been conducted and topsoil returned.</td>
</tr>
<tr>
<td>RA5: Saraji Road</td>
<td>No cover is proposed.</td>
<td>RA4 is to remain an asphalt road in perpetuity.</td>
</tr>
</tbody>
</table>

### 6.1.3 Mine Waste Geochemistry

A geochemical assessment has been undertaken of the overburden, interburden and coal rejects (RGS 2020). This found that overburden and interburden at the Project had a universally low sulphide content and high acid-neutralising capacity due to high pH. All material assessed was non-acid-forming and considered essentially barren for oxidisable
sulphur. All carbonaceous interburden samples within the MLA were classified as non-acid-forming and, as a bulk material, carbonaceous interburden is considered to be non-acid-forming.

An analysis of the concentrations of 22 metals and metalloids (and four other trace elements) within overburden and interburden revealed that no samples were relatively enriched, compared to the mean crustal abundance of each element (RGS 2020). The potential solubility of any metals/metalloids in the materials was investigated further through water extract and kinetic leach column tests. Most metal/metalloid concentrations tested in the water extracts were below the applied water quality guideline criteria. The main exceptions were aluminium (four samples) and copper (three samples), which have a concentration in some of the water extracts above the applied freshwater aquatic ecosystem water quality guideline value for 95% species protection (ANZG 2018), but below the applied guideline values for livestock drinking water. Based on these results, the risk of potential impact on the quality of surface runoff and groundwater from bulk mining waste materials at the Project is low. The results of the kinetic leach column tests supported the results of the water extracts; namely, that the concentration of metals/metalloids in the leachate is low and typically below the laboratory limit of reporting. The concentrations of all metals/metalloids were below the applied water quality guideline criteria for aquatic freshwater ecosystems (95% species protection level) (ANZG 2018).

Like the overburden and interburden, the coal reject material had a mean acid-neutralising capacity that was well over (more than twice) the maximum potential acidity. However, there was variability between samples, such that one sample (out of 11) was classified as “potentially acid-forming”, and a further three samples were classified as “uncertain”. As a bulk mixed material, coal reject has a relatively low risk of generating acidic drainage. This risk can be further lessened by disposing of reject materials within cells contained within overburden dumps, which have a very high acid-neutralising capacity. As for overburden and interburden, leachate from coal reject samples did not have elevated metal concentrations during kinetic leach column tests. Coal reject material is not proposed to be disposed of at the Project site and is rather likely to be disposed of at the facility utilised for toll washing. If reject material is returned to the Project site, it will be disposed of in accordance with the recommendations in RGS 2020.

Overall, surface runoff and seepage from the overburden/interburden material is expected to be pH neutral to slightly alkaline and have a low level of salinity. Dissolved metal and metalloid concentrations in surface runoff and leachate from bulk mining waste materials are expected to be low and unlikely to pose a significant risk to the quality of surface and groundwater resources.

### 6.1.4 Material Availability

All materials (i.e., topsoils and subsoils) to be used for rehabilitating disturbed land will be sourced from the disturbance footprint and stockpiled during the mining process, until required for rehabilitation. Given that the post-mine landform will be similar but not identical to the pre-mine landform, discrepancies are likely between the quantities of materials obtained from each area and the quantities required to be returned. As can be seen by the materials balance shown in Table 6-2, any discrepancies caused by alterations to the landform are expected to be balanced by (a) replacing a slightly thinner layer of topsoil than removed and (b) mixing rock with subsoils. Ample remaining material is available as a contingency.

**Table 6-2** Materials balance for topsoils and subsoils to be used for rehabilitation

<table>
<thead>
<tr>
<th>Material</th>
<th>Amount removed from disturbance footprint (m³)</th>
<th>Amount required for rehabilitation (m³)</th>
<th>Balance (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topsoil*</td>
<td>598,956</td>
<td>513,227</td>
<td>+85,729</td>
</tr>
<tr>
<td>Subsoil†</td>
<td>394,944</td>
<td>351,572</td>
<td>+43,372</td>
</tr>
</tbody>
</table>

*The top 30 cm of topsoil is removed from most disturbed areas prior to mining, while 25 cm is returned to all rehabilitated areas
†The top 30 cm of subsoil is removed from some disturbed areas (extraction areas and dams) prior to mining, and three parts of this is diluted with one part rock when returned to rehabilitated areas.

### 6.1.5 Drainage and surface water management

**Figure 1-15** (see Section 1.3.2) shows the conceptual final landform water management plan for the Project. The key features of the final landform include the following:
No final voids are proposed as part of the final landform. The open cut pit will be backfilled with overburden material;

- Final landform batter slopes will be a maximum of 1(vertical):6(horizontal);
- Contour banks will be constructed on batters to limit topsoil erosion until vegetation has been suitably established;
- Drainage structures will be constructed to direct runoff from disturbed areas to sediment dams;
- The plateau will be shaped to fall to the west with proposed drains and drop structures to drain the top of the landform to natural ground level;
- Mine water dams will be decommissioned following rehabilitation of infrastructure areas;
- A 10 m corridor between the pit shell crest and the toe of the final landform will be provided for drainage on the eastern side of the final landform;
- The constructed channel between the dams SD6 and DD1 will be a permanent landform feature. A drainage corridor will be constructed through the northern side of the final landform; and
- Sediment dams SD7 and SD8 will be implemented on the northern side of the in-pit spoil dump.

When a sediment dam catchment is completely rehabilitated, and monitoring of the runoff has established that water quality is consistent with natural background conditions, the sediment dam and associated drainage infrastructure will be decommissioned. Surface runoff and seepage from the rehabilitated catchment will be allowed to shed directly to the receiving environment.

When the drainage corridor is rehabilitated, DD1 will be decommissioned. DD1 will remain until this time to allow in-stream vegetation to establish before receiving upstream catchment flows.

6.1.6 Flooding

WRM (2020) has produced hydrologic and hydraulic models of flood plains within the Project MLA area and surrounding areas to inform the Project surface water assessment. There are no fourth order (or higher) streams located on the site. A floodplain is defined as the same height, or lower than, the water level modelled with a 0.1% annual exceedance probability for a relevant watercourse under the guideline, *Australian Rainfall and Runoff* (Ball et al. 2019). Flooding based on both the existing pre-mining landform and the post-mining landform were modelled. No final voids are proposed.

The flood impact assessment showed that post-mining conditions will experience changes to flood levels and velocities, compared with pre-mining conditions. However, impacts are generally confined to the Project MLA area. The changes in peak water levels and peak velocities were relatively small for flood events corresponding to the 10% and 1% annual exceedance probability. For rare events (annual exceedance probability = 0.1%), the predicted change in flood level and velocity in the vicinity of the Project MLA area extends downstream of the proposed Saraji Road realignment and the Norwich Park Branch Railway corridor. The predicted increase in water level and velocity is less than 0.35 m and 0.4 m/s, respectively. Erosion and scour protection options will be incorporated along the proposed drainage corridor and existing channels where these increases occur, to mitigate the risk of rapid geomorphic change.

Overall, the impact of the Project on the hydraulic characteristics of Boomerang Creek and its tributaries do not affect the existing conditions significantly. It is expected that the channel and floodplain will undergo little, if any, adjustment to the altered hydraulic conditions upstream or downstream of the Project as a result of the Project.

The flood map produced by these models is presented within the PRCP Schedule (Section 10.1), and the flood plain model is described in detail within Appendix A of this PRC Plan.

6.1.7 Hydrogeology

Hydrogeologist.com.au (2020) has developed a numerical hydrogeological model of all relevant aquifers within the Project MLA area and broader region to predict the effects of the Project on local groundwater levels. This was based on a range of data sources, including an on-site groundwater monitoring network, groundwater assessments from nearby mines, and the Queensland Groundwater Database (DNRME 2019).
The drawdown predicted from the project is limited in geographic extent (up to 3,000 m to the northeast toward existing mining) and magnitude (up to 10 m). Any effects of drawdown will cease soon after the cessation of the Project (hydrogeologist.com.au 2020). No surface expression of groundwater will occur once the final landform is constructed (hydrogeologist.com.au 2020). Due to this negligible risk, no measures are required or proposed to limit groundwater discharge to the surface (hydrogeologist.com.au 2020). Following recharge, minor groundwater interaction with placed waste material within the former pit is expected, however, based on assessment of the waste material and the current quality of groundwater, this is anticipated to be of limited consequence.

All groundwater sampled to date within the survey area is brackish to highly saline, being sodic waters of marine origin. Electrical conductivity of groundwater on site ranges between 2.7 to 11.7 dS/m, with a mean value of 6.1 dS/m (Hydrogeologist.com.au 2020). For context, sea water has an electrical conductivity of approximately 50 dS/m, while drinking water has 0.05–0.5 dS/m. The pH of groundwater on site is generally close to neutral (Hydrogeologist.com.au 2020).

For further information regarding the hydrogeological assessment, refer to Hydrogeologist.com.au (2020).

6.1.8 Predicted stability

In summary, the proposed final landform is expected to be stable under a post-mining land use of low-intensity cattle grazing. The following are the main lines of evidence for this include:

- The final landform is similar to the topography of surrounding areas; the maximum slope proposed in the final landform is 15%, and 45% of the local landscape comprises grazed slopes that are naturally steeper than this;
- A 30% cover of rock applied to 10-15% gradients will be more than adequate for maintaining stability until vegetation establishes;
- Studies conducted at other mines across the Bowen Basin have found that 15% gradients with only a moderate groundcover of 30-40% have very low erosion rates;
- Other Bowen Basin mine sites regularly achieve vegetative cover of 30 to 100% on rehabilitated waste rock, which is more than adequate for maintaining the stability of 15% gradients; and
- Even after considering the removal of vegetation expected from cattle grazing, a sufficient cover is expected to be maintained on rehabilitated sites in the long-term.

Further discussion is provided in the subsection below.

The project is located on the eastern foothills of the Harrow Range, sandstone ridges and escarpments that rise 100-170 m above the surrounding plains. This range and much of the neighbouring plains support remnant vegetation (open eucalypt forests) that is currently used for low-intensity cattle grazing. The project itself is located on cleared pasture and regrowth on relatively low slopes 1 km east of the Harrow Range. Most of the soils on site are sandy and originate from colluvial deposits from the neighbouring range.

The topography of the region is shown in Figure 6-5 and the range of natural slopes present within 3 km of the project is summarised in Figure 6-6. As can be seen from these figures, the proposed final landform has slopes comparable to the existing natural topography, which is stable under low-intensity grazing. In summary, 45.2% of the natural landscape within a 3 km radius of the project is steeper than the maximum slope proposed for the final landform.

Extent of Protective Cover on Natural Slopes

Many naturally steep slopes in the local region maintain low erodibility via a high cover of rock, vegetation and leaf litter. Ecology surveys undertaken across the area surrounding and including the Project measured groundcover and slope across 50 sites. All sites were maintaining stability under low-intensity grazing. This data is plotted in Figure 6-7 and identifies that when slopes were less than 20% there was no relationship between slope and percentage groundcover. These shallow slopes ranged widely in groundcover, from 40% to 95% (average = 70%). This implies that erosion is not an important force on these shallow slopes. Once slopes have a gradient exceeding 20%, increasing groundcover is required to maintain stability, and all natural sites with a slope greater than 40% had a groundcover exceeding 95%.
This data supports the notion that a final landform with slopes $\leq 15\%$ will not be at risk of erosion, provided a moderate cover of rock, vegetation and leaf litter can be established and maintained. An approximate 30% cover of rock mulch is to be applied to gradients of 10-15%. Rock is effective protection against erosion of waste slopes on newly rehabilitated mine sites (Williams 2001; Erskine & Fletcher 2013).

Rock will constitute approximately half of the protective cover required for maintaining long-term stability (based on the natural variation in cover observed in the region), while the remainder will be supplied by developing vegetation.

Figure 6-5 Natural topography of the local region
Figure 6-6  Natural slopes within 3 km of the Vulcan Complex Project. The red arrow indicates the maximum slopes proposed for the final landform of the Vulcan Complex Project.

Figure 6-7  Relationship between ground cover and slope from natural vegetation sites assessed across the Vulcan Complex Project and nearby areas.

Previous Studies – slope stability

Other studies in central Queensland and elsewhere have investigated the stability of varying slopes on mine waste rock stockpiles and dumps. These are broadly consistent with the inferences about slope stability gained from investigating natural variation in slope and groundcover on the site.
Studies in Queensland demonstrated that any gradient exceeding 3.5%, if not protected by some sort of cover, will erode under average rainfall conditions, and extreme rainfall can erode bare slopes greater than 0.35% (Williams 2001). However, rock or vegetation cover drastically reduces erosion rates (Figure 6-8).

The amount of cover required to protect slopes of various gradients from erosion has been investigated in numerous trials across Central Queensland. Carrol and Tucker (2000) found negligible differences in soil erosion for 10%, 20% and 30% slope gradients once vegetation established (Figure 6-9). Both Carroll et al. (2010) and Waters (2000) found that maintaining ground cover at 40-60% was sufficient in reducing erosion to negligible levels (<0.5t/ha), regardless of slope. Likewise, a trial undertaken at Tarong, which simulated a heavy rainfall event on a 15% slope, found that 30-40% ground cover was sufficient to protect against erosion (Loch 2000; Figure 6-10).

In light of published data, the approximate 30% rock cover proposed for slope gradients of 10-15% will provide sufficient protection for these slopes during periods of low vegetation cover (e.g., initial phase of rehabilitation, or following fire or drought). An additional vegetation cover of 10-20% (total groundcover of 40-50%) is expected to provide a highly stable landform in the long-term.
Previous Studies - Stability of Grazed Slopes

The above review of available data presents a coherent case for the proposed VCP final landforms having low erodibility provided they have a moderate vegetation cover of 10-20%. However, in order for the landforms to have long-term stability, they must also support the prescribed post-mine land use of low-intensity grazing. Livestock affect landform stability by removing a portion of the vegetation cover and damaging soil surface structure via trampling (Blackburn 1983). For this reason, a review of published data concerning stability of slopes under grazing was undertaken.

Comparisons between adjacent grazed and ungrazed pastures at Charters Towers found that grazing regimes prevalent at the time reduced protective cover (vegetation and leaf litter) by 0–88% (mean of 41%), depending on seasonal conditions (Scanlan et al. 1996). Ludwig and Tongway (2002) found this reduction in cover to be less severe; grazing led to an 11% reduction in perennial grass cover and a 29% reduction in canopy cover of trees (correlated with leaf litter cover). Taken together, this data predicts that grazing in central Queensland removes, on average, approximately 1/3 of the vegetative groundcover. When this is taken into account, a target vegetative cover (grass, herbs and leaf litter) of 15-30%, in addition to the 30% rock cover proposed to be added to slopes, will be required in an ungrazed rehabilitated landscape to achieve a target cover of 40-50% once grazing is introduced. Given that other Bowen Basin mine sites regularly achieve vegetative cover of 30 to 100% (Carrol and Tucker 2000; Erskine and Fletcher 2013), a pre-grazing target of 15-30% vegetative cover is highly likely to be achieved at the Project.

As summarised above, cattle currently graze natural slopes with gradients well in excess of 15% without compromising the stability of these slopes. However, the steepest slopes are somewhat protected from grazing because cattle prefer not to graze such areas (Mueggerl 1965; Ganskopp & Vavra 1987). Nevertheless, gradients of 15% are well within the range of slopes utilised by cattle for grazing (Ganskopp & Vavra 1987), and the landform proposed for the Vulcan Complex Project is consistent with low-intensity grazing.

Geotechnical Assessment

A geotechnical assessment of the Project final landforms was completed by Blackrock Mining Solutions (2020). Based on a series of analyses, this concluded that the final landform design significantly exceeds a long-term stability Factor of Safety of 1.5 and is therefore considered to be geotechnically stable.

Figure 6-10 Effects of surface cover on erosion from 12-m-long plots with 15% slope under simulated rain at Tarong (figure from Loch 2000).
6.2 Revegetation

6.2.1 Revegetation Objectives

The following are the revegetation objectives for the site, consistent with the proposed PMLUs:

- To ensure rapid establishment of vegetation on exposed soil in order to limit erosion over the early stages of rehabilitation;
- To establish a pasture with native and exotic grass species that is sufficiently dense in the long term to protect the soil surface from erosion and support low-intensity grazing;
- To establish a moderate density of locally native trees and shrubs that provide shade for livestock and sufficient cover for the vulnerable Squatter Pigeon;
- To establish a moderate density of Koala food trees; and
- To limit invasion by declared weed species to levels that are similar to those on site prior to mining or representative of adjacent areas.

All the above objectives apply to rehabilitation areas RA2 (the In-pit Dump) and RA3 (Infrastructure areas). However, due to limited subsoil availability, no trees are proposed for RA1 (the Out-of-pit Dump). As a result, the rehabilitation of Squatter Pigeon and Koala habitat is not an objective for rehabilitation area RA1.

6.2.2 Key Flora Species

The flora species to be planted in disturbed areas vary depending on the topsoil type used at each site. The flora species selected represent the majority of dominant species in regional ecosystems that grow naturally on each soil management unit (Table 6-3). The Crocodile Soil Management Unit won’t be disturbed as part of the Project, however the dominant species that grow on it have been considered for rehabilitation activities on other soil units, where species are known to tolerate alternative soil conditions.

Of the species listed, approximately half are currently commercially available from suppliers such as Nindethana Seed Service and Seed World Australia. It is therefore expected that much of the seed used for rehabilitation efforts on site will require local collection by contractors.

<table>
<thead>
<tr>
<th>SMU</th>
<th>Reference RE</th>
<th>Dominant Trees</th>
<th>Dominant Midstorey</th>
<th>Dominant Grasses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limpopo</td>
<td>11.5.9, 11.5.3, 11.10.7</td>
<td>Corymbia clarksoniana, Eucalyptus crebra, Eucalyptus melanophloia, Eucalyptus populnea,</td>
<td>Acacia burdekensis, Acacia flavescens, Alphitonia excelsa, Cassia brewsteri, Erythroxyllum australe, Grevillea parallela, Grevillea striata, Melaleuca nervosa, Petalostigma pubescens.</td>
<td>Alloteropsis cimicina, Aristida calycina, Bothriochloa bladhii, Bothriochloa pertusa*, Cenchrus ciliaris*, Chrysopogon falax, Eragrostis sororia, Eriochloa crebra, Heteropogon contortus, Peroxis rara, Setaria surgens.</td>
</tr>
<tr>
<td>Zambezi</td>
<td>11.3.2, 11.3.7, 11.3.25</td>
<td>Corymbia clarksoniana, Corymbia tessellaris, Eucalyptus camaldulensis, Eucalyptus crebra, Eucalyptus populnea, Melaleuca leucadendra.</td>
<td>Alphitonia excelsa, Bauhinia hookeri, Cassia brewsteri, Ficus opposita.</td>
<td>Bothriochloa ewartiana, Bothriochloa pertusa*, Cenchrus ciliaris*, Megathyrsus maximus*, Urochloa mosambicensis*.</td>
</tr>
</tbody>
</table>

*Exotic pasture plants common on each soil prior to mining
6.2.3 Species of Conservation Significance

Where this is consistent with a proposed PMLU, habitat for threatened fauna inhabiting the Project area is to be incorporated into the landscape. The following subsections detail how this will be achieved for each species of conservation significance potentially impacted by the Project.

**Koala**

Habitat for Koalas can be incorporated into the PMLU of “low-intensity cattle grazing”. This will be achieved by ensuring that trees established to provide shade for livestock are also food trees for Koalas. The tree species to be planted (via inclusion in the seed mix) vary by soil type, as shown in Table 6-4.

Table 6-4  List of Koala food trees suitable for planting on each soil management unit

<table>
<thead>
<tr>
<th>Soil Management Unit</th>
<th>Suitable Food Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limpopo</td>
<td><em>Eucalyptus populnea</em>, <em>Eucalyptus crebra</em></td>
</tr>
<tr>
<td>Zambezi</td>
<td><em>Eucalyptus camaldulensis</em> (on creek banks), <em>Eucalyptus populnea</em>, <em>Eucalyptus crebra</em>,</td>
</tr>
</tbody>
</table>

**Squatter Pigeon**

Habitat for Squatter Pigeons can be incorporated into the PMLU of “low-intensity cattle grazing” on all soil types contained within the Project MLA area, with the exception of the Crocodile soil management unit (rocky, sandstone-derived soils provide unfavourable foraging substrates).

Squatter Pigeons have two chief habitat needs that require restoration in rehabilitation sites: (1) a diversity of native and introduced pasture grasses and herbs (on which to feed) in the understorey; and (2) a minimum tree cover that generates a Normalised Differential Vegetation Index of at least 0.125 (measured across a 1-ha cell in the late dry season). As these habitat features are generally co-located in productive pastures (related to understorey productivity and diversity) and sites with Koala habitat (a moderate tree cover), a PMLU of “low-intensity grazing”, with a low-moderate tree cover for livestock shade and Koala habitat is likely to provide habitat for Squatter Pigeons with no additional management inputs.

**Short-beaked Echidna**

Short-beaked Echidnas are habitat generalists that are likely to recolonise rehabilitated mine sites provided these contain (1) sufficient vegetation cover (e.g., pasture, woody vegetation) for protection; and (2) populations of termites and ants. It is expected that these habitat needs will be met by any rehabilitated sites that have a suitably dense and productive pasture cover to fulfil completion criteria pertaining to sustaining a PMLU of “low-intensity grazing”. Consequently, no additional management inputs are required to facilitate recolonisation of rehabilitated sites by the Short-beaked Echidna.

6.2.4 Revegetation Approach

**Soil Storage**

Topsoil is the most valuable soil horizon for post-mining rehabilitation. Topsoil contains a seed bank, micro-organisms and nutrients necessary for plant growth. In contrast, many of the subsoils on site are sodic and prone to dispersion (AARC 2020). The soil characteristics of each soil management units present on site (see Section 1.2.6) were used to determine the maximum depth to which suitable topsoil material should be stripped for stockpiling and/or rehabilitation, in order to conserve an optimal growth medium for plants (Table 6-5).

Table 6-5  Maximum topsoil stripping depths for each soil management unit

<table>
<thead>
<tr>
<th>Soil Management Unit</th>
<th>Stripping Depth (m)*</th>
<th>Qualities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limpopo</td>
<td>0.3</td>
<td>Topsoil is favourable for plant growth but has a low nutrient-holding capacity and should be improved with fertiliser when planting. These very sandy soils are prone to slumping and should not be used on slopes exceeding 3% without appropriate measures to management stability. Subsoils are susceptible to dispersion.</td>
</tr>
</tbody>
</table>
Topsoils and subsoils are to be stored separately. Likewise, soils from different soil management units are to be managed separately. Where practicable soils should be directly placed in prepared rehabilitation areas rather than stockpiled. This conserves a viable seedbank, promotes revegetation and limits rehandling.

Where stockpiling of topsoil is required, the following actions, where practicable will be taken to reduce the risk of soil degradation and improve the likelihood of rehabilitation success:

- Topsoil stockpiles should be less than 2 m high and be contoured and positioned in a manner that encourages water drainage and discourages erosion. Grass and herbaceous plants germinating from the soil seed bank are to be maintained as a protective cover for stockpiles;
- If stockpiles fail to develop a natural grass cover, they are to be seeded with a fast-growing, non-invasive, commercially available grass species. Recommended species are listed in Appendix 4 of the Soil Conservation Guidelines for Queensland (DSITI 2015);
- Topsoil should be stockpiled for the minimum time practicable. Studies in the Hunter Valley have shown that the majority of deterioration occurs within the first year (Keipert et al. 2005);
- Stockpiles are to be monitored annually for weeds and control measures implemented as appropriate;
- Where soil must be stockpiled for extended periods (>2 years), soil testing will be considered before use for rehabilitation purposes; and
- Topsoil stockpiles are to be located in areas fenced from livestock.

Most subsoils within the project area (with the exception of the Crocodile SMU) are dispersive and must be managed carefully to reduce the risk of erosion and sedimentation of downstream waterways. Most of these subsoils do not provide a favourable substrate for plant establishment, excluding the use of grass covers as an erosion protection measure. Instead, the following actions, where practicable, are to be taken to manage the storage of subsoils:

- subsoil to be directly placed into its final position rather than stockpiled as a priority;
- subsoil stockpiles to be contained, to ensure that any eroded material is retained within the pit and not released into waterways;
- Subsoil stockpiles should not to be placed on slopes greater than 3%, and the stockpile surface should be levelled to reduce the speed of any run-off; and
- Sediment control infrastructure is to be constructed around any stockpile areas.

### Soil Spreading

A growing medium of approximately 250 mm of topsoil will be placed over the deposited and shaped subsoil/waste-rock. Organic material harvested from the mine footprint will be incorporated into the topsoil, where practicable.

Following the spreading of topsoil, rehabilitated areas are to be ripped to a depth of 0.4 to 0.5 m. Ripping reduces compaction from heavy machinery, encourages the infiltration of water and reduces the risk of erosion.

Spread and ripped soil should have a rough surface with abundant troughs and banks, which help to resist erosion, improve infiltration and retain leaf litter. In accordance with the results of trials elsewhere in the Bowen Basin (Williams 2001), a rock cover (sourced from overburden) is to be placed upon topsoil on slopes greater than 10% (equivalent to 6°). This rock is to constitute approximately 30% of the soil cover, to convey optimal erosion protection during the initial stages of vegetation establishment (Williams 2001).

Where practicable, topsoil placement will occur in October-November, shortly before the commencement of the wet season. Soil operations are to be undertaken when the soil is dry or damp, but not saturated. Manual handling of wet soils is logistically difficult, damages the soil’s structure and leads to compaction.
Fertiliser and Soil Amelioration

Most of the topsoils within the Project area are nutrient-deficient, and the addition of fertiliser at the time of planting will facilitate plant establishment and growth. A controlled-release fertiliser with the following nutrient concentrations is to be applied at the time of seeding as required:

- Nitrogen: 7.0-25.0%;
- Phosphorus: 0.3-2.0%; and
- Potassium: 4.0-15.0%.

Application rates should follow the manufacturer’s guidelines, but are expected to be 100-500 kg/ha, depending on nutrient concentrations.

Seeding

Seeding operations shall not take place until the prepared area has been constructed in accordance with the specified requirements. Ideally, sowing should take place within one week of topsoil placement and ripping. Rainfall between cultivation and sowing results in the partial collapse of furrows and crusting of the soil surface. Sites may need to be re-ripped prior to sowing if rain occurs following the initial treatment. Seeding operations are not to be undertaken on days:

- when wind speeds exceed 15 km/h;
- where the surface is fully saturated;
- when temperatures exceed 37°C; and
- during heavy rain, or when heavy rain is forecast.

The seed mix to be applied varies by soil management unit (Section 6.2.5). However, all seed mixes are to include a combination of sterile grass varieties (e.g., Silk Sorghum Sorghum spp. and/or Japanese Millet Echinochloa esculenta)—which act as cover crops—native species and pasture species.

The seed mix is to be uniformly blended with a bulking agent such as dry sand or dry, fine sawdust at a rate of 1 part seed to 5 parts bulking agent by volume. This mix is then combined with fertiliser on the day of planting and distributed evenly across the planting area. Seed may be pre-mixed and stored with the bulking agent for several months; however, fertiliser should not be stored with seed for longer than necessary.

Planting of Container Stock

Some species of trees and shrubs (especially those with fleshy fruits, such as Erythroxylum australe and Carissa ovata) recolonise poorly from directly sown seed, and are best reared in a nursery environment and planted as one-year-old tube stock. Monitoring of previous years progressive rehabilitation on site (i.e., detecting the failure of certain species to germinate in situ) will inform which species should be prioritised for container stock in ongoing rehabilitation campaigns.

Container stock is to be hand-planted in clusters of 5-10 individuals, each seedling spaced approximately 2 m apart. The planting of container stock is to take place within five days of heavy rain (>40 mm over a 24 hr period), when soil moisture levels are high. The spacing between clusters will depend on the density of other species that successfully germinate, but planting densities of up to 100 trees per hectare may be required where seed germination is particularly poor.

All container stock is to be sun-hardened for at least one month prior to planting.

Planting holes are to be excavated to a minimum diameter equivalent to twice the diameter of the plant container and to a depth equivalent to the height of the plant container. The material at the bottom of the hole is to be broken up to a depth of 50 mm. The sides of the hole are to be roughened. The top of the plant’s root ball is to be level with the surrounding ground. The topsoil is to be tamped down to create a slightly depressed basin surrounding the plant, without exposing the root system.
**Fencing**

Livestock-proof fencing is to be installed around all revegetated areas at or prior to the completion of seeding and planting. Rehabilitated areas are to be maintained free of livestock until these sites are sufficiently established for the commencement of grazing.

### 6.2.5 Seed Mix

Seed is to be sourced from a combination of local collections and commercial suppliers. Local seed collections will begin at least two years prior to the commencement of revegetation, to allow for the potential of unfavourable weather to cause the failure of seed production in any one year. Seed is to be stored for a maximum of five years prior to use, and regular collections/purchases will be required throughout the Project.

The preliminary seed mixes that are proposed for each soil management unit are shown in Table 6-6. These have been developed based on the dominant species of trees, shrubs and grasses present within each soil management unit within the Project area prior to mining. Adjustments to these seed mixes will be made, pending seed availability and the performance of the earliest rehabilitation efforts on site. It is expected that some of the species listed will display poor recruitment via direct seeding, and such species will be removed from the seed mixes and planted as container stock instead.

The value of Buffel Grass (*Cenchrus ciliaris*) for mine rehabilitation in Queensland is debated. This exotic pasture species is a rapid coloniser of disturbed ground and is effective for controlling erosion. Among earlier rehabilitation efforts in the Bowen Basin, Buffel Grass was the dominant pasture species planted (Grice *et al.* 2012). However, it is only moderately palatable to cattle and aggressively outcompetes other plant species, including more valuable pastures (Grice *et al.* 2012; Erskine and Fletcher 2013). Buffel Grass is considered the likely cause of a marked decline in species diversity over time at other mine rehabilitation areas within the Bowen Basin (Erskine and Fletcher 2013). This declining diversity jeopardises the stability and functionality of the rehabilitated landforms.

At the Project, Buffel Grass (*Cenchrus ciliaris*) is included within seed mixes on soil management units in which it was dominant pre-mining, but in much lower ratios than observed in reference sites. This approach is a compromise between replicating the pastures occurring on site prior to mining and establishing a diverse mix of native and exotic pasture species that have high pasture productivity and environmental value (i.e., can sustain the proposed PMLUs).

| Table 6-6 | Proposed seed mixes for each Soil Management Unit (SMU) where the PMLU is low-intensity grazing |
### Limpopo

<table>
<thead>
<tr>
<th>SMU</th>
<th>Trees and shrubs</th>
<th>Rate (kg/ha)</th>
<th>Pasture grasses</th>
<th>Rate (kg/ha)</th>
<th>Sterile cover crop</th>
<th>Rate (kg/ha)</th>
<th>Total Rate (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acacia burdekenis</td>
<td>0.1</td>
<td>Allotropis cimiciniana</td>
<td>1</td>
<td>Japanese Millet - sterile</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Acacia flavescens</td>
<td>0.05</td>
<td>Aristida calycina</td>
<td>1</td>
<td>Silk Sorghum</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alphitonia excelsa</td>
<td>0.1</td>
<td>Bothriochloa bladhii</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cassia brewsteri</td>
<td>0.05</td>
<td>Bothriochloa pertusa</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corymbia clarksoniana</td>
<td>0.2</td>
<td>Cenchrus ciliaris</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eucalyptus crebra</td>
<td>0.15</td>
<td>Chrysopogon fallax</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eucalyptus melanophloia</td>
<td>0.15</td>
<td>Eragrostis sororia</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eucalyptus populnea</td>
<td>0.15</td>
<td>Eriochloa crebra</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grevillea parallala</td>
<td>0.05</td>
<td>Heteropogon contortus</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grevillea striata</td>
<td>0.05</td>
<td>Perotis rara</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Melaleuca nervosa</td>
<td>0.05</td>
<td>Setaria surgens</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Petalostigma pubescens</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1.2</strong></td>
<td><strong>9.5</strong></td>
<td></td>
<td><strong>6</strong></td>
<td><strong>16.7</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Zambezi

<table>
<thead>
<tr>
<th>SMU</th>
<th>Trees and shrubs</th>
<th>Rate (kg/ha)</th>
<th>Pasture grasses</th>
<th>Rate (kg/ha)</th>
<th>Sterile cover crop</th>
<th>Rate (kg/ha)</th>
<th>Total Rate (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alphitonia excelsa</td>
<td>0.1</td>
<td>Bothriochloa bladhii</td>
<td>2</td>
<td>Japanese Millet - sterile</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Bauhinia hookeri</td>
<td>0.2</td>
<td>Bothriochloa evaritiana</td>
<td>2</td>
<td>Silk Sorghum</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cassia brewsteri</td>
<td>0.1</td>
<td>Bothriochloa pertusa</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corymbia clarksoniana</td>
<td>0.3</td>
<td>Cenchrus ciliaris</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corymbia tessellaris</td>
<td>0.3</td>
<td>Megathyrsus maximus</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eucalyptus camaldulensis</td>
<td>0.5</td>
<td>Urochloa mosambicens</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eucalyptus crebra</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eucalyptus populnea</td>
<td>0.4</td>
<td>Ficus opposita</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ficus opposita</td>
<td>0.1</td>
<td>Melaleuca leucadendra</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2.7</strong></td>
<td><strong>8</strong></td>
<td></td>
<td><strong>6</strong></td>
<td><strong>16.7</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*In the RA2 rehabilitation area, no trees and shrubs are to be included in the seed mix.

### 6.2.6 Rehabilitation Trials

In accordance with the *Progressive Rehabilitation and Closure Plans Guideline*, rehabilitation trials are not to result in the delay of rehabilitation. They should also take place in locations that have been or will be disturbed for other components of the project, so as to not unnecessarily enlarge the total disturbance footprint of the project. The short duration of the Project, the narrow window of time until the first rehabilitation commences and the lack of suitable locations to undertake trials precludes rehabilitation trials from being a useful tool for refining the rehabilitation methodology. Instead, the rehabilitation methodology has been informed by rehabilitation trials elsewhere in the Bowen Basin, as well as reference data gathered during ecological surveys of the site prior to mining. The rehabilitation methodology (e.g., seed mixes, relative contribution of tubestock, timing of planting) will also be progressively refined following the early outcome of each year’s progressive rehabilitation efforts.
7 SURRENDER OF THE ENVIRONMENTAL AUTHORITY

A surrender application must comply with requirements contained in section 262 of the Environmental Protection Act 1994. This application must be accompanied by a final rehabilitation report, a post-mining management report and a compliance statement for the EA and PRCP schedule.

The final rehabilitation report is to contain an environmental risk assessment and information on any proposed costs related to residual risks remaining at the site. The environmental risk assessment must be completed using a methodology agreed to by the administering authority. The risk assessment is a key step before the calculation of any residual risk costs for the site. The calculation of costs could include consideration of the present value of the future costs of likely repairs, necessary monitoring and maintenance costs and the ongoing management costs of rehabilitated land.

There is a payment as a pre-condition of the surrender of an EA in order to allow the government to address residual risks associated with a site at surrender. Residual risks may include the possibility that rehabilitation works and engineered structures may fail or the ongoing costs of monitoring and maintenance after surrender.

The residual risk requirements do not remove or change the obligations of an EA holder to complete rehabilitation to required standards. The residual risk framework enables companies to relinquish the tenure and surrender an EA whilst ensuring the State understands any remaining risks on site and is resourced to manage the risks, including possible financial consequences of future environment harm.
8 RISK ASSESSMENT

In accordance with section 126C(1)(f) of the EP Act, Table 8-2 assesses the risks of a stable PMLU not being achieved, and how these risks will be managed or minimised. Risks specific to each rehabilitation milestone are identified. Both inherent risks (in the absence of risk treatments) and residual risks (once controls are in place) are identified and assessed for each hazard. Risks are scored based on definitions in Table 8-1.

Table 8-1 Scoring system used to assess risks

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Likelihood</th>
<th>1 Rare</th>
<th>2 Unlikely</th>
<th>3 Possible</th>
<th>4 Likely</th>
<th>5 Almost Certain</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Catastrophic</td>
<td>Unconfined and widespread environmental damage; impacts reaching into surrounding areas; major remediation measures required.</td>
<td>15</td>
<td>19</td>
<td>22</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>4 Major</td>
<td>Long-term (2-10 years) impact; major remediation measures required.</td>
<td>10</td>
<td>14</td>
<td>18</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>3 Moderate</td>
<td>Medium-term (&lt;2 years) impact; requires moderate intervention.</td>
<td>6</td>
<td>9</td>
<td>13</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>2 Minor</td>
<td>Short-term impact; requires minor remediation or intervention.</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>1 Negligible</td>
<td>No lasting impact; requires minor or no remediation; minor management intervention may be required.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>11</td>
</tr>
</tbody>
</table>
Section 5.1

1. Infrastructure decommissioning and removal:
   - Schedule for infrastructure decommissioning and removal inadequately communicated among management and work teams.
   - Infrastructure decommissioning schedule to be incorporated into annual mine planning.
   - Monthly progress meetings are to take place between management (i.e., responsible personnel) and work crews regarding infrastructure decommissioning and removal.
   - Additional work team resourcing may be sought in the event that the completion of scheduled works is otherwise unlikely by the annual reporting date.
   - The proposed actions will allow the early identification of potential deviations from the PRCP Schedule, affording ample opportunity to adjust work rates to ensure that scheduled works are completed by the reporting date of 10 December.
   - Adequate time allocated for planning and progress meetings.

   Refer to Section 5.1

2. Remediation of contaminated land:
   - Achievements of milestones 4 and 5.
   - Monthly progress meetings are to take place between management (i.e., responsible personnel) and work crews regarding de-contamination works.
   - Compliance with the PRCP schedule is to be overseen by responsible personnel.
   - De-contamination works must be completed to allow sufficient time for milestones 3 and 4 to be accomplished prior to the wet season; or milestone 5 will be delayed by an additional year.
   - Adequate time allocated for planning and progress meetings.

   Refer to Section 10.1.1.

3. Landform 3: In-situ vegetative and revegetation:
   - Heavy rains prior to surface preparation and revegetation (milestones 4 and 5). The planned low slope gradient limits the capacity for water to carry material.
   - Sedimentation of downstream waterways. The sediment management system has been already designed for the planning and approval stages of the Project. Appropriate time and personnel are required for construction of this system.
   - Timing and design specifications for final landform not adequately implemented.
   - Achievement of milestone 3 delayed. Early detection of inconsistencies between constructed landforms and approved designs will allow adequate opportunity for modifications to be completed by the reporting date of 10 December.
   - Adequate time allocated for planning and progress meetings; funding for auditors.

   Refer to Section 10.1.3.

4. Surface preparation:
   - Inappropriate topsoil and subsoil management whilst stockpiled. By minimising stockpile heights, preventing the mixing of arisables and topsoil, maintaining a vegetative cover on stockpiles and controlling weed populations on stockpiles before they become dominant, soil health will be maintained.
   - Topsoil stockpiles to be managed in strict accordance with practices described in Section 6.2.4.
   - Adequate signage, herbicides and personnel are required.

   Refer to Section 10.1.4.

Table 8.2 Risk assessment for rehabilitation of the Project

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Hazard</th>
<th>Impact</th>
<th>Inherent Risk</th>
<th>Likelihood</th>
<th>Consequence</th>
<th>Risk Rating</th>
<th>Proposed actions</th>
<th>Justification for treatment option</th>
<th>Resource requirements</th>
<th>Performance measures</th>
<th>Reporting and monitoring</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Infrastructure decommissioning and removal</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>9</td>
<td>Infrastructure decommissioning schedule to be incorporated into annual mine planning. Monthly progress meetings are to take place between management (i.e., responsible personnel) and work crews regarding infrastructure decommissioning and removal. A register of infrastructure is to track which structures exist in each rehabilitation area and which have been removed. The proposed actions will allow the early identification of potential deviations from the PRCP Schedule, affording ample opportunity to adjust work rates to ensure that scheduled works are completed by the reporting date of 10 December.</td>
<td>Adequate time allocated for planning and progress meetings.</td>
<td>Adequate time allocated for planning and progress meetings.</td>
<td>Refer to Section 5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Remediation of contaminated land</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>Monthly progress meetings are to take place between management (i.e., responsible personnel) and work crews regarding infrastructure decommissioning and removal.</td>
<td>The proposed actions will allow the early identification of potential deviations from the PRCP Schedule, affording ample opportunity to adjust work rates to ensure that scheduled works are completed by the reporting date of 10 December.</td>
<td>Adequate time allocated for planning and progress meetings.</td>
<td>Refer to Section 5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Landform 3: In-situ vegetative and revegetation</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>4</td>
<td>14</td>
<td>Ongoing waste characterisation throughout operations. Ongoing testing of mine-affected water throughout operations. Should waste rock material with reactive chemistry be identified during operations: Extraction is to cease until the situation can be resolved; and Geochemical specialists are to be consulted to advise on appropriate handling and management of the material.</td>
<td>Ongoing testing of waste material and mine-affected water is a standard practice in QLD mining operations. It will provide an early detection system for mischaracterisation of rock. A response procedure will aim to prevent further removal of reactive material until appropriate infrastructure can be designed and constructed to manage the material.</td>
<td>Adequate budget for geochemical testing.</td>
<td>Refer to Section 5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Surface preparation</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>4</td>
<td>21</td>
<td>Spatial segregation of topsoil and subsoil, with signage installed at each stockpile to denote soil type. Topsoil stockpiles to be managed in strict accordance with practices described in Section 6.2.4. By minimising stockpile heights, preventing the mixing of arisables and topsoil, maintaining a vegetative cover on stockpiles and controlling weed populations on stockpiles before they become dominant, soil health will be maintained.</td>
<td>Adequate signage, herbicides and personnel are required.</td>
<td>Adequate time allocated for planning and progress meetings; funding for auditors.</td>
<td>Refer to Section 10.1.4.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Inherent Risk | Risk Ranking | Justification of treatment option | Performance measures | Reporting and monitoring | Residual Risk
--- | --- | --- | --- | --- | ---
Inadequate topsoil cover | 3 4 18 | Effective management of weeds on site. | Adequate waste rock set aside for a protective cover; seed for pioneer grasses; appropriate time and personnel are required for construction of the sediment management system and final landform according to designs. | Adequate waste rock set aside for a protective cover; seed for pioneer grasses; appropriate time and personnel are required for construction of the sediment management system and final landform according to designs. | 2 3 9

Vehicles contaminated with weed seeds used for earthworks | 3 4 18 | Prevention of introduction and early treatment of new infestations are central to the successful and cost-effective management of weeds on site. | Adequate time and budget for wash-downs, monitoring and weed control. | Adequate time and budget for wash-downs, monitoring and weed control. | 2 3 9

Heavy rainfall occurring prior to establishment of vegetative cover. | 4 3 17 | A study of studies elsewhere in the Bowen Basin ( refer Section 6.1 ) indicates that the measures in place at the Project will sufficiently limit the risk of erosion. | Adequate waste rock set aside for a protective cover; seed for pioneer grasses; appropriate time and personnel are required for construction of the sediment management system and final landform according to designs. | Adequate waste rock set aside for a protective cover; seed for pioneer grasses; appropriate time and personnel are required for construction of the sediment management system and final landform according to designs. | 2 3 9

Seed unavailable | 4 3 17 | Seed collection and procurement is to commence at the start of the project, so that supplies are available when revegetation begins. | Approximately half of the species to be used are not currently stocked by commercial seed suppliers and therefore require local collection. Collecting over two years prior to revegetation allows for certain species to seed poorly in any one year. | Funding for seed collection/purchase must be available from the start of the project. | 2 2 5

Heavy rain immediately after sowing | 4 3 17 | A study of studies elsewhere in the Bowen Basin ( refer Section 6.1 ) indicates that the measures in place at the Project will sufficiently limit the risk of erosion. | Adequate waste rock set aside for a protective cover; seed for pioneer grasses; appropriate time and personnel are required for construction of the sediment management system and final landform according to designs. | Adequate waste rock set aside for a protective cover; seed for pioneer grasses; appropriate time and personnel are required for construction of the sediment management system and final landform according to designs. | 2 3 9

Inappropriate quantity of grass seed used in the seed mix | 3 3 13 | Studies elsewhere in the Bowen Basin indicate that dense grass can inhibit vegetation development (Erskine and Fletcher 2013). Early identification of issues and amendments of seed mixes will reduce overall costs associated with remediating over- or under-dense grass swards. | Adequate time for reviewing the revegetation methodology on an annual basis. | Refer to Section 5.1 | 2 2 5

Inadequate topsoil cover | 3 4 18 | A minimum tree and shrub density is required to achieve completion requirements specified in the Koala and Squatter Pigeon. However, excessive tree and shrub densities limit pasture development, compromising the achievement of the desired PMLU. Early identification of issues and amendments of seed mixes will reduce overall costs associated with remediating over- or under-dense grass swards. | Adequate time for reviewing the revegetation methodology on an annual basis. | Refer to Section 10.1.5. | 2 2 5

Inadequate topsoil cover | 3 3 13 | Appropriate time and budget allocated for planting in years following drought. | Adequate time and budget allocated for planting in years following drought. | Adequate time and budget allocated for planting in years following drought. | 2 2 8

Inadequate topsoil cover | 3 3 13 | Adequate time and budget allocated for planting in years following drought. | Adequate time and budget allocated for planting in years following drought. | Adequate time and budget allocated for planting in years following drought. | 2 2 8
Seed mixes have been based on other mine sites across north-eastern Australia. However, weed management practices are required to be modified pending the outcome of initial rounds of rehabilitation. Early refinements of the seed mixes will reduce the need for later interventions. Tubestock is a superior method for adding trees to existing pastures, as tree seeds often fail to germinate/establish among competitive understorey species. Adequate time for reviewing the revegetation methodology on an annual basis: additional seed stocks and fertiliser, as required.

Intruding livestock

- Premature grazing could damage developing trees and shrubs and impair pasture development.

- Fences are to be inspected monthly, faults immediately repaired and livestock immediately removed.

- Re-established areas are to be maintained free of livestock until vegetation is adequately established (at least five years). Personnel for inspections and repairs; tools and equipment for fencing.

- Adequate time for modifying the vegetation development plan and repairs; tools and equipment for fencing.

Vehicles and footwear contaminated with weed seeds

- Intruding livestock could lead to poor seeding establishment.

- Strict vehicle wash-down practices for vehicles entering the site from contaminated areas.

- Annual weed monitoring program, to allow the early detection and treatment of new weed infestations.

- Adequate time and budget for wash-downs, monitoring and weed control.

Poor pasture development

- Insufficient pasture density to meet completion criteria.

- Insufficient species richness of grasses to meet completion criteria.

- Increased risk of erosion.

- Seed mixes have been based on other mine sites across north-eastern Australia.

- Grass seed application rates are to be modified pending the outcome of the initial rounds of rehabilitation.

- In sites with insufficient grass cover, there is to be supplementary sowing and/or fertilisation in bare patches to encourage grass growth.

- Adequate time for reviewing the revegetation methodology on an annual basis: additional seed stocks and fertiliser, as required.

Poor development of Koala food trees

- Insufficient density of food trees to allow use of rehabilitated areas by the Koala.

- Failure to achieve targets of completion criteria.

- Seed mixes have been based on other mine sites across north-eastern Australia.

- Seed application rates are to be modified pending the outcome of the initial rounds of rehabilitation.

- Regular monitoring aims for the early detection of sites with inadequate seeding establishment.

- Sites with insufficient density of food trees developing over the first two years will undergo supplementary planting of tubestock.

- Adequate time for reviewing the revegetation methodology on an annual basis: machinery to undertake thinning of trees and shrubs, if required.

Excessive density of trees and shrubs

- Pasture species become shaded out.

- Habitat becomes unsuitable for the Squatter Pigeon.

- Failure to achieve targets of rehabilitation completion criteria.

- Seed mixes have been based on other mine sites across north-eastern Australia.

- Seed application rates are to be modified pending the outcome of the initial rounds of rehabilitation.

- Thinning of woody vegetation (using machinery or fire) may be required at sites with excessive shrub and tree densities.

- Adequate time for reviewing the revegetation methodology on an annual basis: additional nursery stock to rear tubestock OR contracts with commercial nurseries to rear stock.

Intruding livestock

- Premature grazing could cause damage developing trees and shrubs and impair pasture development.

- Fences are to be inspected monthly, faults immediately repaired and livestock immediately removed.

- Re-established areas are to be maintained free of livestock until vegetation is adequately established (at least five years). Personnel for inspections and repairs; tools and equipment for fencing.

- Adequate time and budget for wash-downs, monitoring and weed control.
<table>
<thead>
<tr>
<th>Milestone</th>
<th>Hazard</th>
<th>Impact</th>
<th>Likelihood</th>
<th>Consequence</th>
<th>Risk Ranking</th>
<th>Proposed actions</th>
<th>Justification of treatment option</th>
<th>Resource requirements</th>
<th>Performance measures</th>
<th>Reporting and monitoring</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low pasture productivity</td>
<td>Failure to support economically viable cattle grazing.</td>
<td>2</td>
<td>3</td>
<td>9</td>
<td>Seed mixes have been based on other mine sites across north-eastern Australia. Grass seed application rates are to be modified pending the outcome of the initial rounds of rehabilitation. In sites with insufficient grass cover, there is to be supplementary sowing and/or fertilising in bare patches to encourage grass growth.</td>
<td>Early identification of issues and amendments of seed mixes will reduce overall costs associated with remediating inadequate grass cover.</td>
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</tr>
<tr>
<td></td>
<td>Low pasture diversity</td>
<td>Over-dominance of one or few pasture species increases the vulnerability of the pasture to extreme environmental events (flood, fire, drought, insect plagues). Low pasture diversity is associated with reduced nutrient cycling and ecosystem stability. Failure to sustain cattle grazing in the long-term.</td>
<td>4</td>
<td>4</td>
<td>23</td>
<td>A multitude of local pasture species are to be included in seed mixes. Non-native grasses known to suppress other species (e.g., Buffel Grass) are to be sown at very low rates. Regular monitoring (every two years) of rehabilitated sites will track pasture diversity and allow for an early modification of seed mixes and/or other interventions.</td>
<td>Over-dominance of Buffel Grass limits rehabilitation success and stability at other Bowen Basin mines (Erskine and Fletcher 2013). It is important to allow less aggressive grass species time to establish prior to Buffel Grass becoming too dense. A diversity of grasses improves ecosystem stability and protects against fluctuations in environmental conditions.</td>
<td>Personnel/contractors required for regular monitoring; adequate time for reviewing the revegetation methodology on an annual basis; additional seed stocks and fertiliser, as required.</td>
<td>Refer to Section 5.1 Refer to Section 10.1.7</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Poor landscape stability</td>
<td>Failure of sites to develop adequate sediment and leaf litter capture by groundcover features. Formation of a dysfunctional landscape that results in a loss of resources (nutrients, water, sediment) over the long term. Failure to achieve rehabilitation completion criteria pertaining to land stability.</td>
<td>2</td>
<td>3</td>
<td>9</td>
<td>Low slope gradient in landform design to limit capacity for sediment loss. 30% rock cover applied to slopes during surface preparation. Inclusion of a diversity of grass, trees and shrubs in seed mixes. Topsoil storage and handling are to be in accordance with practices described in Section 6.2.4.</td>
<td>Landscape function analysis is a widely implemented framework for managing and monitoring landscape stability. A review of studies elsewhere in the Bowen Basin (refer Section 6.1) indicates that the measures in place at the Project will lead to a stable landform with low erodibility.</td>
<td></td>
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</tbody>
</table>
9 MONITORING

9.1 Milestone Monitoring

Eight rehabilitation milestones are described in Section 10.2 (PRCP Schedule). A monitoring program has been developed to determine whether milestone criteria have been achieved. This program is described below, with respect to each of the rehabilitation milestones. Where milestones are only relevant to some rehabilitation areas, this is stated.

9.1.1 Rehabilitation Milestone 1: Infrastructure Decommissioning and Removal

Following the disconnection of services and removal of all buildings and mine infrastructure, an Infrastructure Decommissioning Checklist is to be completed. Failure of a site to meet all items on the checklist will trigger remedial works to remove outstanding infrastructure. This rehabilitation milestone monitoring is applicable to rehabilitation areas RA1 (Out-of-pit Dump, including the MIA) and RA3 (Infrastructure, haul roads, offices, stockpiles and ROM pad). An example checklist is provided below in Figure 9-1.

![Infrastructure Decommissioning Checklist](image-url)
9.1.2 Rehabilitation Milestone 2: Remediation of Contaminated Land

A contaminated land investigation document is to be prepared by an approved auditor, which is to contain the following components:

- a site investigation report, scientifically assessing whether contamination exists;
- a validation report, describing works undertaken to remediate any contamination; and
- a site suitability statement, stating that land is not contaminated and is suitable for any use.

Rehabilitation areas for which this milestone may be relevant include RA1 (Out-of-pit Dump, including the MIA), RA3 (Infrastructure, haul roads, offices, stockpiles and run-of-mine pad) and RA4 (dam and sediment ponds).

9.1.3 Rehabilitation Milestone 3: Landform Development and Reshaping/Reprofiling

Following landform development and reprofiling, survey, inspection and reporting is required to provide assurance that rehabilitation activities occurred in accordance with approved designs. Upon the completion of physical works, all landform works must have ‘as-constructed’ plans prepared. Deviations between design and construction are to be identified and highlighted. A database of design and ‘as-constructed’ plans for any engineering works associated with the mine rehabilitation is to be maintained.

Rehabilitation areas requiring landform development include RA1 (Out-of-pit Dump, including the MIA), RA2 (In-pit dump) and RA4 (dam and sediment ponds).

9.1.4 Rehabilitation Milestone 4: Surface Preparation

Soil assessments of stockpiled topsoil are to be undertaken within the six months prior to spreading. Soil is to be sampled at various depths of each stockpile. These tests are to be carried out by an appropriately qualified person to confirm that soil is suitable for target vegetation establishment.

As a record of milestone completion, GIS files should be kept that record:

- The boundaries of each area that had topsoil applied in each year (areas with different soil management units or topsoil spreading methodology are to be mapped separately);
- The date on which topsoil spreading occurred in each area;
- Depth of topsoil applied in each area;
- The soil management unit of the topsoil applied in each area; and
- Whether a rock mulch was applied.

These records are to be kept wherever topsoil is spread, including in rehabilitation areas RA1 (Out-of-pit Dump, including the MIA), RA2 (In-pit dump), RA3 (Infrastructure, haul roads, offices, stockpiles and ROM pad) and RA4 (dam and sediment ponds).

9.1.5 Rehabilitation Milestone 5: Revegetation

All areas in which seeding and planting have been carried out are to be entered into a GIS database that includes the following details:

- The boundaries of each area rehabilitated (areas with different soil management units, seed mixes or dates of planting are to be mapped separately);
- The soil management unit of the topsoil applied in each area;
- The seed mix applied to each area;
- The date the seed mix was applied to each area;
- The number and species of tubestock planted in each area; and
- The date tubestock was planted.
These records are to be kept wherever planting takes place, including in rehabilitation areas RA1 (Out-of-pit Dump, including the MIA), RA2 (In-pit dump), RA3 (Infrastructure, haul roads, offices, stockpiles and ROM pad) and RA4 (dam and sediment ponds).

**9.1.6 Rehabilitation Milestone 6: Establishment of Target Vegetation Type**

Monitoring of milestone RM6 involves a combination of field surveys and satellite imagery analysis. Methodologies for each are described below.

**Field Surveys**

Field surveys are to monitor the following attributes of rehabilitation areas:

- Relative dominance of Koala food trees;
- Percentage cover of declared weeds; and
- Species composition of the pasture.

These attributes are to be measured within a 10 m x 50 m belt transect installed within rehabilitation areas.

Basal area of woody vegetation is to be measured using a Bitterlich gauge. Each species of tree/shrub is to be measured separately. Each site is to be assessed using two 360° sweeps of the gauge (one at each end of the transect, 50 m apart), and the basal area of each woody species is the average from the two sweeps. The proportion of the total basal area of all woody vegetation that comprises Koala food trees (*Eucalyptus crebra*, *Eucalyptus populnea* and *Eucalyptus camaldulensis*) is used to assess the success of rehabilitation.

The entire belt transect is to be searched, and all species of forbs and grasses contained within it are to be recorded. Percentage ground cover of each species is to be estimated to the nearest 0.1%, with 0.1% cover being equivalent to 0.5 m² total cover within the transect. From this data, milestone completion criteria pertaining the grass species richness and weed cover can be assessed.

Field surveys are to be undertaken in the late wet season (February-May), to coincide with maximum growth of grasses and forbs. Permanent monitoring sites are to be installed within all rehabilitation areas, and each end of each transect is to be marked with a star picket. An average of one monitoring site is to be installed per 10 ha of rehabilitated land. Rehabilitation areas that are less than 10 ha in extent (i.e., RA4: dams and sediment ponds) are to have at least one monitoring site.

Reference sites are to be installed in nearby undisturbed land used for grazing. Reference sites are to be of a similar soil type and slope to rehabilitated sites, and must have a vegetation density appropriate for Squatter Pigeons. Five reference sites are to be installed on flat land (gradients <6%) and five are to be installed on sloping land (gradient of 10-20%). Locations of proposed reference sites are listed in **Table 9-1** and shown in **Figure 9-2**. Reference sites are to be surveyed concurrently with every second rehabilitation area monitoring round. Reference sites must be monitored in the year rehabilitation success is expected. Vegetation development is to be assessed every two years until milestone criteria have been achieved.

**Table 9-1 Proposed reference sites for vegetation monitoring**

<table>
<thead>
<tr>
<th>Reference Site</th>
<th>Slope</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Flat</td>
<td>-22.2780</td>
<td>148.1740</td>
</tr>
<tr>
<td>R2</td>
<td>Flat</td>
<td>-22.2824</td>
<td>148.1789</td>
</tr>
<tr>
<td>R3</td>
<td>Flat</td>
<td>-22.2852</td>
<td>148.1789</td>
</tr>
<tr>
<td>R4</td>
<td>Flat</td>
<td>-22.2805</td>
<td>148.1779</td>
</tr>
<tr>
<td>R5</td>
<td>Flat</td>
<td>-22.2789</td>
<td>148.1731</td>
</tr>
<tr>
<td>R6</td>
<td>Sloping</td>
<td>-22.2784</td>
<td>148.1709</td>
</tr>
<tr>
<td>R7</td>
<td>Sloping</td>
<td>-22.2831</td>
<td>148.1745</td>
</tr>
<tr>
<td>R8</td>
<td>Sloping</td>
<td>-22.2799</td>
<td>148.1746</td>
</tr>
<tr>
<td>R9</td>
<td>Sloping</td>
<td>-22.2975</td>
<td>148.1918</td>
</tr>
<tr>
<td>R10</td>
<td>Sloping</td>
<td>-22.2987</td>
<td>148.1927</td>
</tr>
</tbody>
</table>
Rehabilitation areas for which the PMLU includes habitat for the Squatter Pigeon and Koala (i.e., RA2, RA3 and RA4) are to undergo monitoring of woody vegetation density six years and ten years after the revegetation milestone is achieved. Woody vegetation density is measured using the Normalised Difference Vegetation Index (NDVI). The following approach is to be adopted:

1) The entire rehabilitation area is divided into 1-ha cells.

2) Landsat satellite imagery is to be downloaded from an appropriately dry time of year:
   - following at least two months in which no more than 10 mm of rain fell in a single 24-hour period; AND
   - following at least one week with no rain.

   By using imagery captured during dry periods, when grass is dry, the NDVI (an index of greenness) reflects the density of woody vegetation cover. The months of July-September are usually appropriate, but in unusually wet winters, other months may need to be considered.

3) Using mapping software, the mean NDVI value for each 1-ha cell is to be calculated.

All cells fully contained within the relevant rehabilitation area are to have NDVI values between 0.1240 and 0.1778 in order to satisfy the completion criteria for threatened fauna. One-hectare cells within parts the MLA area in which no disturbance has occurred and in which woody vegetation density is likely to have remained relatively stable over time (e.g., remnant vegetation) is to be used as reference points for NDVI. NDVI values of reference cells within the focal year should closely resemble values of the same cells calculated from Landsat imagery collected in August 2018 (on which completion criteria were based). If this is not the case, imagery from a different time of year should be used or, if this is unavailable or yields a similar outcome, the completion criteria are to be adjusted to account for shifts in greenness that arise from measurement biases or the influence of pasture.

9.1.7 Rehabilitation Milestone 7: Achievement of a Stable PMLU

The achievement of a stable landscape that can support low-intensity cattle grazing is to be monitored through five field survey programs, described below.

**Landscape Function Analysis**

Monitoring of the stability of rehabilitated land is to be based on the “stability index” of Landscape Function Analysis (Tongway and Hindley 2004). Methodology to be adopted is described in detail by Tongway and Hindley (2004). Permanent monitoring sites used for vegetation monitoring (see Section 9.1.6) are also to be monitored for soil stability. Monitoring is to take place in the late wet season (February-May), to coincide with maximum plant growth. Sites are to be monitored at the time of planting and then every two years for 10 years after planting. This time series of six intervals will generate a sigmoidal curve for the stability index. A stable PMLU will be achieved when the forecast sigmoidal curve, fitted to the data, demonstrates a predicted plateau at a value that is equivalent to or exceeds the target value, defined by the range observed in analogue sites that have not been mined (Tongway and Hindley 2004).

Reference sites used for vegetation monitoring (see Figure 9-2 and Table 9-1) are also to be used as analogue sites for monitoring soil stability. If the curve does not plateau or exceed the target value within ten years, additional rounds of monitoring will take place every five years until the target is achieved.

**Ground Cover**

Landscape Function Analysis, discussed above, involves an assessment of percentage ground cover as classes. A more accurate measurement is required to specifically assess the rehabilitation completion criteria that “grazed land maintains a percentage ground cover of between 50% and 96%”. While this criteria relates specifically to rehabilitation areas to which cattle have been introduced (at advanced stages of rehabilitation development), it is prudent to commence this monitoring prior to the introduction of cattle. This data can then be used to calculate the effect of grazing on percentage cover, and thereby predict the groundcover expected at ungrazed sites following cattle introduction. This in turn will be useful for adjusting stocking rates, if required.

Ground cover is to be calculated by running a 50 m measuring tape along the length of each vegetation monitoring transect. Observations of the type of cover (limited to the cover present below 1 m above ground level) are made at point intercepts along the centre line of the 50 m transect at 0.5 m intervals. Cover types include (a) vegetation
(including all live vegetation and standing senescent vegetation that is still attached to the main plant and is not in intimate contact with the soil); (b) leaf litter and woody debris; (c) rock or (d) bare ground. The cover type that is intercepted directly below each point is recorded. The intercept point is to be assessed by viewing the ground through a small observation hole (in a piece of stiff card or plastic) or tube. Preferably, this should contain a cross hair, although this is not obligatory. A total of 100 observations are made per transect, and the sum of each cover type equates to its percentage cover.

Percentage cover is to be assessed at rehabilitation sites only (reference site data is not required). Monitoring is to be undertaken concurrently with assessments of landscape function and vegetation surveys in the late wet season.

**Pasture Productivity**

Pasture productivity within rehabilitated sites is to be equivalent to nearby unmined sites on the same soil types. Pasture productivity is to be assessed via one of two methods:

1) **Manual measurements of pasture mass at specific moments in time.** An electronic dry matter capacitance meter (e.g., Grassmaster Pro) can be used to estimate pasture dry mass (kg/ha) at points within rehabilitation areas. This technique is superior to traditional plate meters on stony ground, such as will be found on sloping rehabilitation areas. The exact number of replicate points required per rehabilitation area is dictated by the variation observed between points and the need to meet the conditions of the completion criteria, namely that pasture mass is not significantly different from unmined areas, with adequate sampling to detect \( \geq 10\% \) difference between groups. An appropriate sample size \( n \) is based on the following formula:

\[
n = \frac{15.68 \cdot \sigma^2}{d^2},
\]

where \( \sigma^2 \) is the population variance, and \( d \) is the minimum difference required to be detected. This formula is based on a standard 95% confidence interval and 80% power. It is anticipated that several hundred point-readings are likely to be required per rehabilitation area and reference paddock. Data from the first 100 readings can be used to calculate \( n \) for a \( d \) value that represents 10% of the mean dry mass at the reference site. Reference and rehabilitation areas are to be assessed concurrently, at the end of the growing season (April-May).

2) **Satellite estimation of pasture growth rate.** The CSIRO is in the process of developing their “Pastures from Space” website, which uses satellite imagery to provide real-time data on pasture growth rates at fine spatial scales. This technique has been optimised for temperate Australian pastures, but its applicability to the tropics and subtropics remains unclear. With further development and optimisation, this tool could provide a highly efficient method for comparing pasture productivity between rehabilitation and reference areas, without the need to undertake labour-intensive field studies. It is expected that this tool may be available by the time pasture productivity monitoring is to commence at the Project (i.e., 2031, six years after the first planting).

**Water Quality**

The Project will have a groundwater and surface water monitoring program operating throughout all phases of the Project, including through rehabilitation and closure. For a detailed description of the methodology to be adopted and the location of sampling sites, refer to the Receiving Environment Water Monitoring Program, which is to be completed prior to the commencement of the Project. A draft water monitoring schedule and proposed monitoring locations are presented in Appendix A.

**9.1.8 Monitoring Report**

Rehabilitation milestones RM6 and RM7 are generally to be assessed concurrently and, as both constitute the primary rehabilitation completion criteria for the Project, they will be monitored over an extended period of at least 10 years. The results of each round of monitoring (every two years) are to be presented in a report that assesses progress of these two milestones. Each report is to contain details about how the methodology used is consistent with this PRC Plan. Each report is also to discuss how the results obtained indicate progression towards the fulfilment of milestone criteria. This monitoring report is to be completed by 1 October in the calendar year in which surveys are undertaken, to allow adequate time for Vitritine to report on the findings by the state-wide reporting deadline of 10 December.
9.2 Audits
In accordance with section 285 of the *Environmental Protection Act 1994*, holders of a PRCP schedule must commission a rehabilitation auditor to undertake an audit of the PRCP schedule every three years. The first audit must be for the three year period that commences from the day the schedule takes effect. Each subsequent audit period is for the three years commencing on the day after the previous audit period ended. Each audit report must be delivered to the administering authority within four months after the end of each audit period.

In accordance with section 286 of the *Environmental Protection Act 1994*, each audit must include the following:

- a statement about whether the holder has complied with the schedule during the audit period;
- a description of actions the holder has taken with respect to rehabilitation milestones and management milestones;
- whether the holder has complied with conditions imposed on the schedule;
- a declaration stating the holder has not knowingly given false or misleading information;
- an assessment of whether the post-mining land use is likely to be achieved; and
- recommendations about actions the holder should take to ensure rehabilitation milestones and management milestones are achieved.

In addition to the mandatory three-yearly audits, the administering authority has the power (under section 322 of the *Environmental Protection Act 1994*) to issue an audit notice, which requires the holder of a PRCP schedule to commission an audit.

9.3 Annual Return
In addition to the annual return requirements that relate to EAs, in accordance with section 316IA of the *Environmental Protection Act 1994*, the annual return must also include an evaluation of the effectiveness of the PRCP schedule, including the environmental management carried out under the schedule, for the year to which the annual return relates. This evaluation must include:

- whether any milestones to be completed under the PRCP schedule during the year have been met; and
- whether the conditions imposed on the PRCP schedule have been complied with.

9.4 Progressive Rehabilitation Report
In the event that a particular rehabilitation area within the tenure of the Project has been rehabilitated in accordance with all relevant requirements of the *Environmental Protection Act 1994*, the relevant environmental authority, the PRCP schedule and any relevant guidelines made under the *Environmental Protection Act 1994*, the holder of the EA can apply for progressive certification. In accordance with section 318ZD of the *Environmental Protection Act 1994*, the application for progressive certification must be accompanied by a progressive rehabilitation report. The requirements for a progressive rehabilitation report are listed in section 318ZF of the *Environmental Protection Act 1994*.

9.5 Final Rehabilitation Report
A final rehabilitation report is to be prepared when applying to surrender the EA. The purpose of this final rehabilitation report is to demonstrate that the conditions of the EA have been complied with, and that rehabilitation of disturbed land has been carried out satisfactorily. The requirements of this final rehabilitation report are listed in section 262 of the *Environmental Protection Act 1994*.

9.6 Post-mining Management Report
A post-mining management report is to be submitted as part of the surrender application for the EA. This report states the requirements for ongoing management of the land, and includes an environmental risk assessment. The requirements of this post-mining management report are listed in section 264A of the *Environmental Protection Act 1994*.
10 PRCP SCHEDULE

This section has been prepared in accordance with section 126D(1) of the *Environmental Protection Act 1994*. It contains a description of each rehabilitation area, a schedule of land availability for rehabilitation and a detailed description of the rehabilitation milestones that apply to each rehabilitation area. This information is used to develop a draft PRCP schedule that describes when each rehabilitation milestone is to be progressively achieved in each rehabilitation area.

10.1 Final Site Design

The final site design—showing the maximum disturbance footprint, the mining lease boundaries, the PMLUs for land within the mining lease, and flood plain extent—is shown in Figure 10-1.

10.1.1 Rehabilitation Areas

The proposed disturbance footprint of the Project has been divided into the following five rehabilitation areas with a common PMLU and rehabilitation methodology:

- RA1: Out-of-pit dump;
- RA2: In-pit dump;
- RA3: Infrastructure, haul roads, offices, stockpiles and run-of-mine pad;
- RA4: Dam and sediment ponds; and
- RA5: Saraji Road.

The division of the disturbance footprint into rehabilitation areas is shown in Figure 10-2.
10.2 Schedule of Land Availability

Due to the gradual back-filling of the mined pit, land will become progressively available for rehabilitation throughout the four years of the Project. Disturbed land is available for rehabilitation when:

1) the land is no longer being mined;
2) the land is no longer being used to dump further overburden;
3) the land is no longer being used for operating infrastructure or machinery for mining; and
4) the land does not support permanent infrastructure (e.g., Saraji Road).

10.2.1 Timing Considerations

Mine plans, which include the schedule of land available for rehabilitation, have been developed for each 12 months starting at the commencement of the Project. However, in accordance with the Progressive Rehabilitation and Closure Plans Guideline, annual reporting of rehabilitation works is to be based on the completion date of 10 December each calendar year. Consequently, the progression of the mine (and its rehabilitation) within any one calendar year is strongly dependent on the date the Project commences. All calculations and predictions of land availability within each calendar year are based on the current forecast Project commencement date of 31 July 2021. This date is subject to change, pending the government approval process and progression of the bulk sampling that precedes the Project.

One rehabilitation milestone ( revegetation) is strongly season-dependent, and is only to take place following the start of the wet season rain. It is assumed that any land available for rehabilitation later than July in any one calendar year is unlikely to have sufficient time to undergo infrastructure removal, decontamination and final landform shaping in preparation for revegetation at the start of the wet season (November-January, depending on the year). Consequently, deferring the commencement of rehabilitation of such land until the following year will not delay the revegetation stage.

Land that is available for rehabilitation before July will commence rehabilitation in the same calendar year. It is expected that milestones RM1, RM2 and RM3 (see Section 10.3) will be completed in the year that land becomes available for rehabilitation. Milestones RM4 and RM5 may also be completed the same year (relative to the reporting date of 10 December), but only if the wet season commences early (e.g., November). As the start of the wet season is unpredictable, for the purposes of the schedule, it is assumed that milestones RM4 and RM5 will be completed early in the following year, and hence are attributed to the following years’ progress in the schedule.

10.2.2 Schedule of Availability

The schedule of land availability for rehabilitation in each rehabilitation area is shown in Table 10-1.

<table>
<thead>
<tr>
<th>Rehabilitation Area</th>
<th>Land available for rehabilitation in each year (ha)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2022</td>
</tr>
<tr>
<td>RA1 Out-of-pit dump</td>
<td>0</td>
</tr>
<tr>
<td>RA2 In-pit dump</td>
<td>0</td>
</tr>
<tr>
<td>RA3 Infrastructure, haul roads, offices, soil stockpiles and run-of-mine pad</td>
<td>0</td>
</tr>
<tr>
<td>RA4 Dam and sediment ponds†</td>
<td>0</td>
</tr>
<tr>
<td>RA5 Saraji Road‡</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0</strong></td>
</tr>
</tbody>
</table>

*Land areas represent hectares of land that becomes available for the first time in that year (i.e., is not cumulative across years).
†Erosion control infrastructure is to remain in place until sufficient vegetative cover has developed on rehabilitated land. This is conservatively estimated to be three years post-mining, but may be sooner.
‡The realigned Saraji Road corridor will be constructed and operational within year 1, however further rehabilitation works within the corridor fringes may be required following construction of the final in-pit dump landform. Hence rehabilitation works are schedule to occur after the landform is established.
Rehabilitation milestones relevant to the Project area are listed in Table 10-2.

<table>
<thead>
<tr>
<th>Code</th>
<th>Milestone</th>
<th>Description</th>
<th>Applicable Rehabilitation Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM1</td>
<td>Infrastructure decommissioning and removal</td>
<td>Disconnect and terminate services such as water and electricity; Demolish and remove buildings (administration, ablution block, workshops, warehouses, etc.); Remove bitumen, blue metal, aggregate, etc.; Remove fencing; and Decommission boreholes.</td>
<td>RA1, RA3</td>
</tr>
<tr>
<td>RM2</td>
<td>Remediation of contaminated land</td>
<td>Carry out contaminated land investigations; Removal or onsite-treatment of contaminated water (e.g. affected by hydrocarbons); Removal and appropriate disposal of contaminated materials; On-site remediation of hydrocarbon-contaminated soils; and Conduct validation testing to confirm that contaminated soils have been removed/remediated.</td>
<td>RA1, RA3, RA4</td>
</tr>
<tr>
<td>RM3</td>
<td>Landform development and reshaping/reprofiling</td>
<td>Bulk earthworks to achieve required landform and slopes; Placement of subsoils over overburden; General reshaping to achieve final landform; and Installation of erosion and sediment control systems.</td>
<td>RA1, RA2, RA4</td>
</tr>
<tr>
<td>RM4</td>
<td>Surface preparation</td>
<td>Remediate any erosion or subsidence; Source, cart and spread growth media (topsoil); Adding ameliorants to improve or stabilise soils; and Deep rip.</td>
<td>RA1, RA2, RA3, RA4</td>
</tr>
<tr>
<td>RM5</td>
<td>Revegetation</td>
<td>Direct seeding; Applying fertiliser; Planting tube stock; and Installing stock fencing to protect planting.</td>
<td>RA1, RA2, RA3, RA4</td>
</tr>
<tr>
<td>RM6</td>
<td>Establishment of target vegetation type</td>
<td>Monitoring determines that vegetation meets the completion criteria.</td>
<td>RA1, RA2, RA3, RA4</td>
</tr>
<tr>
<td>RM7</td>
<td>Achievement of post-mining land use to stable condition</td>
<td>Monitoring determines that the land is safe, structurally stable, does not cause environmental harm and is able to sustain the PMLU.</td>
<td>RA1, RA2, RA3, RA4</td>
</tr>
<tr>
<td>RM8</td>
<td>Fulfilment of all conditions of the agreement with Isaac Regional Council for the construction and commissioning of Saraji Road.</td>
<td>The road is to be commissioned, and all conditions agreed between Isaac Regional Council and Vitrinite Pty Ltd regarding works within the realigned road reserve are to be complete and signed off by the council.</td>
<td>RA5</td>
</tr>
</tbody>
</table>
10.3.1 Milestone Criteria

Milestone criteria pertaining to each of the rehabilitation milestones are listed in Table 10-3.

Table 10-3 Milestone criteria

<table>
<thead>
<tr>
<th>Code</th>
<th>Milestone</th>
<th>Milestone criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM1</td>
<td>Infrastructure decommissioning and removal</td>
<td>• All services disconnected;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All road materials (bitumen, gravel) removed;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All pipelines drained and removed;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All fencing that is not part of the PMLU removed;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All buildings demolished and removed;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All machinery and equipment removed;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All surface water drainage infrastructure that is not required in the PMLU is removed; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All rubbish removed.</td>
</tr>
<tr>
<td>RM2</td>
<td>Remediation of contaminated land</td>
<td>• All contamination is remediated or removed from site; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A contaminated land investigation document is prepared by an approved auditor, which is to contain a site suitability statement stating that land is not contaminated and is suitable for any use.</td>
</tr>
<tr>
<td>RM3</td>
<td>Landform development and reshaping/reprofiling</td>
<td>• All earthworks except topsoil are to be completed;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All erosion and sediment control systems are to be installed; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All rehabilitation and associated works must have ‘as-constructed’ plans prepared.</td>
</tr>
<tr>
<td>RM4</td>
<td>Surface preparation</td>
<td>• 250 mm of topsoil is to be placed over all surfaces; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• An assessment of soil health and suitability has been completed by an appropriately qualified person to confirm soil is suitable for target vegetation establishment.</td>
</tr>
<tr>
<td>RM5</td>
<td>Revegetation</td>
<td>• Completed seeding at a rate of 16.7 kg/ha; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Tubestock planted at a density of 20-100 seedlings/ha.</td>
</tr>
<tr>
<td>RM6</td>
<td>Establishment of target vegetation type*</td>
<td>• *Eucalyptus crebra and/or Eucalyptus populnea are to constitute ≥21% of the total basal area of woody vegetation on sand plains AND *Eucalyptus camaldulensis is to constitute ≥33% of the total basal area of woody vegetation along Ripstone Creek and North Creek;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Rehabilitated areas are to have a mean NDVI between 0.1240 and 0.1778 AND/OR Squatter Pigeons are observed within rehabilitated areas;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The species richness of grasses within 10 m × 50 m plots in rehabilitated areas is to equal or exceed the 10th percentile among equivalent plots in reference sites on the same soil management unit; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Rehabilitated areas are to have ≤0.2% cover of Parthenium hysterophorus AND rehabilitated areas are to have ≤0.1% cover of Harrisia martini AND any other weeds listed under the Biosecurity Act are to be present in densities of &lt;1 individual per hectare.</td>
</tr>
<tr>
<td>RM7</td>
<td>Achievement of post-mining land use to stable condition*</td>
<td>• Rehabilitated areas are to have a pasture mass that is not statistically significantly different (with adequate sampling to detect ≤10% difference between groups) from unmined areas within the same soil management unit measured at the same time;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The forecast sigmoidal curve, fitted to the data, demonstrates a predicted plateau at a value that is equivalent to or exceeds the target value, defined by the range observed in analogue sites that have not been mined;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Grazed land maintains a percentage ground cover of between 50% and 96%;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Surface water in downstream monitoring locations is to remain within site specific water quality monitoring limits, once established; and</td>
</tr>
<tr>
<td>Code</td>
<td>Milestone</td>
<td>Milestone criteria</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>--------------------</td>
</tr>
<tr>
<td>RM8</td>
<td>Fulfilment of all requirements of the agreement with Isaac Regional Council for the construction and commissioning of Saraji Road.</td>
<td>* Vitrinite completes all works within the realigned road reserve required under agreement between Isaac Regional Council and Vitrinite.</td>
</tr>
</tbody>
</table>

*For a more detailed description and justification of milestone criteria used for the final two rehabilitation milestones, refer to Section 5.1.

### 10.4 Draft PRCP Schedule

The draft PRCP Schedule is provided in Table 10-4.
### PRC Plan – Vulcan Complex Project

#### Draft PRCP Schedule

<table>
<thead>
<tr>
<th>Rehabilitation area</th>
<th>RA1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant activities</td>
<td>Out-of-pit waste rock dump; Mine Infrastructure Area</td>
</tr>
<tr>
<td>Total size of rehabilitation area (ha)</td>
<td>30.63 ha</td>
</tr>
<tr>
<td>Commencement of first milestone (RM1)</td>
<td>01 Aug 2023</td>
</tr>
<tr>
<td>PMLU</td>
<td>Low-intensity cattle grazing</td>
</tr>
<tr>
<td>Date area is available</td>
<td>31 Jul 2023</td>
</tr>
<tr>
<td>Cumulative area available (ha)</td>
<td>15.13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Milestone completed by</th>
<th>10 Dec 2023</th>
<th>10 Dec 2024</th>
<th>10 Dec 2025</th>
<th>10 Dec 2026</th>
<th>10 Dec 2027</th>
<th>10 Dec 2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM1</td>
<td>15.13</td>
<td>30.26</td>
<td>30.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RM2</td>
<td>15.13</td>
<td>30.26</td>
<td>30.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RM3</td>
<td>15.13</td>
<td>30.26</td>
<td>30.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RM4</td>
<td>15.13</td>
<td>30.26</td>
<td>30.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RM5</td>
<td>15.13</td>
<td>30.26</td>
<td>30.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RM6</td>
<td>15.13</td>
<td>30.26</td>
<td>30.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RM7</td>
<td>15.13</td>
<td>30.26</td>
<td>30.63</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rehabilitation area</th>
<th>RA2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant activities</td>
<td>Open-cut mining pit; In-pit waste rock dump</td>
</tr>
<tr>
<td>Total size of rehabilitation area (ha)</td>
<td>147.33 ha</td>
</tr>
<tr>
<td>Commencement of first milestone (RM1)</td>
<td>01 Aug 2023</td>
</tr>
<tr>
<td>PMLU</td>
<td>Low-intensity cattle grazing with habitat for Koalas and Squatter Pigeons</td>
</tr>
<tr>
<td>Date area is available</td>
<td>31 Jul 2023</td>
</tr>
<tr>
<td>Cumulative area available (ha)</td>
<td>28.19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Milestone completed by</th>
<th>10 Dec 2023</th>
<th>10 Dec 2024</th>
<th>10 Dec 2025</th>
<th>10 Dec 2026</th>
<th>10 Dec 2027</th>
<th>10 Dec 2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM3</td>
<td>28.19</td>
<td>84.90</td>
<td>147.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RM4</td>
<td>28.19</td>
<td>84.90</td>
<td>147.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RM5</td>
<td>28.19</td>
<td>84.90</td>
<td>147.33</td>
<td></td>
<td></td>
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<tr>
<td>RM6</td>
<td>28.19</td>
<td>84.90</td>
<td>147.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RM7</td>
<td>28.19</td>
<td>84.90</td>
<td>147.33</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rehabilitation area</th>
<th>RA3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant activities</td>
<td>Haul roads, internal tracks, offices, soil stockpiles, run-of-mine pad, magazine</td>
</tr>
</tbody>
</table>

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## PRC Plan – Vulcan Complex Project

<table>
<thead>
<tr>
<th>Total size of rehabilitation area (ha)</th>
<th>58.13 ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commencement of first milestone (RM1)</td>
<td>01 Aug 2025</td>
</tr>
<tr>
<td>PMLU</td>
<td>Low-intensity cattle grazing with habitat for Koalas and Squatter Pigeons</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date area is available</th>
<th>31 Jul 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative area available (ha)</td>
<td>58.13</td>
</tr>
</tbody>
</table>

### Milestone completed by

<table>
<thead>
<tr>
<th>Date</th>
<th>10 Dec 2025</th>
<th>10 Dec 2026</th>
<th>10 Dec 2036</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Milestone code</th>
<th>Cumulative area achieved (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM1</td>
<td>58.13</td>
</tr>
<tr>
<td>RM2</td>
<td>58.13</td>
</tr>
<tr>
<td>RM4</td>
<td>58.13</td>
</tr>
<tr>
<td>RM5</td>
<td>58.13 58.13 58.13</td>
</tr>
<tr>
<td>RM6</td>
<td>58.13</td>
</tr>
<tr>
<td>RM7</td>
<td>58.13</td>
</tr>
</tbody>
</table>

### Rehabilitation area

<table>
<thead>
<tr>
<th>Rehabilitation area</th>
<th>RA4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant activities</td>
<td>Dam, sediment control drains and ponds</td>
</tr>
<tr>
<td>Total size of rehabilitation area (ha)</td>
<td>7.30 ha</td>
</tr>
<tr>
<td>Commencement of first milestone (RM1)</td>
<td>01 Aug 2028</td>
</tr>
<tr>
<td>PMLU</td>
<td>Low-intensity cattle grazing with habitat for Koalas and Squatter Pigeons</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date area is available</th>
<th>31 Jul 2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative area available (ha)</td>
<td>7.30</td>
</tr>
</tbody>
</table>

### Milestone completed by

<table>
<thead>
<tr>
<th>Date</th>
<th>10 Dec 2028</th>
<th>10 Dec 2029</th>
<th>10 Dec 2039</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Milestone code</th>
<th>Cumulative area achieved (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM2</td>
<td>7.30</td>
</tr>
<tr>
<td>RM3</td>
<td>7.30</td>
</tr>
<tr>
<td>RM4</td>
<td>7.30</td>
</tr>
<tr>
<td>RM5</td>
<td>7.30</td>
</tr>
<tr>
<td>RM6</td>
<td>7.30</td>
</tr>
<tr>
<td>RM7</td>
<td>7.30</td>
</tr>
</tbody>
</table>

### Rehabilitation area

<table>
<thead>
<tr>
<th>Rehabilitation area</th>
<th>RA5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant activities</td>
<td>Saraji Road</td>
</tr>
<tr>
<td><strong>PRC Plan – Vulcan Complex Project</strong></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>

| **Total size of rehabilitation area (ha)** | 11.45 ha |
| **Commencement of first milestone (RM1)** | 30 Apr 2026 |

<table>
<thead>
<tr>
<th><strong>PMLU</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date area is available</strong></td>
<td>30 Apr 2026</td>
</tr>
<tr>
<td><strong>Cumulative area available (ha)</strong></td>
<td>11.45</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Milestone completed by</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 Dec 2027</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Milestone code</strong></th>
<th><strong>Cumulative area achieved (ha)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>RM8</td>
<td>11.45</td>
</tr>
</tbody>
</table>
11 REVISION OF THE PRC PLAN

The holder of a PRC plan may, at any time, apply to the administering authority to amend their PRCP schedule (an amendment application). An application may be made to amend only the PRCP schedule, or as part of an amendment application for an EA. An amendment application must be submitted in the approved form and be accompanied by the relevant fee and an amended rehabilitation planning part for the holder’s PRC plan that complies with section 126C of the EP Act. Due to the dependencies between an EA and the PRCP schedule, an applicant should always consider whether a proposed amendment to the PRCP schedule requires a concurrent amendment to the EA in order to ensure consistency between both instruments.

Once a PRCP schedule has been amended, the rehabilitation planning part of the PRC plan must be reviewed and revised to make any necessary or appropriate changes. The administering authority is to be provided with a copy of the amended PRC plan within 10 business days of receiving a copy of the amended PRCP schedule (or receiving written notice under section 211 of the EP Act), unless the administering authority agrees to a longer period.
12 SPATIAL INFORMATION

Shapefiles detailing the following spatial information will be submitted to the administering authority following submission of this PRC plan (Table 12-1):

- the location and maximum extent of the disturbance footprint for the mine life;
- the PMLU and NUMAs for the area within the resource tenures;
- the rehabilitation areas within the resource tenures;
- the locations of sensitive receptors; and
- the extent of the floodplain.

<table>
<thead>
<tr>
<th>Table 12-1</th>
<th>Shapefiles accompanying this PRC Plan</th>
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<td>File</td>
<td>Contents</td>
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<tr>
<td>1</td>
<td>PRC Plan Polygons:</td>
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<tr>
<td></td>
<td>Maximum extent of the disturbance footprint</td>
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<td>Rehabilitation area</td>
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<td>Post-mine land-use</td>
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<td>PRC Plan Points:</td>
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<td>Locations of sensitive receptors</td>
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<td></td>
<td>Locations of permanent monitoring sites</td>
</tr>
</tbody>
</table>
13 REFERENCES


METServe (2020). Terrestrial Ecological Assessment for the Vulcan Complex Project. Reported prepared for Vitrinite Pty Ltd by Mining and Energy Technical Services Pty Ltd, Brisbane.


14 APPENDICES
A) Vulcan Complex Project Surface Water Assessment Report (WRM, 2020)